Fourth Edition of the International Conference Series on Wine Active Compounds

WAC 2017

29, 30, 31 March 2017

Book of abstract

/

Livret des résumés

Organisation des Nations Unies pour l'éducation, la science et la culture

Chaire UNESCO Culture et Traditions du Vin

Institut Jules Guyot

WAC 2017

Acknowledgements - Remerciements

Once again, this WAC 2017 conference is the result of a great collective work from the members of both the scientific and the organizing committees, and all of them are warmly thanked here. A particular attention goes to Candice Charlieux, who recently joined the organization, and significantly contributed to the design of this book of abstracts.

The organization of international conferences such as WAC, relies on financial supports, and all institutional and private partners, who contributed to this event are warmly acknowledged. Special thanks also go to Oenoplurimedia for communicating on WAC 2017, and to the following partners, who provided wines.

Cave de Lugny, Maison Bichot, Maison Louis Bouillot, Maison Vitteault-Alberti,
Domaine Henri Maire, Maison Champy, Boisset Famille des grands vins,
Les vins Georges Duboeuf, Domaine Vincent Girardin, Château de Marsannay,
La Chablisienne, Domaine Louis Latour, Château de Val Mercy,
Domaine Jaffelin, Domaine de Bellene, Compagnie des Indes,
Bureau Interprofessionnel des Vins de Bourgogne

W A C 2 0 1 7

Foreword - Avant-propos

Nine years after the first edition in 2008, this fourth conference WAC 2017 opens a new field of thinking about the latest scientific updates on wine active compounds in a context of sustainability. In line with current societal and environmental issues, WAC 2017 aims at allowing researchers in economy, history, biology, chemistry or sensory sciences to exchange views on wine active compounds in a continuously evolving context of sustainability, where new research tracks are to be opened.
These nine years of WAC conferences have been dedicated to new ways of diffusion of the scientific knowledge on the diversity of wine active compounds and their associated anthropogenic dimensions. Wine active compounds can indeed be linked to the many strategies of vineyard management and winemaking, including bottling. Alternatively, they can lead to a whole spectrum of sensory perceptions and health related properties, in relation with their nature and concentration in wine. These four WAC sessions show us, that crossing views on these various aspects is definitely a source of inspiration for preparing the wine of tomorrow.

Neuf ans après la première édition en 2008, cette quatrième conférence WAC 2017 ouvre un nouveau champ de réflexion autour des avancées scientifiques les plus récentes sur les composés actifs du vin dans un contexte de développement durable. En phase avec les préoccupations sociétales et environnementales actuelles, WAC 2017 ambitionne donc de donner la parole aussi bien à des chercheurs en économie ou en histoire qu'à des chercheurs en biologie, chimie ou psychologie cognitive afin de croiser les regards sur les composés actifs du vin dans ce contexte de durabilité en plein développement et où de nouvelles pistes de recherche sont à creuser.
Ces neuf années de WAC ont été caractérisées par une volonté de diffusion originale de la connaissance sur la diversité de composés actifs du vin et sur toutes les dimensions anthropiques associées. Les composés actifs du vin peuvent en effet être liés aux choix de pratiques du viticulteur et du vinificateur, au travers des multiples étapes de l'élaboration, de la gestion de la vigne à la vinification et jusqu'à la mise en bouteille. Alternativement, ils peuvent conduire à tout un spectre de perceptions sensorielles et de processus biologiques bénéfiques, en fonction de leur nature, mais aussi de leur teneur dans les vins. Ces quatre éditions de WAC nous montrent donc, que croiser les regards sur ces différents aspects est indiscutablement source d'inspiration pour préparer le vin de demain.

W A C 2 0 1 7

Table of contents - Table des matières

W A C 2 0 1 7

Organizing commitee - Comité d'organisation

Hervé ALEXANDRE	Université de Bourgogne, IUVV
Jordi BALLESTER	Université de Bourgogne, IUVV, CGA, INRA
Christian COELHO	Université de Bourgogne, IUVV
Vanessa DAVID	Université de Bourgogne, IUVV
Dominique DELMAS	Université de Bourgogne, INSERM
Jean-Philippe GERVAIS	Bureau Interprofessionnel des Vins de Bourgogne
Régis GOUGEON	Université de Bourgogne, IUVV
Michèle GUILLOUX-BENATIER	Université de Bourgogne, IUVV
Olivier JACQUET	Université de Bourgogne, Chaire UNESCO
Christine MARGET	Université de Bourgogne, IUVV
Yamina MESLEM	Université de Bourgogne, IUVV
Maria NIKOLANTONAKI	Université de Bourgogne, IUVV
Laurence NORET	Université de Bourgogne, IUVV
Jocelyne PERARD	Université de Bourgogne, Chaire UNESCO
Dominique PEYRON	Université de Bourgogne, IUVV
Sandrine ROUSSEAUX	Université de Bourgogne, IUVV
Raphaëlle TOURDOT-MARECHAL	Université de Bourgogne, IUVV
Dominique VALENTIN	AgroSup Dijon, CGA, INRA

W A C 2 0 1 7

Scientific commitee - Comité scientifique

Marielle ADRIAN	IUVV, Université de Bourgogne, France
Hervé ALEXANDRE	IUVV, Université de Bourgogne, France
Jordi BALLESTER	IUVV, Université de Bourgogne, France
Luigi BAVARESCO	Università Cattolica del Sacro Cuore, Milano, Italy
Luca BONARDI	Università Degli Studi Di Milano, Italy
Thibault BOULAY	Université François-Rabelais, Tours, France
Dario CANTU	UC Davis, California, USA
Véronique CHEYNIER	INRA, Montpellier, France
Dominique DELMAS	INSERM, Université de Bourgogne, France
Pascale DENEULIN	HES-SO, Changins, Nyon, Switzerland
Gilles DE REVEL	Université de Bordeaux, France
Agnès DIENES-NAGY	Agroscop, Bern, Switzerland
Benoit DIVOL	Stellenbosch University, South Africa
Julien DUCRUET	Changins, Nyon, Switzerland
Susan EBELER	UC Davis, California, USA
Vicente FERREIRA	University of Zaragoza, Spain
Marion FOURCADE	UC Berkley, California, USA
Celito GUERRA	Brazilian Agricultural Research Corporation, Brazil
Markus HERDERICH	The Australian Wine Research Institute, Australia
Olivier JACQUET	Chaire UNESCO, Université de Bourgogne, France
Philippe JEANDET	Université de Reims Champagne-Ardenne, France
Luigi MOIO	Università degli Studi di Napoli, Italy
Fito MONTSSERAT	Consorci Mar Parc Salut de Barcelona, Spain
Hélène NIEUWOUDT	Stellenbosch Universitu, South Africa
Wendy PARR	Lincoln University New Zealand, New Zealand
Tristan RICHARD	ISVV, Université de Bordeaux, France
Cédric SAUCIER	Université de Montpellier, France
Valérie SCHINI-KERTH	Université de Strasbourg, France
Philippe SCHMITT-KOPPLIN	Helmholtz Zentrum München, Germany
Neil SHAY	Oregon State University, Oregon, USA
Maurizio UGLIANO	University of Verona, Italy
Dominique VALENTIN	AgroSup Dijon, France
Elizabeth WATERS	University of Melbourne, Australia
Peter WINTERHALTER	Technische Universität Braunschweig, Germany
Vivian ZUFFEREY	Agroscope Changins, Nyon, Switzerland

WAC 2017

General program

	Wednesday March 29th, 2017	Thursday March 30th, 2017	Friday March 31st, 2017
9:00	Welcome coffee	**Session III Wine Active Compounds and Sensoriality**	**Session IV Wine Active Compounds and enological processes**
9:30	**Official Opening Inaugural Conference**		
10:00			
10:30		*Pause Second Posters Session*	*Pause Fourth Posters Session*
11:00	**Session I Wine Active Compounds and Vineyard Practices**		
11:30		**Follow-up Session III**	**Follow-up Session IV**
12:00			
12:30	Lunch		Lunch
13:00		Lunch	
13:30			
14:00	**Follow-up Session I**	**Follow-up Session III**	**Follow-up Session IV**
14:30			
15:00	*Pause First Posters Session*	*Pause Third Posters Session*	*Awards*
15:30			**Official Closure**
16:00	**Session II Health & Wine Active Compounds**	**Visit**	
16:30			
17:00			
17:30			
18:00	Welcome Drink		
18:30			
19:00			
19:30			
20:00			
20:30		Gala diner	
...			

W A C 2 0 1 7

Detailed Program

Wednesday March 29th, 2017

09.00 **Welcome, coffee, registrations, mounting posters**

09.30 **Official opening of the conference**

10.15 **Inaugural conference : Jill J. MCCLUSKEY**
Washington State University
PRICE IMPACTS OF MULTIPLE SOCIAL AND ENVIRONMENTAL CLAIMS AND CERTIFICATIONS ON U.S. WINES

11.15 **SESSION I – Wine Active Compounds and vineyard practices**

Chair : Neil SHAY

11.15 **Keynote : Jean MASSON**
BEYOND DISAGREEMENT ON ENVIRONEMENTAL AND VITICULTURE ISSUES : A RESEARCH-ACTION RETHINKING THE WAY OF CHANGE

11.40 **Lecture 1 : Marie-Claude PICHERY**
SUSTAINABLE VITICULTURE AND ECONOMIC MODEL IN BURGUNDY

11.55 **Lecture 2 : Céline SPARROW**
IMPACTS DES METAUX LOURDS ISSUS DES TRAITEMENTS PHYTOSANITAIRES DE LA VIGNE SUR LES MOUTS ET LA QUALITE DES VINS

12.10 **Questions**

12.20 **Lunch**

14.00 **Follow-up SESSION I –**
Wine Active Compounds and vineyard practices

Chair : Peter WINTERHALTER

14.00 **Lecture 3 : Michael ZIEGLER**
IMPACT OF CLONAL VARIATION, BERRY SIZE AND DEFOLIATION ON THE FORMATION OF FREE AND BOUND TDN IN RIESLING

14.15 **Lecture 4 : Justine VANDEN HEUVEL**
QUANTITATIVE LIGHT RESPONSE CURVES FOR WINE ACTIVE COMPOUNDS IN RIESLING AND CABERNET FRANC

14.30 **Lecture 5 : Guillaume ANTALICK**
LATE SEASON SHIRAZ BERRY DEHYDRATION ALTERS COMPOSITION AND SENSORY QUALITIES OF WINE

14.45 **Lecture 6 : Cedric GRANGETEAU**
ARE CHEMICAL COMPOSITION AND QUALITY OF WINE INFLUENCED BY REDUCTION OF INPUTS IN VINEYARD AND WINERY?

15.00 **Questions**

15.15 *Pause & First Posters Session*

16.15 SESSION II – Health & Wine Active Compounds

Chair : Tristan RICHARD

16.15 **Keynote : Veronika SOMOZA**
CAN A GLASS OF WINE A DAY KEEP THE DOCTOR AWAY ?

16.40 **Lecture 1 : Neil SHAY**
EVALUATING THE RELATIVE METABOLIC IMPROVEMENTS OF RED WINE VS. OAK TANNIN INTAKE IN C57BL/6J MICE FED A HIGH-FAT DIET

16.55 **Lecture 2 : Celito GUERRA**
GRAPE PHENOLIC COMPOUNDS RELATED TO OXIDATIVE STRESS RESISTANCE THROUGH CAENORHABDITIS ELEGANS MODEL

17.10 **Lecture 3 : Dominique DELMAS**
RED WINE EXTRACT AND GRAPEVINE POLYPHENOLS AS ESSENTIAL ACTORS TO FIGHT INFLAMMATION THROUGH A MODULATION OF IMMUNE SYSTEM IN AN CANCEROUS CONTEXT

17.25 **Lecture 4 : Caroline DANI**
GRAPE JUICE CHRONIC CONSUMPTION PROMOTES WEIGHT LOSS AND OTHER HEALTH BENEFITS IN ELDERLY PEOPLE

17.40 **Questions**

18.00 Welcome drink

W A C 2 0 1 7

Thursday March 30th, 2017

9.00 SESSION III - Wine Active Compounds and sensoriality

Chair : Gilles DE REVEL

9.00 **Keynote : Dominique VALENTIN**
EXPECTATION OR SENSORIAL REALITY? AN EMPIRICAL INVESTIGATION OF THE BIODYNAMIC CALENDAR FOR WINE DRINKERS

9.25 **Lecture 1 : Ronan SYMONEAUX**
PERCEPTION DES VINS SANS SULFITES PAR LES CONSOMMATEURS

9.40 **Lecture 2 : Astrid BUICA**
SOUTH AFRICAN CHENIN BLANC STYLES DESCRIPTION AS PERCEIVED BY LOCAL EXPERTS

9.55 **Lecture 3 : Olivier GEFFROY**
ASSESSING CONSUMER RESPONSE TO THE PEPPER AROMA COMPOUND ROTUNDONE IN DURAS RED WINE

10.10 **Lecture 4 : Olivier JACQUET**
LA QUALITÉ PAR LA TYPICITÉ : L'INVENTION DE NOUVELLES NORMES DE DESCRIPTION DES VINS AU XXE SIÈCLE AU SERVICE DES AOC

10.25 **Questions**

10.40 *Pause & second posters session*

11.35 Follow-up SESSION III - Wine Active Compounds and sensoriality

Chair : Anna Katharine MANSFIELD

11.35 **Lecture 5 : Gerard LIGER-BELAIR**
EVAPORATION OF DROPLETS IN A CHAMPAGNE WINE AEROSOL : HOW THE FIZZ ENHANCE THE PERCEPTION OF VOLATILE COMPOUNDS

11.50 **Lecture 6 : Francis CANON**
APPLICATION OF AN IN VIVO PTR-TOF-MS APPROACH TO DETERMINE DIFFERENCES IN WINE AROMA RELEASE AMONG WINES SPIKED WITH DIFFERENT TYPES OF OENOLOGICAL TANNINS

12.05 **Lecture 7 : Marine GAMMACURTA**
IDENTIFICATION AND QUANTITATION OF NEW AROMATIC COMPOUNDS ASSOCIATED TO HAZELNUT-LIKE NOTES OF GREAT CHARDONNAY WINES

12.20 **Lecture 8 : Pascal WEGMANN-HERR**
USE OF GLUTATHIONE DURING WHITE WINE PRODUCTION – IMPACT ON S-OFF-FLAVORS AND SENSORY PERCEPTION

12.35 **Questions**

12.50 Lunch

14.00 Follow-up SESSION III - Wine Active Compounds and sensoriality

Chair : Cédric SAUCIER

14.00 **Lecture 9 : Nicolas Le MENN**
CHEMICAL AND ORGANOLEPTIC DESCRIPTION OF AGED CHAMPAGNE RESERVE WINES

14.15 **Lecture 10 : Laura LAGUNA**
WINE COMPOUNDS' ROLE ON MOUTHFEEL PERCEPTION

14.30 **Lecture 11 : Maria Angeles DEL POZO-BAYON**
EFFECT OF ETHANOL ON THE ORAL AROMATIC PERSISTENCE OF TYPICAL WINE FRUITY ESTERS CONSIDERING INDIVIDUAL PHYSIOLOGYCAL DIFFERENCES

14.45 **Lecture 12 : Maria-Pilar SAENZ-NAVAJAS**
ANTHOCYANIN-DERIVED PIGMENTS DRIVING DRYNESS AND PERSISTENCY IN RED WINES

15.00 **Questions**

15.15 *Pause & third posters session*

16.15 - 16.30 Bus departure to visits

20.30 Gala diner

W A C 2 0 1 7

Friday March 31th 2017

9.00 SESSION IV - Wine Active Compounds and enological processes

Chair : Patricia TAILLANDIER

9.00 Keynote : Nicholas BOKULICH
MICROBIAL TERROIR : ANOTHER FACET OF WINE QUALITY

9.25 Lecture 1 : Marion BRENIAUX
OENOCOCCUS OENI STRAINS OF TWO DIFFERENT GENETIC GROUPS AREPHENOTYPICALLY ADAPTED TO FERMENT WHITE OR RED WINES OF BURGUNDY

9.40 Lecture 2 : Remy JUNQUA
DEVELOPPEMENT DE PROCEDES INNOVANTS POUR LA STABILISATION MICROBIOLOGIQUE DES VINS

9.55 Lecture 3 : Youzhong LIU
EXPLORING WINE PEPTIDE DIVERSITY

10.10 Questions

10.20 *Pause & fourth posters session*

11.20 Follow-up SESSION IV - Wine Active Compounds and enological processes

Chair : Maurizio UGLIANO

11.20 Lecture 4 : Franziska BUHRLE
IDENTIFICATION OF NOVEL OXIDATION PRODUCTS RELATED TO GLUTATHIONE

11.35 Lecture 5 : Chloe ROULLIER-GALL
SULFUR METABOLOME OF BOTTLED WHITE WINES HOLDS A MEMORY OF SO_2 ADDED TO THE MUST

11.50 Lecture 6 : Monica PICCHI
RELATION BETWEEN QUALITY, TYPICALITY, ATTRIBUTES AND CHEMICAL COMPOSITION OF CONVENTIONAL AND BIODYNAMIC PROTECT DESIGNATION OF ORIGIN (PDO) WINES

12.05 Questions

12.15 Lunch

14.00 **Follow-up SESSION IV -**
Wine Active Compounds and enological processes

Chair : Celito GUERRA

14.00 **Lecture 8 : Julien DUCRUET**
OXYGEN MANAGMENT DURING AND AFTER WINE BOTTLING WITH REGARD TO REDUCING SO2 ADDITION

14.15 **Lecture 9 : Raffaele GUZZON**
THE OZONE, A SUSTAINABLE TOOL IN THE PREVENTION OF MICROBIAL SPOILAGE IN TRADITIONAL WINERIES

14.30 **Lecture 10 : Donato COLANGELO**
CHITOSAN AS BENTONITE REPLACEMENT FOR WHITE WINE FINING

14.45 **Lecture 11 : Almudena MARRUFO**
OXYGEN, AN ACTIVE COMPOUND OF WINE. STUDY OF THE KINETICS OF OXYGEN CONSUMPTION BY RED WINES

15.00 Questions

15.15 Best poster awards

15.30 Official Closure

WAC 2017

Programme général

	Mercredi 29 mars 2017	Jeudi 30 mars 2017	Vendredi 31 mars 2017
9:00	Accueil	**Session III Molécules actives du vin et sensorialité**	**Session IV Composés actifs du vin et procédés œnologiques**
9:30	**Ouverture officielle Conférence inaugurale**		
10:00			
10:30		*Pause Deuxième séance posters*	*Pause Quatrième séance posters*
11:00	**Session I Molécules actives du vin et pratiques viticoles**		
11:30		**Suite Session III**	**Suite Session IV**
12:00			
12:30	Déjeuner		Déjeuner
13:00		Déjeuner	
13:30			
14:00	**Suite Session I**	**Suite Session III**	**Suite Session IV**
14:30			
15:00	*Pause Première séance posters*	*Pause Troisième séance posters*	*Remise des prix posters*
15:30			**Clôture officielle**
16:00	**Session II Santé et molécules actives du vin**	**Visite**	
16:30			
17:00			
17:30			
18:00	Welcome Drink		
18:30			
19:00			
19:30			
20:00			
20:30		Diner de gala	
...			

W A C 2 0 1 7

Programme détaillé

Mercredi 29 mars 2017

09.00 **Accueil des participants, café, inscriptions, montage posters**

09.30 **Ouverture officielle de la conférence**

10.15 **Conférence inaugurale : Jill J. MCCLUSKEY**
Washington State University
PRICE IMPACTS OF MULTIPLE SOCIAL AND ENVIRONMENTAL CLAIMS AND CERTIFICATIONS ON U.S. WINES

11.15 **SESSION I – Molécules actives du vin et pratiques viticoles**

Chair : Neil SHAY

11.15 **Keynote : Jean MASSON**
BEYOND DISAGREEMENT ON ENVIRONEMENTAL AND VITICULTURE ISSUES : A RESEARCH-ACTION RETHINKING THE WAY OF CHANGE

11.40 **Lecture 1 : Marie-Claude PICHERY**
SUSTAINABLE VITICULTURE AND ECONOMIC MODEL IN BURGUNDY

11.55 **Lecture 2 : Céline SPARROW**
IMPACTS DES METAUX LOURDS ISSUS DES TRAITEMENTS PHYTOSANITAIRES DE LA VIGNE SUR LES MOUTS ET LA QUALITE DES VINS

12.10 **Questions**

12.20 **Déjeuner**

13:50 **Suite SESSION I – Molécules actives du vin et pratiques viticoles**

Chair : Peter WINTERHALTER

13.50 **Lecture °3 : Michael ZIEGLER**
IMPACT OF CLONAL VARIATION, BERRY SIZE AND DEFOLIATION ON THE FORMATION OF FREE AND BOUND TDN IN RIESLING

14.05 **Lecture 4 : Justine VANDEN HEUVEL**
QUANTITATIVE LIGHT RESPONSE CURVES FOR WINE ACTIVE COMPOUNDS IN RIESLING AND CABERNET FRANC

14.20 **Lecture 5 : Guillaume ANTALICK**
LATE SEASON SHIRAZ BERRY DEHYDRATION ALTERS COMPOSITION AND SENSORY QUALITIES OF WINE

14.35 **Lecture °6 : Cedric GRANGETEAU**
ARE CHEMICAL COMPOSITION AND QUALITY OF WINE INFLUENCED BY REDUCTION OF INPUTS IN VINEYARD AND WINERY?

14.50 **Questions**

15.00 *Pause et première séance posters*

16.00 **SESSION II – Santé et molécules actives du vin**

Chair : Tristan RICHARD

16.00 **Keynote : Veronika SOMOZA**
CAN A GLASS OF WINE A DAY KEEP THE DOCTOR AWAY ?

16.25 **Lecture °1 : Neil SHAY**
EVALUATING THE RELATIVE METABOLIC IMPROVEMENTS OF RED WINE VS. OAK TANNIN INTAKE IN C57BL/6J MICE FED A HIGH-FAT DIET

16.40 **Lecture °2 : Celito GUERRA**
GRAPE PHENOLIC COMPOUNDS RELATED TO OXIDATIVE STRESS RESISTANCE THROUGH CAENORHABDITIS ELEGANS MODEL

16.55 **Lecture 3 : Dominique DELMAS**
RED WINE EXTRACT AND GRAPEVINE POLYPHENOLS AS ESSENTIAL ACTORS TO FIGHT INFLAMMATION THROUGH A MODULATION OF IMMUNE SYSTEM IN AN CANCEROUS CONTEXT

17.10 **Questions**

17.25 **Lecture °4 : Caroline DANI**
GRAPE JUICE CHRONIC CONSUMPTION PROMOTES WEIGHT LOSS AND OTHER HEALTH BENEFITS IN ELDERLY PEOPLE

18.10 Questions

19.00 **Welcome drink**

Jeudi 30 mars 2017

9.00 **SESSION III - Molécules actives du vin et sensorialité**

Chair : Gilles DE REVEL

9.00 **Keynote : Dominique VALENTIN**
EXPECTATION OR SENSORIAL REALITY? AN EMPIRICAL INVESTIGATION OF THE BIODYNAMIC CALENDAR FOR WINE DRINKERS

9.25 **Lecture 1 : Ronan SYMONEAUX**
PERCEPTION DES VINS SANS SULFITES PAR LES CONSOMMATEURS

9.40 **Lecture 2 : Astrid BUICA**
SOUTH AFRICAN CHENIN BLANC STYLES DESCRIPTION AS PERCEIVED BY LOCAL EXPERTS

9.55 **Lecture 3 : Olivier GEFFROY**
ASSESSING CONSUMER RESPONSE TO THE PEPPER AROMA COMPOUND ROTUNDONE IN DURAS RED WINE

10.10 **Lecture 4 : Olivier JACQUET**
LA QUALITÉ PAR LA TYPICITÉ : L'INVENTION DE NOUVELLES NORMES DE DESCRIPTION DES VINS AU XXE SIÈCLE AU SERVICE DES AOC

10.25 **Questions**

10.40 *Pause et deuxième séance posters*

11.35 **Suite SESSION III - Molécules actives du vin et sensorialité**

Chair : Anna Katharine MANSFIELD

11.35 **Lecture 5 : Gerard LIGER-BELAIR**
EVAPORATION OF DROPLETS IN A CHAMPAGNE WINE AEROSOL : HOW THE FIZZ ENHANCE THE PERCEPTION OF VOLATILE COMPOUNDS

11.50 **Lecture °6 : Francis CANON**
APPLICATION OF AN IN VIVO PTR-TOF-MS APPROACH TO DETERMINE DIFFERENCES IN WINE AROMA RELEASE AMONG WINES SPIKED WITH DIFFERENT TYPES OF OENOLOGICAL TANNINS

12.05 **Lecture 7 : Marine GAMMACURTA**
IDENTIFICATION AND QUANTITATION OF NEW AROMATIC COMPOUNDS ASSOCIATED TO HAZELNUT-LIKE NOTES OF GREAT CHARDONNAY WINES

12.20 **Lecture 8 : Pascal WEGMANN-HERR**
USE OF GLUTATHIONE DURING WHITE WINE PRODUCTION – IMPACT ON S-OFF-FLAVORS AND SENSORY PERCEPTION

12.35 **Questions**

12.50 **Déjeuner**

14.00 **Suite SESSION III - Molécules actives du vin et sensorialité**

Chair : Cédric SAUCIER

14.00 **Lecture 9 : Nicolas Le MENN**
CHEMICAL AND ORGANOLEPTIC DESCRIPTION OF AGED CHAMPAGNE RESERVE WINES

14.15 **Lecture 10 : Laura LAGUNA**
WINE COMPOUNDS' ROLE ON MOUTHFEEL PERCEPTION

14.30 **Lecture 11 : Maria Angeles DEL POZO-BAYON**
EFFECT OF ETHANOL ON THE ORAL AROMATIC PERSISTENCE OF TYPICAL WINE FRUITY ESTERS CONSIDERING INDIVIDUAL PHYSIOLOGYCAL DIFFERENCES

14.45 **Lecture 12 : Maria-Pilar SAENZ-NAVAJAS**
ANTHOCYANIN-DERIVED PIGMENTS DRIVING DRYNESS AND PERSISTENCY IN RED WINES

15.00 **Questions**

15.15 *Pause et troisième séance posters*

16.15 **Départ visite**

20.30 **Diner de gala**

W A C 2 0 1 7

Vendredi 31 mars 2017

9.00 SESSION IV - Composés actifs du vin et procédés œnologiques

Chair : Patricia TAILLANDIER

9.00 **Keynote : Nicholas BOKULICH**
MICROBIAL TERROIR : ANOTHER FACET OF WINE QUALITY

9.25 **Lecture 1 : Marion BRENIAUX**
OENOCOCCUS OENI STRAINS OF TWO DIFFERENT GENETIC GROUPS AREPHENOTYPICALLY ADAPTED TO FERMENT WHITE OR RED WINES OF BURGUNDY

9.40 **Lecture 2 : Remy JUNQUA**
DEVELOPPEMENT DE PROCEDES INNOVANTS POUR LA STABILISATION MICROBIOLOGIQUE DES VINS

9.55 **Lecture 3 : Youzhong LIU**
EXPLORING WINE PEPTIDE DIVERSITY

10.10 **Questions**

10.20 *Pause et quatrième séance posters*

11.20 Suite SESSION IV - Composés actifs du vin et procédés œnologiques

Chair : Maurizio UGLIANO

11.20 **Lecture 4 : Franziska BUHRLE**
IDENTIFICATION OF NOVEL OXIDATION PRODUCTS RELATED TO GLUTATHIONE

11.35 **Lecture 5 : Chloe ROULLIER-GALL**
SULFUR METABOLOME OF BOTTLED WHITE WINES HOLDS A MEMORY OF SO_2 ADDED TO THE MUST

11.50 **Lecture 6 : Monica PICCHI**
RELATION BETWEEN QUALITY, TYPICALITY, ATTRIBUTES AND CHEMICAL COMPOSITION OF CONVENTIONAL AND BIODYNAMIC PROTECT DESIGNATION OF ORIGIN (PDO) WINES

12.05 **Questions**

12.15 **Déjeuner**

14.00 **Suite SESSION IV -**
Composés actifs du vin et procédés œnologiques

Chair : Celito GUERRA

14.00 **Lecture 8 : Julien DUCRUET**
OXYGEN MANAGMENT DURING AND AFTER WINE BOTTLING WITH REGARD TO REDUCING SO2 ADDITION

14.15 **Lecture 9 : Raffaele GUZZON**
THE OZONE, A SUSTAINABLE TOOL IN THE PREVENTION OF MICROBIAL SPOILAGE IN TRADITIONAL WINERIES

14.30 **Lecture 10 : Donato COLANGELO**
CHITOSAN AS BENTONITE REPLACEMENT FOR WHITE WINE FINING

14.45 **Lecture 11 : Almudena MARRUFO**
OXYGEN, AN ACTIVE COMPOUND OF WINE. STUDY OF THE KINETICS OF OXYGEN CONSUMPTION BY RED WINES

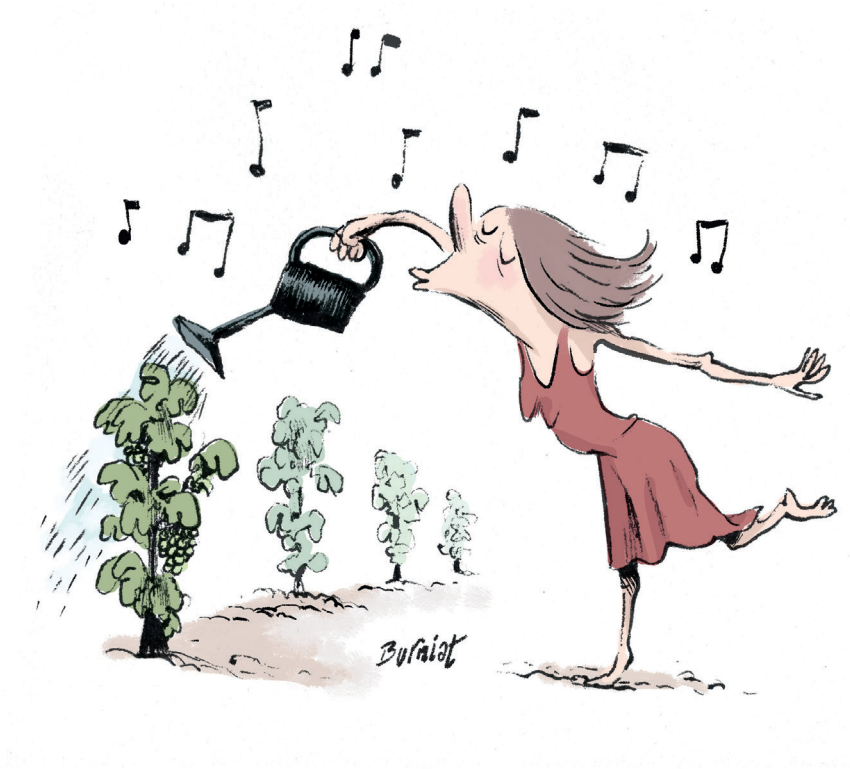
15.00 **Questions**

15.15 **Remise des prix pour les meilleurs posters**

15.30 **Clôture officielle**

ORAL SESSION I

Wine Active Compounds and Vineyard Practices
Molécules actives du vin et pratiques viticoles



Wine Active Compounds And Vineyard Practices K

BEYOND DISAGREEMENT ON ENVIRONMENTAL AND VITICULTURE ISSUES : A RESEARCH-ACTION RETHINKING THE WAY OF CHANGE

Whereas wine growing, and the vines, are intimately associated with our societies, critics are raising against its environmental impact, and the research/innovation model which is associated to. Thus, controversies initially focusing on biotechnology in viticulture are now broadening to include its environmental and human health impact. Do improvements in conventional viticulture or organic viticulture develop at time scale and surfaces to address the economic/ecologic dilemma? We suggest that strong disagreement between actors exists as to the values and knowledges associated with distinct ways of reasoning, thus rooting a double-bind situation. We designed theoretical models which, across disciplines, legitimize all arguments of all actors in play, in all forms of viticulture, by linking them up, thus bringing to light a collective epistemology. Within this new paradigm, the expected levels of change were conceived of, and achieved across a 200-hectare vineyard grown by winegrowers and bordering an ecological reserve. This transdisciplinary research may be influential in rethinking complex scientific and social problems for major environmental/ human issues linked to viticulture and beyond.

Jean-Eugene Masson

SVQV, INRA, Université de Strasbourg jean.masson@colmar.inra.fr
Colmar, France

Anne Moneyron

Tuque Rouge, Cuzorn, France
SVQV, INRA, Université de Strasbourg
Colmar, France

Carine Schmitt, Mireille Perrin, LMC

SVQV, INRA, Université de Strasbourg
Colmar, France

Westhalten group, Jean-Francois Lallemand

GIEE, Westhalten, France

Isabelle Soustre-Gacougnolle

SVQV, INRA, Université de Strasbourg
LVBE, Univesité de Haute Alsace
Colmar, France

Wine Active Compounds And Vineyard Practices 1

SUSTAINABLE VITICULTURE AND ECONOMIC MODEL IN BURGUNDY
VITICULTURE DURABLE ET MODÈLE ECONOMIQUE EN BOURGOGNE

La Bourgogne qui vient de voir ses climats classés par l'UNESCO au Patrimoine Mondial est un vignoble de réputation et la qualité de ses vins est mondialement reconnue. Ceux-ci sont perçus comme chers notamment les Grands Crus qui figurent souvent dans les classements des vins les plus chers au monde. Cependant en raison des conditions de production spécifiques en Bourgogne, on peut s'interroger sur la durabilité économique de ses exploitations. Un foncier au coût très élevé et récemment recherché par des investisseurs et amateurs fortunés, une forte densité de plantation, le choix assumé de travailler sur un parcellaire émietté, des pratiques culturales demandeuses de main-d'oeuvre, une sensibilité forte aux aléas climatiques, une viticulture familiale touchée par les problématiques de transmission concourent à fragiliser la santé économique des domaines. Est-ce que ces pratiques permettent à toutes les exploitations et dans chaque niveau hiérarchique de ses appellations une juste rémunération ?

Nous nous interrogerons sur l'efficacité économique du modèle bourguignon notamment en comparant la valorisation des vins blancs dans plusieurs appellations bourguignonnes de Chablis, Côte de Beaune, et Côte chalonnaise à celle d'une production de vins blancs issus de chardonnay produits en Californie.

Si la viabilité économique des exploitations viticoles dans certaines régions est déjà reconnue comme difficile, il peut paraître paradoxal de poser cette question dans une région considérée comme pratiquant des prix élevés. La viticulture durable en Bourgogne assure déjà l'obtention de produits de qualité ; la valorisation des aspects patrimoniaux, historiques, culturels, écologiques, et paysagers grâce à une viticulture de précision permettait-elle la pérennité économique de toutes les structures ?

Joelle Brouard
Consultante, Dijon, France joellebrouard21@gmail.com

Marie-Claude Pichery
Pole d'Economie et Gestion
Université de Bourgogne-Franche-Comté
Dijon, France marie-claude.pichery@u-bourgogne.fr

Wine Active Compounds And Vineyard Practices 2

IMPACTS DES MÉTAUX LOURDS ISSUS DES TRAITEMENTS PHYTOSANITAIRES DE LA VIGNE SUR LES MOUTS ET LA QUALITÉ DES VINS

La sécurité du consommateur est une préoccupation de premier ordre pour l'industrie agroalimentaire. A ce titre, le vin n'y échappe pas. C'est ainsi que de plus en plus d'analyses sont réalisés ou demandées par les pays importateurs pour contrôler l'innocuité des vins. Il n'en n'est pas moins que le vin reste parmi les boissons les plus saines tant que l'on n'en n'abuse pas. En effet, le vin est issu de la transformation du jus de raisin par Saccharomyces cerevisiae et ce mécanisme permet l'élimination naturelle d'un certains nombres de molécules indésirables provenant de la culture de la vigne (pesticides, traitements phytosanitaires, etc.).

C'est d'ailleurs sur cette famille des produits phytosanitaires que nous nous sommes penchés. Plus spécifiquement sur ceux constitués de métaux lourds tels que le cuivre, le zinc ou l'aluminium que l'on peut retrouver dans des produits comme les bouillies, le Métirame zinc ou le Phoséthyl d'aluminium. En effet, ces produits ne sont pas retrouvés en tant que tel dans les vins, mais les métaux lourds qu'ils peuvent laisser dans les mouts, participent de façon notoire à des réactions chimiques et biochimiques générant des problématiques oenologiques plus ou moins graves (retard, voir inhibition dans les cas les plus graves des fermentations alcooliques et/ou malolactiques, catalyseurs d'oxydations enzymatiques dans les moûts et d'oxydations chimiques dans les vins, destruction directe ou indirect de composés aromatiques). Nous nous proposons donc de faire un état des lieux des concentrations en métaux lourds (cuivre, fer, aluminium et zinc) trouvés dans les moûts de diverses régions françaises, puis mettre en évidence leurs impacts sur les fermentations alcooliques et malolactiques ainsi que sur les réactions chimiques induites. Pour finir, nous parlerons de quelques solutions permettant d'éliminer précocement ces métaux lourds dans les moûts aux travers d'agents de collages de nouvelle génération.

Céline Sparrow

Œnofrance, Magenta, France

Christophe Morge

Œnofrance, Magenta, France

Wine Active Compounds And Vineyard Practices 3

IMPACT OF COLONIAL VARIATION, BERRY SIZE AND DEFOLIATION ON THE FORMATION OF FREE AND BOUND TDN IN RIESLING

1,1,6-Trimethyl-1,2-dihydronaphthalene (TDN) evokes the off-odor of «petrol» or "kerosene"in wine, especially in the variety Riesling and it is formed by a breakdownof carotenoids [1]. Increasing UV-radiation due to climate change intensifies formationof carotenoids in the berry skins and foster an increase of TDN precursors [2]. Strategies for minimizing the amount of TDN precursors are essential for the future processing of Riesling wines since TDN is partially released during fermentation and aging from its bound form and will trigger above a threshold the rejection by consumers [3]. Current research revealed a rather low sensory detection threshold for TDN of 2 µg/L [4] and even young commercial Riesling wines clearly exceed this threshold [5]. So far, no selective fining agent is known to remove TDN from wine and thus the minimizing strategy has to focus on lowering the formation of TDN precursors in the vineyards. Defoliation in a Riesling vineyard was carried out at three different time points and the degree of defoliation was varied for one time point. Due to these measures the bound TDN varied between 77 and 208 µg/L releasable TDN. Besides the "petrol" off-flavor other sensory attributes were significantly altered by defoliation. Clonal variety and choice of rootstock vary cluster density and berry size as well as shading due to vigor differences, which will subsequently alter sun exposure of berries. Thus, we studied free and bound TDN in grapes and wines made from eight Riesling clones and one clone grafted on four rootstocks. Furthermore, berries were fractionated according to their diameter and berry fractions were crushed, pressed and fermented separately. After six months, free TDN varied between 1 and 6 µg/L among wines made from different Riesling clones. Cluster density explained nearly 50% of free and bound TDN, yielding a probability value of 0.089. Berry size however did not yield a significant impact on free and bound TDN.

[1]: Simpson, R. F. 1978. 1,1,6-Trimethyl-1,2-dihydronaphthalene: an important contributor to the bottleaged bouquet of wine. Chem. Ind. 1, 37.
[2]: Winterhalter, P., Goek, R. 2013. TDN and β-damascenone: two important carotenoid metabolites inwine. ACS Symp. Series. 1134, 125-137
[3]: Ross, C.F., Zwink, A.C., Castro, L., Harrison, R. 2014. Odour detection threshold and consumerrejection of 1,1,6-trimethyl-1,2-dihydronaphthalene in 1-year-old Riesling wines. Aust. J. Grape Wine Res. 20, 335-339
[4]: Sacks, G. L., Gates, M. J., Ferry, F. X., Lavin, E. H., Kurtz, A. J., Acree, T. E. 2012. SensoryThreshold of 1,1,6-Trimethyl-1,2-dihydronaphthalene (TDN) and Concentrations in Young Rieslingand Non-Riesling Wines. J. Agric. Food Chem. 60, 2998.
[5]: Goek, R., Bechtloff, P., Philipp, C., Eder, R., Fischer, U., Winterhalter, P. 2016. Vergleich der Gehalte an freiem sowie gebundenem TDN in deutschen und österreichischen Rieslingweinen, Poster at 45. German Food Chemist Day, Freising, Germany

Michael Ziegler, Ulrich Fischer

DLR Rheinpfalz
Institute for Viticulture and œnology
Breitenweg 71, Neustadt, Germany
michael.ziegler@dlr.rlp.de

Recep Gok, Peter Winterhalter

TU Braunschweig
Institute of Food Chemistry
Schleinitzstr 20, Braunschweig, Germany

Wine Active Compounds And Vineyard Practices 4

QUANTITATIVE LIGHT RESPONSE CURVES FOR WINE ACTIVE COMPOUNDS IN RIESLING AND CABERNET FRANC

Many wine active compounds are known to respond to fruit-zone cluster exposure, but optimal cultural influences with respect to cluster exposure timing and intensity have not been established. The following experiments were established in the cool climate Finger Lakes region of New York State. To determine the impact of cluster exposure on concentration of potential aroma compounds in Riesling, correlations between naturally occurring cluster light exposure during the growing season and relative concentrations of eight representative aroma compounds at harvest were determined. At harvest, fruit samples were whole-cluster pressed and resulting musts were immediately treated with sulfur dioxide, sampled, frozen, and then later analyzed using gas chromatography-mass spectrometry. The aroma compounds were 13 carbon (C13) norisoprenoids (1,1,6-trimethyl-1,2-dihydronaphthalene (TDN), β-damascenone, and vitispirane), monoterpenes (linalool oxide, α-terpineol), and phenolics (4-vinylguaiacol, vanillin and eugenol). Cluster exposure was determined using enhanced point quadrat analysis (EPQA), specifically the cluster exposure flux availability (CEFA) metric.1 Regression analysis of significant responses revealed generally higher predictive power of light response curves at veraison compared with fruit set. TDN responded positively at veraison ($p=0.0019$, $R2=0.77$), as did β-damascenone ($p=0.0247$, $R2=0.54$), while Vitispirane responded positively to fruit exposure at fruit set ($p=0.0420$, $R2=0.47$). Responses of other compounds were less consistent across vineyards and years of the study. None of the compounds responded to variable cluster exposure levels below 20% of ambient sunlight (CEFA <0.2). In Cabernet Franc, vines were subjected to four levels of leaf removal, resulting in a range of CEFA. Fruit was harvested at maturity, crushed, destemmed, stabilized with sulfur dioxide, and sampled after 48 hours of maceration. Samples were analyzed by high performance liquid chromatography to quantify phenolic compounds. Linear regression revealed that phenolic compounds correlated positively with fruit set CEFA in the first year of the study (total flavonols: $p<0.0001$, $R2=0.70$; and total hydroxycinnamates: $p=0.0044$, $R2=0.45$) and with veraison CEFA (flavonols: $p=0.0004$, $R2=0.61$; hydroxycinnamates: $p=0.0183$, $R2=0.34$). In the second year of the study, phenolic compounds correlated positively with fruit set CEFA (total anthocyanins: $p=0.0255$, $R2=0.31$; flavonols: $p<0.0001$, $R2=0.90$; hydroxycinnamates: $p=0.0291$, $R2=0.30$; tannins: $p=0.0445$, $R2=0.26$). Compounds responding positively to veraison CEFA included anthocyanins ($p=0.0010$, $R2=0.55$), flavonols ($p<0.0001$, $R2=0.89$), hydroxycinnamates ($p=0.0007$, $R2=0.57$) and tannin ($p=0.0072$, $R2=0.41$). Comparison of fruit set and veraison responses suggested that relative phenolic concentrations at maturity among treatments can be determined as early as fruit set. Quadratic regression suggested that all responses of anthocyanins, hydroxycinnamates, and tannin were nonlinear with positive responses turning negative when ambient sunlight exceeds approximately 50% (CEFA >0.5). Similar to the Riesling response curves, there was generally no response of compounds when cluster exposure levels were below approximately 20% of ambient sunlight (CEFA <0.20).

Justine Vanden Heuvel

Horticulture Section
School of Integrative Plant Science
Cornell University, Ithaca NY, USA
jev32@cornell.edu

James Mayers

School of Integrative Plant Science
Cornell University, Ithaca NY, USA

David Manns, Gavin Sacks, Anna Katharine Mansfield

Department of Food Science
Cornell University, Ithaca NY, USA

Wine Active Compounds And Vineyard Practices 5

LATE SEASON SHIRAZ BERRY DEHYDRATION ALTERS COMPOSITION AND SENSORY QUALITIES OF WINE

Late ripening of Shiraz (*Vitis vinifera L.*) is often accompanied by berry dehydration, leading to significant yield decrease and economic losses. This occurrence is accelerated by hot and dry weather conditions, however the impact of berry dehydration on wine composition remains poorly characterised. The presented investigation examined the influence of late season berry dehydration, the most common form of Shiraz berry shrivelling, on wine chemical and sensory composition.

Triplicate wines, made from Shiraz grapes with approximately 80% shrivel, were vinified and compared to control wines, which were hand-sorted in order to remove all shrivelled berries. Pre-fermentation parameters including total soluble solids and pH were significantly higher in juice from the shrivelled berries compared to the nonshrivelled control. This resulted in wines with a greater than 1% v/v higher ethanol content. In contrast, no significant differences in juice nitrogenous compounds or individual amino acids were noted between the treatments. Wines from shrivelled berries generally exhibited lower concentrations of higher alcohol acetate esters whereas straight chain fatty esters were not altered significantly by berry shrivelling. C6 compounds were higher in wines from shrivelled berries, a possible result of differences in juice lipid composition. Furthermore, wines from shrivelled berries resulted in higher γ-nonalactone and massoia lactone concentrations, which are known contributors to prune, jammy, overripe aromas of red wines. Finally, wines from shrivelled berries were sensorially ranked higher in stewed fruit perception and were also perceived as more alcoholic and astringent. Wines from non-shrivelled control were perceived higher in red fruit notes and acidity.

This study has provided insights into the sensory and compositional properties of wines made from shrivelled Shiraz berries.

Guillaume Antalick

National Wine and Grape Industry Centre
Charles Sturt University, Wagga Wagga, Australia

Hsiao-Chi Chou, Guillaume Antalick, Campbell Meeks, Katja Suklje

National Wine and Grape Industry Centre
Charles Sturt University, Wagga Wagga, Australia

Leigh M. Schmidtke, John W. Blackman

School of Agricultural and Wine Science
National Wine and Grape Industry Centre
Charles Sturt University, Wagga Wagga, Australia

Wine Active Compounds And Vineyard Practices 6

ARE CHEMICAL COMPOSITION AND QUALITY OF WINE INFLUENCED BY REDUCTION OF INPUTS IN VINEYARD AND WINERY ?

The effects of three phytosanitary protection strategies (conventional, organic and ecophyto (dose reduction compare to conventional)) in the vineyard and the use or not of sulfur dioxidein the winery have been recently studied on the fungal populations of grape berries and during alcoholic fermentations [1].
Fungal populations on berries and must were modified depending on the phytosanitary protection resulting in a decrease in biodiversity of the plot cultivated with organic protection. The addition of sulfur dioxide in must also modified population dynamics. However differences depending on the plant protection persisted during fermentation. The non-targeted chemical analysis (nonvolatile compounds) of wines by FT-ICR-MS showed that the wines could be discriminated at the end of alcoholic fermentation based on either the presence or absence of SO_2, or above all the phytosanitary protection. Sensory profiles of wines produced from these grapes have been established by a panel of 12 trained assessors. Significant differences, strongly linked to the degree of oxidation, were observed between the three types of protection for wines produced without SO_2. The floral flavors were higher for ecophyto wines which also showed white and exotic fruit flavors significantly lower than for conventional wines. For wines produced with SO_2, the differences are not significant for most descriptors. However, the impact of SO_2 appears different depending on the protection strategy. On conventional wines, reduction is noted for the wines with SO_2 and on the contrary significant oxidation is noted on the wines without SO_2. For ecophyto wines, the effect of SO_2 is slightly marked. The greatest resistance to oxidation of these wines could be related to the reduction of doses and numbers of treatments used in the vineyard. This phytosanitary protection could lead to higher content of grapes polyphenols linked to natural defences of the vine.

[1] Grangeteau' C., Roullier-Gall, C., Rousseaux, S., Gougeon' R.G., Schmitt--Kopplin, P., Alexandre, H., Guilloux--Benatier, M. 2016. Wine microbiology is driven by vineyard and winery anthropogenic factors. Microbial Biotechnology, in press.

Cédric Grangeteau

Université de Bourgogne-France-Comté
AgroSup Dijon, PAM UMR A 02.102
Dijon, France
cedric.grangeteau@u-bourgogne.fr

Sandrine Rousseau, Régis D. Gougeon, Herve Alexandre, Michelle Guilloux-Benatier

Université de Bourgogne-France-Comté
AgroSup Dijon, PAM UMR A 02.102
Dijon, France

Chloé Rouiller-Gall, Philippe Schmitt-Kopplin

Chair of Analytical Food Chemistry
Technische Universität München
Freising-Weihenstephan, Germany
Research Unit Analytical BioGeoChemistry
Department of Environmental Sciences
Helmholtz Zentrum München, Neuherberg, Germany

Wine Active Compounds And Vineyard Practices

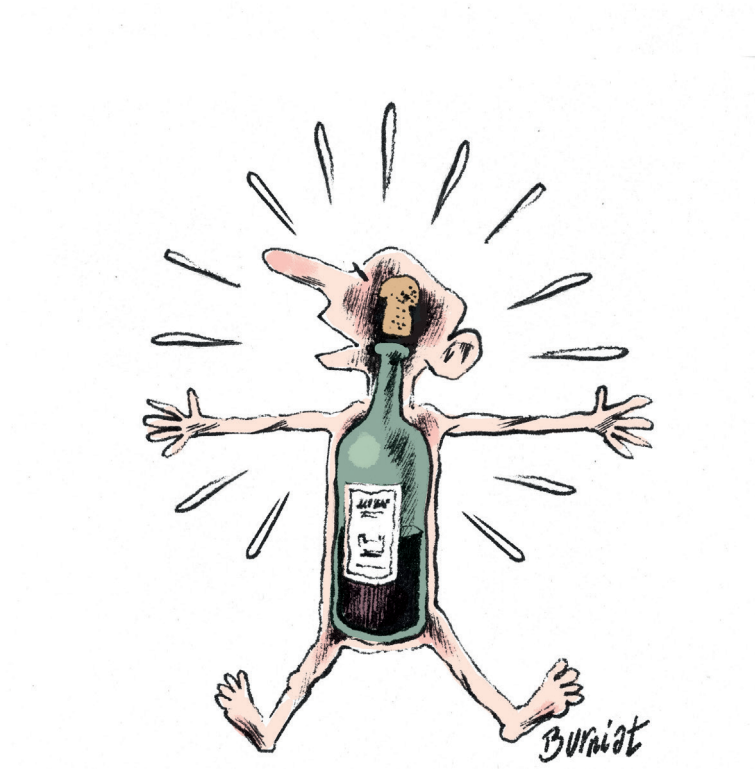
ARE CHEMICAL COMPOSITION AND QUALITY OF WINE INFLUENCED BY REDUCTION OF INPUTS IN VINEYARD AND WINERY ?

Jordi Ballester

Centre des Sciences de l'alimentation et du goût
UMR CNRS/uB/INRA, Equipe CEP
Dijon, France

ORAL SESSION II

Health & Wine Active Compounds
Santé et molécules actives du vin



Health & Wine Active Compounds K

CAN A GLASS OF WINE A DAY KEEP THE DOCTOR AWAY ?

Wine, especially the red variety, has been studied extensively over the past years with interesting findings suggesting it may promote various health benefits.
This review focuses on the health benefits of moderate wine consumption and provides insights into the bioactivity of wine constituents.
When consumed in moderation, red wine in particular has been demonstrated to promote metabolic improvements associated with a longer lifespan, provide benefits to the heart, help to fight against inflammatory processes and certain cancers, and improve mental health. Most of these health benefits have been attributed to phenolic wine constituents, e.g. flavonoids, acting as anti-oxidants either by scavenging free radicals or reactive carbonyls, or by inducing anti-oxidative defense mechanisms. However, some of the wine constituents are metabolised extensively upon digestion and absorption, resulting in secondary metabolites that may also elicit health benefits, like, e.g., resveratrol for which an anti-inflammatory activity has been demonstrated not only for the parent compound but also for its sulphated metabolites [2]. In addition to the widely-studied group of flavonoids as bioactive compounds, other constituents such as organic acids and phenolic acids are also worth to consider as they have been shown to aid digestion by regulating gastric acid secretion prior to absorption [3,4]. Knowing a wine's health beneficial constituents, their metabolic transformations and pharmacokinetics will help to optimize their contents through the selection of grape varieties and improving the wine making processes.

[1] http://www.nhs.uk/Livewell/alcohol/Pages/alcohol-units.aspx
[2] Schueller, K., Pignitter, M., Somoza, V. 2015 Sulfated and Glucuronated trans-Resveratrol Metabolites Regulate Chemokines and Sirtuin-1 Expression in U-937 Macrophages. J Agric Food Chem. 29, 6535-45.
[3] Liszt, K.I., Walker, J., Somoza, V. 2012 Identification of organic acids in wine that stimulate mechanisms of gastric acid secretion. J Agric Food Chem. 60, 7022-30. doi: 10.1021/jf301941u.
[4] Liszt, K.I, Eder, R., Wendelin, S., Somoza, V. 2015 Identification of Catechin, Syringic Acid, and Procyanidin B2 in Wine as Stimulants of Gastric Acid Secretion. J Agric Food Chem. 35, 7775-83

Veronica Somoza

Department for Nutritional and Physiological Chemistry veronika.somoza@univie.ac.at
Christian Doppler Laboratory for Bioactive Aroma Compounds
University of Vienna, Vienna, Austria

Health & Wine Active Compounds 1

EVALUATING THE RELATIVE METABOLIC IMPROVMENTS OF RED WINE VS. OAK TANNIN INTAKE IN C57BL/6J MICE FED A HIGH-FAT DIET

As ellagic acid has been found to retard the development of chronic disease associated with the consumption of a high-fat (HF) diet by mice [1-4], we hypothesized that ellagic acid and other phytochemicals present in oak (Quercus robur) may contribute to the health benefits associated with barrel-aged red wine consumption. This hypothesis was tested using C57BL/6J mice fed the following diets: a 'healthy' low-fat control diet (LF), the HF control diet, and HF diet with the following additions: oak tannin powder (HF+OT); an unoaked red wine grape extract (HF+RWP); and two red wine concentrates made from oaked and unoaked Barbera red wine (HF+OWC; HF+UWC). Powders were added at 0.2% (w/w) of the diet and concentrates were added at 7% (w/w). Experimental diets were provided ad libitum for 10 weeks.

Mice fed high-fat diets containing extracts and purified compounds exhibited some improved metabolic parameters compared to control mice fed the high-fat control diet.
Weight gain associated with consumption of the HF diet was significantly reduced ($P<0.05$) in HF+OT-, HF+OWC-, HF+UWC- , but not HF+RWP-fed mice. The reduced weight gain vs. HF appears to be related to reduced food intake. Similar results were observed for the ratio of liver weight to total body weight, an indicator of relative fat content in the liver. The HF+OT-, HF+OWC-, and HF+UWC-fed groups all had significantly lower ratios ($P<0.05$) consistent with lower liver fat content; again HF+RWC-fed mice did not show this reduction. Serum glucose levels were not different in all groups as tested at the end of the feeding period, however reductions in serum resistin, a marker for loss of glucose control associated with diabetes was reduced in HF+OT-fed mice as was a marker of chronic inflammation, monocyte chemoattractant protein-1 (MCP-1). Our results are consistent with the hypothesis that intake of phytochemicals contained in oak can lessen the development of MetS symptoms in HF-fed mice.

[1] Shay NF, Banz WJ (2005) Regulation of gene transcription by botanicals: novel regulatory mechanisms.Annu Rev Nutr. 2005;25:297-315.
[2] Zhao B, Smith S, and Shay NF (2014) Metabolic effects in C57BL/6J Mice Fed a High-fat Diet Supplemented with Resveratrol, Quercetin, Ellagic Acid, or Pinot Noir Juice and Wine Extracts. Proceedings of the Third Edition of the International Conference Series on Wine Active Compounds. 441-445.
[3] Gourineni V, Shay NF, Chung S, Sandhu AK, Gu L. (2012) Muscadine grape (Vitis rotundifolia) and wine phytochemicals prevented obesity-a sociated metabolic complications in C57BL/6J mice. J Agric Food Chem. 2012 Aug 8;60(31):7674-81.
[4] Kang I, Buckner T, Shay NF, Gu L, Chung S. (2016) Improvements in Metabolic Health with Consumption of Ellagic Acid and Subsequent Conversion into Urolithins: Evidence and Mechanisms. Adv Nutr. 2016 Sep 15;7(5):961-72.

Neil Shay

Department of Food Science and Technology neil.shay@oregonstate.edu
Oregon State University, Corvallis, Oregon, USA

Ting Luo, Marlena Sturm

Department of Food Science and Technology
Oregon State University, Corvallis, Oregon, USA

Tedd Goldfinger

Desert Cardiology of Tucson
Tucson, Arizona, USA

Health & Wine Active Compounds 2

GRAPE PHENOLIC COMPOUNDS RELATED TO OXIDATIVE STRESS RESTISTANCE THROUGH CAENORHABDITIS ELEGANS MODEL

Grapes are majoritarian sources of phenolic compounds (PCs) in human diet, having considerable antioxidant activity [1]. The nematode *Caenorhabditis elegans* presents high homology to mammals, and it has been used to evaluate potential protective effects of chemicals [2]. Here, the nematode model was used to evaluate which are the main PCs related to the grapes biological activity. Different varieties of the *Vitis vinifera* L. grapes (Arinarnoa, Barbera, Marselan, Teroldego, and Tempranillo) of *Campanha Gaúcha* (Southern Brazil) from 2014 and 2015 vintages were used. Eighteen PCs were quantified in the grape extracts through an ultra-performance liquid chromatograph coupled to a mass spectrometer and with an high-performance liquid chromatograph coupled to a diode array detector. *In vitro* assays were also conducted to measure total phenolic index and antioxidant activity against free radicals (DPPH and ABTS reagents). The nematodes were exposed to the extracts for 48h, from larval stage 1 (L1) to larval stage 4 (L4). Following, the animals were challenged with oxidative stress (ParaquatTM 5mM), heat stress (30°C 4h) or UV light (254nm 10min). The number of animals that survived was compared to non-challenged group. Chemometrics was used through principal component analysis (PCA) to identify correlations. Arinarnoa (2014 vintage), Marselan (2014 vintage) and Rebo (2015 vintage) varieties presented higher survival rates when the nematodes were submitted to paraquat stress, which is mainly oxidative. Marselan reveled protection against heat shock, which is mainly at protein folding level. Rebo counteracted UV stress, which is expected to happen as DNA damage. A PCA graph revealed that some PCs, as astilbin, followed by flavanols (*i.e.* (+)-catechin and related compounds), were positively correlated to the samples with more pronounced antioxidant activity. These combined chemical and biological methods may identify PCs with potent activities in grapes.

[1] Flamini, R. et al. 2013. Advanced knowledge of three important classes of grape phenolics: anthocyanins, stilbenes and flavonols. International Journal of Molecular Science. Volume 14.
[2] Lima, M.E. et al. 2014. *Ilex paraguariensis* extract increases lifespan and protects against the toxic effects caused by paraquat in *Caenorhabditis elegans*. International Journal of Environmental Research and Public Health. Volume 11.

Celito Crivellaro Guerra

LACEM, Labororatòrio de Cromatografia e Espectrometria de Massas
Embrapa Uva e Vinho
Bento Gonçalves, Brazil
celito.guerra@embrapa.br

Marco Flores Ferrão

Instituto de Quìmica
Universidade Federal de Rio Grande do Sul,
Porto Alegre, Brazil

Magda Salvador

LACEM, Labororatòrio de Cromatografia e Espectrometria de Massas
Embrapa Uva e Vinho
Bento Gonçalves, Brazil

Health & Wine Active Compounds

GRAPE PHENOLIC COMPOUNDS RELATED TO OXIDATIVE STRESS RESTISTANCE THROUGH CAENORHABDITIS ELEGANS MODEL

Ana Maria Bergold

Laboratòrio de Quimica Farmacêutica
Faculdade de Farmàcia
Universidade Federal do Rio Grande do Sul,
Porto Alegre, Brazil

Daiana Àvila, Willian Salgueiro

Grupo de Pesquisa em Bioquìmica e Toxicologia
em Caenorhabditis elegans,
Universidade Federal do Pampa, Uruguaiana, Brazil

Letìcia Flores da Silva

LACEM, Labororatòrio de Cromatografia e
Espectrometria de Massas, Embrapa Uva e Vinho
Bento Gonçalves, Brazil
Laboratòrio de Quimica Farmacêutica
Faculdade de Farmàcia, Universidade Federal do Rio
Grande do Sul, Porto Alegre, Brazil

Health & Wine Active Compounds 3

RED WINE EXTRACT AND GRAPEVINE POLYPHENOLS AS ESSENTIAL ACTORS TO FIGHT INFLAMMATION THROUGH A MODULATION OF IMMUNE SYSTEM IN A CANCEROUS CONTEXT

A wide variety of plant-derived compounds, including polyphenols and flavonoids, is present in the human diet and may protect against vascular diseases, cancers and associated inflammatory effects. Among these compounds, polyphenols produced by grapevine seem to be good candidates for chemoprevention against various degenerative diseases where inflammation process has a capital role in their initiation and development. We have recently shown the mechanism that link inflammation, immune system and cancer progression involves various cell types. Subsequently, it appears that immunomodulation of tumor microenvironment represent interesting targets for chemoprevention strategies. In this study, we investigated the potential benefit effects of red wine extract (RWE) containing different polyphenols on immune response inflammation. Especially, we measured the ability of RWE to decrease the differentiation of adaptive immune cells such as lymphocytes T helper into one of several subtypes particularly into lymphocytes Th17. Our results demonstrate that RWE decrease Th17 differentiation and subsequently abolish proinflammatory interleukins production (i.e. IL-17). These new data are comforted with the results obtained with polyphenols present in this RWE such as resveratrol. In mouse model of melanoma (B16F10), polyphenol prevented tumor growth and angiogenesis in an IL-17- dependent manner. This phenomenon could be due to a strong inhibition of the expression of the Th17-specific transcription factor Rorc at the mRNA level, which is dependent of the sirtuin-1. This work brings new highlights of polyphenols from red wine extract in their antiinflammatory mechanisms and in their anticancer effects through a modulation of the immune system.

Dominique Delmas

Université de Bourgogne, Dijon, France ddelmas@u-bourgogne.fr
Centre de Recherche INSERM, Dijon, France

P. Chalons, E. Limagne, F. Courtaut, M. Thibaudin, F. Vegran, G. Mignot, L. Apetoth, V. Aires

Université de Bourgogne, Dijon, France
Centre de Recherche INSERM, Dijon, France
Equipe Chimiothérapie, Métabolisme Lipidique et
Réponse Immunitaire Antitumorale

Raul F. Guerrero

Instituto de Investigaciòn y Formaciòn Agaria y
Pesquera, Càdiz, Spain

Health & Wine Active Compounds

RED WINE EXTRACT AND GRAPEVINE POLYPHENOLS AS ESSENTIAL ACTORS TO FIGHT INFLAMMATION THROUGH A MODULATION OF IMMUNE SYSTEM IN A CANCEROUS CONTEXT

Tristan Richard

Université de Bordeaux, ISVV
Villenave d'Ornon, France
Groupe d'Etude des Substances Végétales
à Activité Biologique

P. Chabert, V. Schini-Kerth

Biophotonique et Pharmacologie
Faculté de Pharmacie
Université de Strasbourg, Illkirch, France

F. Ghiringhelli

Centre Georges François Leclerc, Dijon, France

Health & Wine Active Compounds 4

GRAPE JUICE CHRONIC CONSUMPTION PROMOTES WEIGHT LOSS AND OTHER HEALTH BENEFITS IN ELDERLY PEOPLE

Grape juice plays an important economic role in Rio Grande do Sul, a state in the south part of Brazil. This drink is rich in phenolic compounds that are related to various health benefits, as hepatoprotection, neuroprotection and cardio protection. The aim of this study was to determine the influence of chronic supplementation with grape juice (400 ml / day), for thirty days, in modulating the anthropometric parameters, antioxidant potential, oxidative stress and nuclear alterations. Our work is classified as quasiexperiments, characterized as “studies that aim to evaluate interventions but that do not use randomization. Similar to randomized trials, quasi-experiments aim to demonstrate causality between an intervention and an outcome. Thirty-nine (n = 39) seniors participated and were evaluated at baseline after 30 days. Parametric data were analyzed by paired t test and not by parametric Wilcoxon test, considered statistically significant ($p < 0.05$). The chronic consumption of grape juice reduced weight ($p = 0.01$), BMI ($p = 0.027$) and waist circumference ($p = 0.047$). The chronic consumption of grape juice reduced the levels of protein oxidation through carbonyls ($p = 0.02$). The antioxidant potential increased significantly ($p = 0.003$), as did the enzymatic activity of SOD ($p = 0.01$) and the SOD / CAT ratio ($p = 0.02$), in the nuclear alterations we can show a decrease in micronucleus frequency ($p = 0.035$) and picnolysis ($p = 0.01$). In conclusion, the chronic consumption of purple grape juice brings several benefits to the elderly´s health, such as weight loss, decreased waist circumference, protect DNA damage (nuclear aletrations), increase de antioxidant potential and moderate the oxidative stress.

Caroline Dani

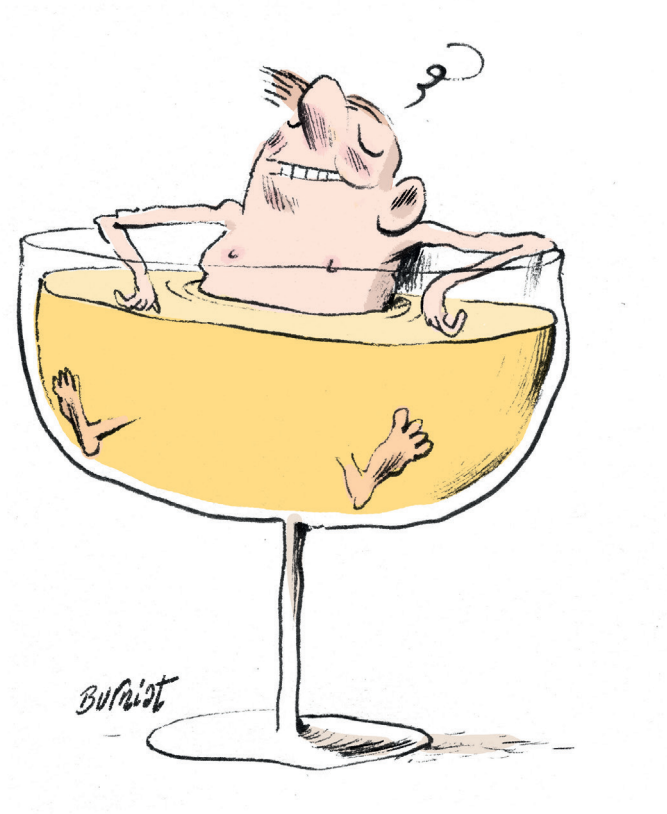
Centro Universitàrio Metodista, Porto Alegre caroline.dani@ipa.metodista.br
Rio Grande do Sul, Brazil

Pedro Canete Da Costa, Luciana Kneib Goncalves, Valesca Veiga Cardoso, Claudia Funchal

Centro Universitàrio Metodista, Porto Alegre
Rio Grande do Sul, Brazil

ORAL SESSION III

Wine Active Compounds and Sensoriality
Molécules actives du vin et sensorialité



Wine Active Compounds and Sensoriality K

EXPECTATION OR SENSORIAL REALITY ? AN EMPIRICAL INVESTIGATION OF THE BIODYNAMIC CALENDAR FOR WINE DRINKERS

Will a fruit day make my wine taste better? Tasting the same wine over various days you might found that it tastes different. Why is that? There are many factors influencing wine taste including wine composition factors, human perception factors and environment factors: The wine you drink on vacation tastes often better than the same wine back home! Recently anecdotal evidence in the form of wine industry media suggests that the moon may exert some sort of influence over how wine tastes on a particular day. Based on Maria Thun's biodynamic calendar the theory suggests that wine will taste best on 'fruit' days, when the moon is passing through the zodiac 'fire' signs of Sagittarius, Aries and Leo, and that it will taste more bitter on 'root' days, when the moon is in the earth signs of Virgo, Capricorn or Taurus. The aim of this talk is to present some data investigating the extension of the biodynamic philosophy to wine tasting, namely that wines taste different in systematic ways on days determined by the lunar cycle.

Dominique Valentin

Centre des Sciences du Goût et de l'Alimentation dominique.valentin@u-bourgogne.fr
Université de Bourgogne
Dijon, France

Wendy V. Parr

Lincoln University New Zealand
New Zealand

Phil Reedman, Claire Grose, James A. Green

Wine Active Compounds and Sensoriality 1

PERCEPTION DES VINS SANS SULFITES PAR LES CONSOMMATEURS

Depuis l'obligation (Règlement CE 1991/2004) d'indiquer la présence de sulfites sur les étiquettes de vins, l'intérêt des consommateurs pour les vins « sans sulfites » semble augmenter [1]. Mais peu de travaux de recherche font état de la perception des consommateurs pour ces vins [2-3].
L'objectif de ce travail était d'identifier la sensibilité des consommateurs face aux mentions « Vins Sans Sulfites » et « Contient des Sulfites » lors de dégustations de vins. Deux études ont été menées avec, respectivement, 144 et 305 consommateurs de vin. La première consistait à l'appréciation des vins effervescents de Gamay produits avec et sans sulfites et présentés avec des étiquettes commerciales mentionnant la présence ou l'absence de sulfites. La deuxième comportait l'évaluation de Muscadet avec et sans sulfites mais en séparant les consommateurs en trois groupes dégustant avec des informations différentes : « sans sulfites » ou « contient des sulfites » ou « sans information spécifique ». Parallèlement, les consommateurs ont répondu à des questions relatives à leur perception des sulfites.
Les résultats montrent que les consommateurs ont une perception négative des sulfites. Si les consommateurs sont partagés quant à leur impact sur le goût, plus de 40 % identifient que ce sont des conservateurs et une large majorité pense qu'ils ont un impact négatif sur la santé. Conséquemment, lorsque les vins de l'étude Gamay Effervescent sont présentés avec des étiquettes mentionnant l'absence de sulfites, ils sont un peu mieux appréciés que les vins avec la mention « contient des sulfites ». En revanche, dans le cas des Muscadet, qui ont été présentés avec des messages uniques à des groupes indépendants, il n'apparait pas de différence d'appréciation globale. Ces résultats suggèrent que les consommateurs perçoivent une valeur positive dans les vins sans sulfites mais que celle-ci doit être communiquée de manière très explicite pour provoquer une plus-value hédonique.

[1] Immele, A. (2012). Les Grands Vins Sans Sulfite. Merignac.
[2] Costanigro M. Appleby C. & Menke S. D. (2014) The Wine Headache : Consumer Perceptions Of Sulfites And Willingness To Pay For Non Sulfited Wines. Food Quality And Preference, Vol.31

Ronan Symoneaux

Unité de Recherche GRAPPE, Senso'Veg
Ecole Supérieure d'Argriculture (ESA)-INRA
Université Bretagne Loire, Angers, France
r.symoneaux@groupe-esa.com

Christophe Marchais

Loire VittiVini Distribution, Mozé sur Louet, France

Cecile Coulon-Leroy, Chantal Maury

Unité de Recherche GRAPPE, Senso'Veg
ESA-INRA, Université Bretagne Loire, Angers, France

Fabrice Gouraud

TERRENA les Vignerons des Terroires de la Noëlle
Ancenis, France

Wine Active Compounds and Sensoriality 2

SOUTH AFRICAN CHENIN BLANC STYLES DESCRIPTION AS PERCEIVED BY LOCAL EXPERTS

Chenin Blanc Association of South Africa recognises three dry styles, namely Fresh and Fruity (FF), Rich and Ripe Unwooded (RRU), and Rich and Ripe Wooded (RRW). Even though they are generally accepted, the styles are not clearly defined (e.g. by a list of descriptors or by specific winemaking procedures). It is believed that the South African wine experts have an understanding of the styles' characteristics and should be able to differentiate between them.

As part of a larger project aimed at style characterisation by sensory and chemical means, the experiment presented here was designed to test the ability of experts to distinguish between various styles and describe them in two different types of sensory exercises. 1. Sort and characterise a number of Chenin Blanc wines according to own criteria (free sorting); 2. Sort and characterise the same wines into pre-defined groups according to style name (directed sorting). The first exercise was aimed at the free characterisation of the wines presented, and gave the experts freedom to choose their criteria for grouping. The second exercise targeted the preconceived ideas linked to Chenin Blanc style attributes, even in the absence of predefined style characteristics.

The results indicated that, in the absence of restrictions linked to grouping according to style, the general cultivar characteristics predominated in the descriptions, while during the directed sorting exercise, some attributes considered as style-specific were used by the assessors. One exception was noted, namely that the judges could, in both exercises, indicate which of the wines belonged to the wooded group/RRW style.

Astrid Buica

Department of Viticulture and Œnology
Stellenbosch University
Stellenbosch, South Africa
abuica@sun.ac.za

Jeanne Brand, Christine Wilson

Department of Viticulture and Œnology
Stellenbosch University
Stellenbosch, South Africa

Wine Active Compounds and Sensoriality 3

ASSESSING CONSUMER RESPONSE TO THE PEPPER AROMA COMPOUND ROTUNDONE IN DURAS RED WINE

Rotundone is the aroma compound responsible for peppery aroma in red wine. Previous results showed that these peppery notes were not appreciated in red wine by all consumers [1, 2] which indicates that rotundone might be considered as a taint from a certain level of concentration. The current study aimed at determining a consumer rejection threshold (CRT) in Duras red wine using the method previously described for cork taint [3]. Regular consumers of red wine (n = 62) were recruited in Toulouse, South West of France. A base wine from Duras having a negligible level of rotundone for this cultivar (9 ng/L) was spiked with increasing concentrations of food quality rotundone (25, 50, 100, 200 and 400 ng/L). Replicate paired comparison tests were conducted for each concentration level, totaling five replicate tests. Presentation order was randomized and each concentration was presented to subjects in order of increasing concentration. The 0.05 probability level for paired comparison tests was used to identify the level of concentration for which a wine was significantly preferred by the panel. As specific anosmia has been reported for rotundone [4], anosmic respondents were identified using a triangular test (plain water vs water solution spiked with rotundone at 200 ng/L). Anosmic respondents represented 31% of the panelists which is more than the 20% described previously (4) and suggests that there is more anosmia to rotundone within the French population than within the Australian one. The wine spiked with 25 ng/L of rotundone was significantly rejected by anosmic panelists. This indicates that rotundone might have the ability to induce a trigeminal sensation in wine at low concentration. For the rest of the panel, we were not able to determine any CRT. Data were treated through principal component analysis and hierarchical clustering in order to identify several clusters of consumer profiles. The first cluster mainly composed of young consumers preferred the control. The second cluster liked moderate levels of rotundone (< 37.5 ng/L) and rejected high concentrations (>300 ng/L). The last group appreciated peppery wines especially when rotundone exceeded 75 ng/L.

[1] Geffroy, O., Buissière, C., Lempereur, V., Chatelet, B. 2016. A sensory, chemical and consumer study of the peppery typicality of French Gamay wines from cool-climate vineyards. Journal International des Sciences de la Vigne et du Vin. 50, 35-47.
[2] Williamson, P.O., Robichaud, J., Francis, I.L. 2012. Comparison of Chinese and Australian consumers' liking responses for red wines. Australian Journal of Grape and Wine Research. 18, 256-267.
[3] Prescott, J., Norris, L., Kunst, M., Kim, S. 2005. Estimating a "consumer rejection threshold" for cork taint in white wine. Food Quality and Preference. 16, 345-349.
[4] Wood, C., Siebert, T.E., Parker, M., Capone, D.L., Elsey, G.M., Pollnitz, A.P., Eggers, M., Meier, M., Vossing, T., Widder, S., Krammer, G., Sefton, M.A., Herderich, M.J. 2008. From wine to pepper : rotundone, an obscure sesquiterpene,

Olivier Geoffroy

Institut Français de la Vigne et du Vin
Pôle Sud-Ouest, V'innopôle
Lisle sur Tarn, France
Ecole d'Ingénieurs de Purpan, Toulouse, France
olivier.geoffroy@vignevin.com

Juliette Descotes, Eric Serrano

Institut Français de la Vigne et du Vin
Pôle Sud-Ouest, V'innopôle
Lisle sur Tarn, France

Wine Active Compounds and Sensoriality

ASSESSING CONSUMER RESPONSE TO THE PEPPER AROMA COMPOUND ROTUNDONE IN DURAS RED WINE

Laurent Dagan

Nyseos, Montpellier, France

Remi Schneider

Institut Français de la Vigne et du Vin Pech Rouge
Domaine Pech Rouge
Gruissan, France

Wine Active Compounds and Sensoriality 4

LA QUALITÉ PAR LA TYPICITÉ : L'INVENTION DE NOUVELLES NORMES DE DESCRIPTION DES VINS AU XXE SIÈCLE AU SERVICE DES AOC

Découvrir des notes de fleurs, de fruits ou des odeurs animales dans un vin fait aujourd'hui partie du vocabulaire courant employé par le dégustateur expert, voire par l'amateur éclairé. Un renversement du rapport au sens olfactif s'est opéré dans le monde du vin. Le bouquet et la saveur s'imposent désormais comme les éléments dominant tout jugement d'un cru. A l'Université, même les Sciences du Goût sont devenues une discipline à part entière tentant d'objectiver notre rapport aux saveurs. Cette façon de préciser ce que l'on sent, par la comparaison avec d'autres odeurs, et ce vocabulaire cherchant à « objectiver » l'olfactif, n'apparaissent pourtant de façon systématique et normée que relativement tardivement. En effet, durant le XXe siècle, sous l'influence de plusieurs acteurs (INAO, producteurs, oenologues) nous assistons une évolution inédite des modes de description du vin, passant d'une pratique centrée sur la vue et le toucher à un intérêt croissant pour l'odorat et la rétro olfaction.

Ces mutations sont à mettre en parallèle avec d'importants changements structurels dans les mondes vitivinicoles durant le siècle dernier. Le développement des normes d'appellation d'origine tout comme d'importantes évolutions scientifiques engendrent l'apparition de nouvelles formes de prescription et de description des vins. Dans ce contexte, l'analyse scientifique des vins devient en effet un passage essentiel de contrôle de leur caractère marchand puis, pour les AOC, de leur typicité, d'un lien plus direct entre le goût des vins et leurs terroirs d'origine. Ces mutations des modalités de la dégustation consacrent ainsi, au tournant des années 1970, des nouvelles manières d'appréhender la qualité des vins. Elles viennent fournir des outils techniques et discursifs « objectifs » permettant de hiérarchiser mais surtout, d'identifier les vins selon leur provenance, ancrant et pérennisant dès lors durablement le système des AOC dans le paysage viticole Français.

Olivier Jacquet

Chaire UNESCO «Culture et Traditions du Vin» de l'Université de Bourgogne,
UMR CNRS/uB CGC 7366
Institut «Jules Guyot», Université de Bourgogne
Dijon, France

olivier.jacquet@u-bourgogne.fr

Wine Active Compounds and Sensoriality 5

CHEMICAL AND ORGANOLEPTIC DESCRIPTION OF AGED CHAMPAGNE RESERVE WINE

Champagne regulations allow winegrowers to stock wines in order to compensate quality shifts in vintages and to maintain the sensory profile. According to their technical requirements and house style, Champagne producers also employ these stored wines in their blends to enhance complexity. During ageing, reserve wines change in terms of chemical composition and, as a consequence, in terms of organoleptic expression.
The main winemakers' challenge is to blend the reserve wines when their aroma composition is optimal. Until now, the selection was exclusively based on sensory evaluation. The aim of this study was to investigate possible relationships between wine sensory qualities and wine ageing markers, in order to evaluate the possibility of including chemical quantifications in the blend management.
Firstly, fifty-five wines were tasted by the intern panel of the Champagne house Veuve Clicquot Ponsardin. The aim was to give a full sensory description of the old and young reserve wines. Results highlighted the importance of toasty, empyreumatic and spicy notes during wine ageing. Secondly, the chemical composition of these reserve Champagne wines was explored and some aromatic heterocycles related to these specific nuances were quantified using GC/MS [1][2]. This last study revealed an accumulation of some heterocycles during ageing. This was closely related with the amino acids richness. Moreover, the statistical data also pointed out a possibility to propose groups of wines according to their age and chemical composition, highlighting, for some samples, a discrepancy between the real age and chemical age. Then, this point was confronted to sensory data and specificities with vintages in the Champagne region. Following these observations, a study on the concept of reserve wines aging potential is underway.

[1] Cadwallader, K. R., Tan, Q., Chen, F. & Meyers, S. P. 1995.Evaluation of the Aroma of Cooked Spiny Lobster Tail Meat by Aroma Extract Dilution Analysis. J. Agric. Food Chem. 43, 2432–2437.
[2] Burin, V. M., Marchand, S., de Revel, G. & Bordignon-Luiz, M. T. 2013. Development and validation of method for heterocyclic compounds in wine: Optimization of HS-SPME conditions applying aresponse surface methodology. Talanta 117, 87–93.

Nicolas Le Menn

Université de Bordeaux, ISVV
INRA, ISVV, USC 1366 Œnology, Villenave d'Ornon
University of Reims Champagne-Ardenne, URVVC
Campagne Veuve Clicquot, Reims, France

Richard Marchal

University of Reims Champagne-Ardenne
URVVC EA 4707, Reims, France

Dominique Demarville, Delphine Laborde

Champagne Veuve Clicquot, Reims, France

Gilles de Revel, Stephanie Marchand

Université de Bordeaux, ISVV
INRA, ISVV, USC 1366 Œnology
Villenave d'Ornon, France

Wine Active Compounds and Sensoriality 6

APPLICATION OF AN *IN VIVO* PTR-TOF-MS APPROACH TO DETERMINE DIFFERENCES IN WINE AROMA RELEASE AMONG WINES SPIKED WITH DIFFERENT TYPES OF ŒNOLOGICAL TANNINS

During wine consumption two key modes of perception of aroma could be distinguished : the immediatearoma impression produced when wine is just swallowed, and the prolonged retronasal aroma perceptionafter swallowing or aroma persistence [1]. Recent studies have shown that representative wine aroma compounds can be adsorbed onto the oral cavity following in-mouth wine exposure before to be desorbed [2]. The adsorption/ desorption mechanism affects the length of aroma persistence after wine intake. The ability of aroma compounds to bind onto the oral cavity is determined by their structure and physicochemical properties [1]. The type and amount of wine matrix components (ethanol, tannins, sugars, etc) might also play an important role. In this sense, there are an increasing number of applications of oenological tannins as a strategy to improve wine aroma characteristics and specifically wine aroma persistence. However, so far, no scientific studies have been conducted to know their real impact on aroma release during wine consumption.

Therefore, the objective of this work was to determine if different types of oenological tannins might affect aroma release (immediate aroma perception) and aroma persistence (long lasting aroma perception) after wine consumption. For this purpose, a proton transfer reaction mass spectrometry (PTR-ToF-MS) was used to monitor the nosespace of nine panelists after in-mouth wine exposure over a 5-minutes period. Three wine samples were assayed: the control wine (without added-oenological tannins), and the same wine with a condensed tannin extract (procyanidin type) or with a hydrolysable tannin (ellagic type). Prior to the evaluation, the wines were aromatized with five targeted volatile compounds at the same molar concentration. Results showed the adequacy of the PTR-ToF-MS to monitor aroma persistence after wine intake at real time for most of the volatile compounds assayed. Nonetheless, the impact of the oenological tannins was different for each individual, highlighting the importance of oral physiological factors when assessing the impact of polyphenols on aroma release.

[1] Jackson, R. S. (2002). Wine Tasting: A Professional Handbook, Elsevier Science.
[2] Esteban-Fernández, A., Rocha-Alcubilla, N., Muñoz-González, C., Moreno-Arribas, M. V., & Pozo-Bayón, M. Á. (2016). Intra-oral adsorption and release of aroma compounds following in-mouth wine exposure. Food Chemistry, 205,280-288.

Francis Canon

Centre des Sciences du Goût et de l'Alimentation
CNRS, INRA, Université de Bourgogne, Dijon, France

Carolina Muñoz-Gonzàlez, Etienne Semon, Olivier Berdeaux, Gilles Ferron, Elisabeth Guichard

Centre des Sciences du Goût et de l'Alimentation
CNRS, INRA, Université de Bourgogne, Dijon, France

Marià Àngeles Del Pozo-Bayòn

Instituto de Investigaciòn en Ciencias
de la Alimentaciòn (CIAL) (CSIC-UAM)
Madrid, Spain

Wine Active Compounds and Sensoriality 7

IDENTIFICATION AND QUANTITATION OF NEW AROMATIC COMPOUNDS ASSOCIATED TO HAZELNUT-LIKE NOTES OF GREAT CHARDONNAY WINES

Chardonnay is the world's most planted white grape variety and has met a great commercial success for decades. The finest Chardonnay wines impart a unique and complex bouquet described by experts as revealing "hazelnut", "flint", "oatmeal" and "grilled bread" nuances. However, the aromatic compounds responsible for these typical notes remain widely unknown. Among the terms belonging to the sensory space of Chardonnay wines, this study investigated hazelnut-like nuances.

Multi-dimensional gas-chromatography coupled to olfactometry evidenced five pyrroles reminiscent of hazelnut. A quantitative method was developed and validated in must and in white wine, highlighting their significantly higher abundance in Chardonnay. However, they proved irrelevant in sensory terms, given the low amounts measured in wine compared to their detection threshold. Thus, these aromatic compounds could represent interesting chemical markers of Chardonnay wines.

Nevertheless, searching for thiol-derivatives of the pyrroles led to the identification of two new compounds that had never been observed in in wine or in a natural product. Sensory analysis revealed that these two compounds have a powerful hazelnut-like aroma, with quite low detection thresholds. A validated quantitative method developed in our laboratory demonstrated their higher levels in Chardonnay wine. Concentrations found in these wines were above or close to their detection threshold, making these molecules the first key aromatic compounds of Chardonnay dealing with the hazelnut-like aroma.

Marine Gammacurta

Université de Bordeaux, ISVV, EA 4577 marine.gammacurta@u-bordeaux.fr
Unité de reherche ŒNOLOGIE
INRA, ISVV, USC 1366 ŒNOLOGIE,
Villenave d'Ornon, France

Valérie Lavigne

Université de Bordeaux, ISVV, EA 4577
Unité de reherche ŒNOLOGIE
INRA, ISVV, USC 1366 ŒNOLOGIE,
Villenave d'Ornon, France
Seguin Moreau France, Cognac, France

Jacques Gros, Cécile Thibon, Denis Dubourdieu, Philippe Darriet, Axel Marchal

Université de Bordeaux, ISVV, EA 4577
Unité de reherche ŒNOLOGIE
INRA, ISVV, USC 1366 ŒNOLOGIE,
Villenave d'Ornon, France

Virginie Moine

Biolaffort, Bordeaux, France

Wine Active Compounds and Sensoriality 8

USE OF GLUTATHIONE DURING WHITE WINE PRODUCTION IMPACT ON S-OFF-FLAVORS AND SENSORY PERCEPTION

Recently two OIV resolutions (OENO 445-2015 and OENO 446-2015) were adopted, defining the use of glutathione (GSH) up to a maximum level of 20 mg/L in must and wine [1,2]. Various studies have shown the benefits of GSH addition, especially in Sauvignon blanc wines [3]. On the other hand, the formation of hydrogen sulfide (H2S) and other S-off-flavors favored by GSH addition are reported [4]. To investigate the effect of glutathione on the color development, the sensory expression and the formation of sulfide off-flavors, Riesling, Sauvignon Blanc and Chardonnay grapes were processed under different conditions and musts were obtained with different phenolic concentrations. By the addition of GSH as a pure substance or the use of GSHrich inactivated yeast preparations, the GSH concentration in the musts was varied. Bottled wines showed generally lower GSH levels than the corresponding musts.

However, higher GSH concentrations after yeast aging could be determined, which may explain increased protection against oxidation during further storage. The sensory analysis after bottling showed that the fruity character of Riesling and Sauvignon blancs was enhanced at moderate GSH addition. Overuse of GSH in musts with low phenolic content, however, can lead to sensory perceptible S-off-flavors in the later wines.

[1] OIV-Oeno 445-2015
[2] OIV-Oeno 446-2015
[3] Vaimakis, V., Roussis, I.G. 1996. Must oxygenation together with glutathione addition in the oxidation of white wine. Food Chem. 57, 419-422
[4] Ugliano, M., Kwiatkowski, S., Vidal, S., Capone, D., Siebert, T., Dieval, J.B.. Aagaard, O., Waters, E.J. 2013. Evolution of 3-mercaptohexanol, hydrogen sulfide, and methyl mercaptan during bottle storage of Sauvignon blanc wines. Effect of glutathione, copper, oxygen exposure, and closure-derived oxygen. J. Agric.Food Chem. 59, 2564-2572

Pascal Wegman-Herr

Institute for Vitivulture and Œnology
DLR Rheinpfalz, Neustadt, Germany
pascal.wegmann-herr@dlr.rlp.de

Sebastian Ullrich, Hans-Georg Schmarr, Dominik Druner

Institute for Vitivulture and Œnology
DLR Rheinpfalz, Neustadt, Germany

Johanna Kost

Rheinische Friedrich-Wilhelms University Bonn
Food Technology and Biotechnology Bonn, Germany

Wine Active Compounds and Sensoriality 9

EVAPORATION OF DROPLETS IN A CHAMPAGNE WINE AEROSOL : HOW TO FIZZ ENHANCE THE PERCEPTION OF VOLATILE COMPOUNDS

When a bubble reaches an air-liquid interface, it ruptures, projecting a multitude of tiny droplets in the air. Across the oceans, an estimated 1018 to 1020 bubbles burst every second, and form the so-called sea spray, a major player in earth's climate system. At a smaller scale, in a glass of champagne about a million bubbles nucleate on the wall, rise towards the surface and burst, giving birth to a particular aerosol that holds a concentrate of wine aromas [1].

Based on the model experiment of a single bubble bursting in simple liquids, we depict each step of this process, from bubble bursting to droplet evaporation. In particular, we demonstrate how damping action of viscosity produces faster and smaller droplets and more generally how both the bubble size and the liquid phase viscosity enable to control the bubble bursting aerosol characteristics [2]. We demonstrate that compared to a still wine, champagne fizz drastically enhances the transfer of liquid into the atmosphere. Conditions on bubble radius and wine viscosity that optimize aerosol evaporation are provided [3]. These results pave the way towards the fine tuning of aerosol characteristics and flavor release during sparkling wine tasting, a major issue of the sparkling wine industry.

[1] Liger-Belair, G., Cilindre, C., Gougeon, R., Lucio, M., Gebefügi, I., Jeandet, P., Schmitt-Kopplin, P. 2009. Unraveling different chemical fingerprints between a champagne wine and its aerosols. Proc. Natl. Acad. Sci. USA, 106, 16545-16549.
[2] Ghabache, E., Antkowiak, A., Josserand, C., Séon, T. 2014. On the physics of fizziness: How bubble bursting controls droplets ejection. Phys. Fluids, 26, 121701.
[3] Ghabache, E., Liger-Belair, G., Antkowiak, A., Séon, T. 2016. Evaporation of droplets in a Champagne wine aerosol. Sci. Rep., 6, 25148.

Gérard Liger-Belair

Equipe Effervescence, Champagne et Applications gerard.liger-belair@univ-reims.fr
(GSMA-UMR CNRS 7331
Université de Reims Champagne-Ardenne, France

Elisabeth Ghabache, Thomas Seon

Sorbonne Universités
Université Pierre et Marie Curie (UMR CNRS 7190)
Institut Jean Le Rond d'Alembert, Paris, France

Wine Active Compounds and Sensoriality 10

WINE COMPOUNDS ROLE ON MOUTHFEEL PERCEPTION

Wine creates a group of oral-tactile stimulations not related to taste or aroma, such as astringency or fullness [1]. This work aims to understand the role of wine components in mouthfeel perception. Eight different model wines with/without ethanol (8%), glycerol (10 g/L) and grape and oak tannins (1 g/L) were studied. A panel of thirteen assessors was trained to perform a descriptive sensory assessment. The descriptors used by the trained sensory panel were divided into the visual phase (sediment, colour, viscosity), in the mouth phase (sweetness, acidity, bitterness, wood taste, astringency, dryness, earthiness, hotness mouthfeel, alcoholic feeling, viscosity) and after taste (global and alcohol persistence, wood aftertaste). The physical origin of the perceived changes were studied through rheology (rheometer, Malvern, UK), and tribology (MTM machine PCS, UK). Also, structural modifications in saliva proteins were studied by dynamic light scattering and Fourier transform infrared spectroscopy (FTIR). Statistical analysis was done to study the sensory differences among wine and its relation to instrumental analysis. Ethanol presence was related to the hotness mouthfeel, alcohol persistence, and feeling; ethanol also increases the intensity of other attributes. The presence of tannins was related to the intensity of colour, astringency, and dryness, furthermore ethanol did not hide this mouthfeel, having a synergetic effect. Instrumental results showed an increment of viscosity in presence of saliva, and a bulk effect in presence of wine components. The presence of tannins differentiated the samples colour, increased the z-average diameter of the saliva and affected FTIR bands. The evolution of friction as a function of entrainment velocity and sliding distance was observed and correlated with sensory and rheological measurements. More understanding of mouthfeel sensory perception and instrumental characterization will allow better understanding of wine quality aiming/directing the consumer preferences.

[1] Laguna, L.; Bartolomé, B.; Moreno-Arribas M.V. (2016) Trends Food Sci Technol., *in press*.

Laura Laguna

Instituto de Investigaciòn en Ciencias de la Alimentaciòn (CIAL) CSIC-UAM
Campus de Cantoblanco, Madrid, Spain
laura. laguna@csic.es

Anwesha Sarkar

Food Colloids and Processing Group
School of Food Science and Nutrition
University of Leeds, Leeds, UK

Michael Bryant

Institute of Functional Surfaces
School of Mechanical Engineering
University of Leeds, Leeds, UK

Begoña Bartolomé, M. Victoria Moreno-Arribas

Instituto de Investigaciòn en Ciencias de la Alimentaciòn (CIAL) CSIC-UAM
Campus de Cantoblanco, Madrid, Spain

Wine Active Compounds and Sensoriality 11

EFFECT OF ETHANOL ON THE ORAL AROMATIC PERSISTENCE OF TYPICAL WINE FRUITY ESTERS CONSIDERING INFIVIDUAL PHYSIOLOGYCAL DIFFERENCES

During wine intake, aroma compounds interact with oral and pharyngeal mucosa determining the rate of aroma release into the respiratory flows that reaches the olfactory receptors. This aspect is important not only for the immediate aroma perception, but also for the long lasting aroma perception (aroma persistence). In this process, factors related to the wine composition and oral physiology can be involved. Among the former, the impact of ethanol in wine aromatic persistence has been mostly evaluated using *-in vitro* approaches (using static and dynamic headspace), or by sensory studies showing contradictory results. On the other hand, there is a current interest of the wine industry in meeting the demands of today's consumer to produce fresh and fruity wines with lower ethanol content. This indicates the necessity to better understand the effect of ethanol in the aroma-oral mucosa interactions using -in vivo approaches, which could match better with sensory studies

Therefore, the aim of this study was to evaluate the impact of ethanol in the intraoral adsorption and release of typical wine fruity esters at different times after exposure the oral cavity to aromatized wines with different ethanol content (0, 5 and 10%). Aroma adsorbed to oral mucosa was determined by LLE-GCMS in the spit off wine solutions, while aroma released from oral mucosa was monitored by the intraoral-SPME technique recently developed [1] using a group of volunteers (n=10). Aroma release data were correlated to physiological parameters (saliva proteins, pH, esterase activity, flow, etc) determined in each individual. Results have confirmed the large inter-individual variability in the aroma persistence among individuals, which could be related to physiological differences in the flow, total protein content and esterase activity of saliva. Furthermore, it was found that the most hydrophobic esters (ethyl octanoate and ethyl decanoate) were the most persistent compounds, and were present in the oral cavity four minutes after rinsing. The effect of ethanol was variable between individuals, and for some of them an increase in intraoral aroma release in wines with higher ethanol content was observed, while for others the opposite effect was determined.

[1] Esteban-Fernández, A., Rocha-Alcubilla, N., Muñoz-González, C., Moreno-Arribas, M. V., & Pozo-Bayón, M. Á. (2016). Intraoral adsorption and release of aroma compounds following in-mouth wine exposure. Food Chemistry, 205, 280-288.

Marìa Àngeles Del Pozo-Bayòn

Instituto de Investigaciòn en Ciencias de la Alimentaciòn (CIAL) (CSIC-UAM)
Madrid, Spain
m.delpozo@csic.es

Marìa Perez-Jiménez, Nuria Rocha-Alcubilla

Instituto de Investigaciòn en Ciencias de la Alimentaciòn (CIAL) (CSIC-UAM)
Madrid, Spain

Wine Active Compounds and Sensoriality 12

ANTHOCYANIN-DERIVED PIGMENTS DRIVING DRYNESS AND PERSISTENCY IN RED WINES

It is widely accepted that astringency in wines is mainly driven by flavanol-derived compounds. Oligomers and polymers of those compounds, also called tannins, are able to either precipitate or form complexes with salivary proteins, leading to an absence of lubrication of the oral cavity, which is traditionally thought to elicit sensory astringency or dryness. Recently, it has been demonstrated that monomers of anthocyanins (malvidin-3-Oglucoside) are able to form complexes with proteins and thus suggested to be candidates to be involved in astringency formation [1].
The present work aimed at sensory and chemical characterizing wine fractions eliciting different in-mouth sensations, mainly dryness and or astringency. Therefore, three wines with different astringency levels were submitted to a chemical fractionation method combining two preparative chromatographic separations and providing 6 different odorless fractions per wine (F11, F12, F13, F21, F22 and F23). Fractions were sensory analyzed by sorting task, repertory grid and Rate-All-That-Apply method (RATA) with 30 wine experts. Results showed that fractions elicited consistently different in-mouth properties. As expected, fractions F22 of the three wines, which contained tetramers up to decamers of flavanols, were mainly characterized with terms such as coarse, grainy, dry on the tongue and dry on the palate. More surprising was the sensory properties of fraction F13 for the most astringent wine, being described as sandy, dry, dry on the palate, bitter, sour, burning, hot, prickly and persistent. Chemical characterization of this fraction revealed that it did not contain either oligomers or polymers of flavanols or flavanol-anthocyanin pigments, but a series of trimers of monomeric antocyanin. Further separation strategies are being developed to isolate these compounds to further confirm their sensory impact in wines.

[1] Ferrer-Gallego, R., Soares, S., Mateus, N., Rivas-Gonzalo J., Escribano-Bailón, M.T., de Freitas, V. 2015. New Anthocyanin–Human Salivary Protein Complexes. Langmuir. 31, 8392–8401.

Marìa-Pilar Sàenz-Navajas

Laboratorio de Anàlisis del Aroma y Enologìa LAAE masaenn@unizar.es
Instituto Agroalimentario de Aragòn (IA2)
Universidad de Zaragoza, Zaragoza, Spain

José-Miguel Avizcuri

Instituto Agroalimentario de Aragòn (IA2)
Universidad de Zaragoza, Zaragoza, Spain
Instituto de Ciencias de la Vid y del Vino
Universidad de La Rioja, Logroño, La Rioja, Spain

Sara Ferrero-del-Teso, Vicente Ferreira

Instituto Agroalimentario de Aragòn (IA2)
Universidad de Zaragoza, Zaragoza, Spain

Wine Active Compounds and Sensoriality

ANTHOCYANIN-DERIVED PIGMENTS DRIVING DRYNESS AND PERSISTENCY IN RED WINES

Dominique Valentin

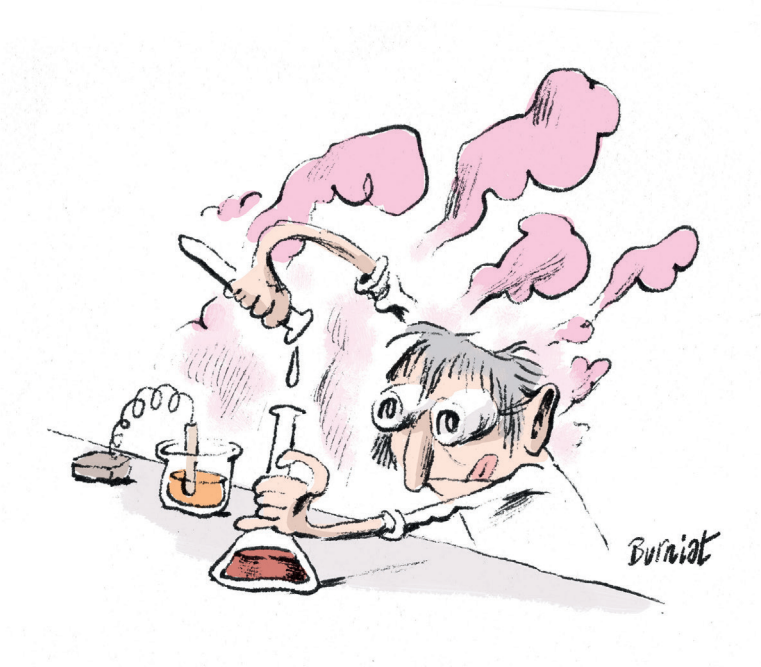
Centre des Sciences du Goût et de l'Alimentation
AGROSUP, Université de Bourgogne, Dijon, France

Mònica Bueno, Purificaciòn Fernàndes Zurbano

Instituto de Ciencias de la Vid y del Vino
Universidad de La Rioja, Logroño, La Rioja, Spain

ORAL SESSION IV

Wine Active Compounds and enological processes
Composés actifs du vins et procédés œnologiques



Wine Active Compounds and enological processes K

MICROBIAL TERROIR : ANOTHER FACET OF WINE QUALITY ?

Terroir is an important feature of wine quality and consumer appreciation, but the many factors that contribute to terroir characteristics are poorly understood. Microbial activity and biogeography may be additional aspects of this complex relationship, influencing wine quality and fermentation performance both pre- and post-harvest. Evidence indicates that the wine grape microbiome is associated with regional, varietal, and climatic factors across multi-scale viticultural zones, suggesting that the vineyard environment shapes the microbiota of local wine fermentations [1]. Individual growing regions, sub-regions, and even vineyards can be distinguished by their grape microbiota and metabolite profiles. Microbial patterns pre-fermentation are associated with the metabolome of the wine post-fermentation, and can predict the resulting abundance of specific metabolites [2]. The grape/vine microbiome reflects several regional factors, including climate and soil type, suggesting multiple pathways that may shape wine quality before and during fermentation. Untangling this relationship may elevate our ability to identify, appreciate, and protect terroir characteristics.

[1] Bokulich, N.A., Thorngate, J.H., Richardson, P.M., Mills, D.A. 2014. Microbial biogeography of wine grapes is conditioned by cultivar, vintage, and climate. Proc. Natl. Acad. Sci. USA 111: E139–E148.
[2] Bokulich, N.A., Collins, T.S., Masarweh, C., Allen, G., Heymann, H., Ebeler, S.E., Mills, D.A. 2016. Associations among wine grape microbiome, metabolome, and fermentation behavior suggest microbial contribution to regional wine characteristics. mBio 7:e00631-16.

Nicholas Bokulich

The Pathogen and Microbiome Institute
Northern Arizona University
Flagstaff, Arizona, USA

Nicholas.Bokulich@nau.edu

Wine Active Compounds and enological processes 1

ŒNOCOCCUS OENI STRAINS OF TWO DIFFERENT GENETIC GROUPS ARE PHENOTYPICALLY ADAPTED TO FERMENT WHITE OR RED WINES OF BURGUNDY

Wild strains of Oenococcus oeni that perform spontaneous malolactic fermentation belong to different genetic groups and are sometimes associated to specific types of wine [1]. This is the case of white and red wines of Burgundy in which two different groups of strains were identified. Strains of these two groups are clearly distinguishable by their genomic features and their aromatic impacts when they do MLF [2]. In this study, we have investigated the phenotypic differences that might explain why these strains develop preferentially in one of these two types of wine. Four strains of each group were tested in musts and white and red wines adjusted to different pHs, ethanol levels, or tannins concentrations. All the strains tolerate ethanol similarly. White wines strains are more resistant to low pH in grape must, but they behave like the other strains in wine. They are also more sensitive to tannins in red wine, although the type of wine, red or white, plays a significant role in this sensitivity. These findings shed new light on the preference of O. oeni strains for certain types of wines. They also allow better rationalize the choice of industrial malolactic starter cultures used to ferment these types of wines.

[1] El Khoury, M., Campbell-Sills, H., Salin, F., Guichoux, E., Claisse, O., Lucas, P. Biogeography of Oenococcus oeni reveals distinctive but non-specific populations in wine-producing regions. Applied and Environmental Microbiology. In press.
[2] Campbell-Sills, H. 2015. Phylogenomic structure of Oenococcus oeni and its occurrence in different products unveiled by comparative genomics and metabolomics. PhD thesis. University of Bordeaux.

Marion Breniaux

Université de Bordeaux, ISVV, Unité Œnologie
USC 1366 INRA
Villenave d'Ornon, France

Marine Trujillo, Hugo Campbell-Sills, Lucie Dutilh, Michael Jourdes, Pierre-Louis Teissedre, Patrick Lucas

Université de Bordeaux, ISVV, Unité Œnologie
USC 1366 INRA
Villenave d'Ornon, France

Anthony Silvano, Sibylle Krieger, Magali Bou

Lallemand
Blagnac, France

Wine Active Compounds and enological processes 2

DÉVELOPPEMENT DES PROCÉDÉS INNOVANTS POUR LA STABILISATION MICROBIOLOGIQUE DES VINS

Le dioxyde de souffre (SO_2) est un des additifs les plus utilisés dans la vinification pour ses propriétés antiseptiques et antioxydantes. La limitation des intrants dans le procédé de vinification est une des préoccupations majeures des consommateurs et des vinificateurs. Dans cette étude, nous travaillons sur le développement d'un procédé par rayons ultraviolets germicides permettant d'assurer la stabilisation microbiologique des vins en alternative aux procédés classiques (filtration, pasteurisation et SO_2).

Actuellement, le rayonnement ultraviolet (UV-C à 254 nm) est connu pour son effet germicide dans le traitement de l'eau et des surfaces. Les recherches visent à étendre l'utilisation de ce procédé sur des liquides absorbants. Une dose d'UV-C trop élevée pouvant entraîner des défauts, aussi appelés « goûts de lumière », il est donc nécessaire de maitriser la mise en circulation du vin autour de la source UV-C pour assurer une répartition homogène du rayonnement. Afin de parvenir à ce résultat, un réacteur hélicoïdal entraînant la création de vortex de Dean autour de la source UV-C a été étudié à plusieurs étapes de la vinification. Dans un premier temps, des essais en laboratoire permettent de confirmer l'efficacité du procédé sur différents vins (blanc, rouge et rosé), inoculés avec différentes souches (S.cerevisiae, D.bruxellensis diploïde et triploïde, et O.oeni) sur des concentrations de 106 UFC/mL. Des analyses physico-chimiques et sensorielles ont montré que le traitement ainsi réalisé n'avait pas d'impact sur la qualité des vins. Par la suite, des essais au niveau semi-industriel ont aussi montré que ce procédé est adaptable à des volumes plus importants et a différentes étapes de la vinification puisqu'il peut être utilisé avec succès en alternative au mutage par SO_2 de vins liquoreux aussi bien qu'avant la mise en bouteille sur vins finis.

Rémy Junqua

Université de Bordeaux, ISVV
Unité de Recherche ŒNOLOGIE
INRA, ISVV, USC 1219 ŒNOLOGIE
Villenave d'Ornon, France
remy.junqua@u-bordeaux.fr

Martine Mietton Peuchot, Rémy Ghidossi

Université de Bordeaux, ISVV
Unité de Recherche ŒNOLOGIE
INRA, ISVV, USC 1219 ŒNOLOGIE
Villenave d'Ornon, France

Wine Active Compounds and enological processes 3

EXPLORING WINE PEPTIDE DIVERSITY

Bioactive peptides have been discovered in different food products, displaying tremendous diversity in structure and function. The discovery of health and flavour-related peptides has been a research hotspot in recent years, and some identified peptides are gaining considerable biotechnological and pharmaceutical importance [1]. Grape wine contains a wide variety of peptides mainly due to yeast protease activity and autolysis. However, this family of compounds has received little attention in literature except for a few well known compounds such as glutathion.

The aim of the work is to develop a new methodology to screen the profile of wine peptides, or the wine peptidome. Our workflow has two distinct parts: (1) non-targeted metabolomics study of oligopeptides < 1000 Da (2) non-targeted peptidomics study of all peptides < 3000 Da. In the first part, non-targeted metabolomics combining ultrahigh-resolution FT-ICR-MS analysis and powerful machine learning methods suggested thousands of potential peptide features [2] and a complex network structure. The second part consists of peptidome extraction via ultrafiltration and SPE, followed by de-novo peptide sequencing via UPLC-MS/MS. Combining metabolomics and peptidomics, we not only provided a global picture of wine peptides but also identified several peptide structures. This new methodology helps to build a bridge between wine peptide profile and wine quality, health promoting and sensory properties.

[1] Korhonen, H., Pihlanto, A. 2006. Bioactive peptides: Production and functionality. International Dairy Journal. 16, 945–960.
[2] Liu, Y., Forcisi, S., Harir, M., Deleris-Bou, M., Krieger-Weber, S., Lucio, M., Longin, C., Degueurce, C., Gougeon, R.D., Schmitt-Kopplin, P., Hervé A. 2016. New molecular evidence of wine yeast-bacteria interaction unraveled by non-targeted exometabolomic profiling. Metabolomics. 12, 69.

Youzhong Liu
Université de Bourgogne-Franche-Comté
AgroSup Dijon, PAM UMR, Dijon, France

Sara Forcisi, Marianna Lucio
German Research Center of Enrionmental Health
Department of BioGeoChemistry and Analytics
Helmholts Zentrum Munchen, Ingolstädter Landstr
Neuherberg, Germany

Hervé Alexandre, Régis Gougeon
Université de Bourgogne-Franche-Comté
AgroSup Dijon, PAM UMR, Dijon, France

Magali Deleris-Bou, Sibylle Krieger-Weber
Lallemand SAS, Blagnac, France

Philippe Schmitt-Kopplin
Lallemand SAS, Blagnac, France
Technische Universität München
Chair of Analytical Food Chemistry
Alte Akademie
Freising-Weihenstephan, Germany

Wine Active Compounds and enological processes 4

IDENTIFICATION OF NOVEL OXIDATION PRODUCTS RELATED TO GLUTATHIONE

Over the last decades the anti-oxidant activity of reduced glutathione (GSH) in must and wine has been well established. Nevertheless, the impact of GSH is discussed controversially. [1] GSH is able to regenerate o-diphenol groups of oxidized polyphenols such as caftaric acid (formation of grape reaction product, GRP) [2], caffeic acid [3] or flavan-3-ols [4]. These reactions prevent polymerization and subsequent browning in must and wine [1]. Understanding the chemistry of the reactions between GSH and major grape polyphenols under oxidative conditions is essential to evaluate the efficacy of GSH as anti-oxidant in wine making. The aim of the present study was to examine the role of GSH in oxidation processes in model wine under chemical or enzymatic (tyrosinase and laccase) oxidation conditions. The trapping capability of GSH towards caftaric acid, GRP and catechin o-quinones was investigated. GSH-adducts and other derivatives were analyzed by UPLC-DAD-ESI-MS/MS. Browning development was measured as the increase of absorbance at 420 nm. Six novel GRP-derived products, tentatively identified by MS, were found including a GRP-caftaric acid conjugate. Contrary to the scientific consensus the results imply that 2,5-di-S-glutathionyl caftaric acid (GRP2) can be oxidized under wine-like conditions. Since hydroxycinnamic acids and catechin compete for GSH, browning is strongly dependent of the GSH to polyphenol ratio and the confounding factors copper and enzyme activity. Thus, the polyphenol profile of musts and wine as well as copper content and Botrytis contamination status need to be thoroughly evaluated to attain a successful prevention of browning by the addition of GSH.

[1] Kritzinger, E. C., Bauer, F. F., du Toit, W. J. 2013. Role of glutathione in winemaking: A review. J. Agric. Food Chem. 61, 269–277
[2] Cheynier, V. F., Trousdale, E. K., Singleton, V. L., Salgues, M. J. 1986. Characterization of 2-Sglutathionyl caftaric acid and its hydrolysis in relation to grape wines. J. Agric. Food Chem. 34, 217–221
[3] Ferreira-Lima, N., Vallverdú-Queralt, A., Medeuc, E., Mazauric, J. P., Sommerer, N., Bordignon-Luiz, M. T., Cheynier, V., Le Guerneve, C. 2016 Synthesis, identification, and structure elucidation of adducts formed by reactions of hydroxycinnamic acids with glutathione or cysteinylglycine. J. Nat. Prod. 79, 2211–2222
[4] Moridani, M. Y., Scobie, H., Salehi, P., O'Brien, P. J. 2001. Catechin metabolism: Glutathione conjugate formation

Franziska Bührle
Institureof Nutritional and Food Sciences
Molecular Food Technology
University of Bonn, Germany

Diana Brockert, Andreas Schieber, Fabian Weber
Institureof Nutritional and Food Sciences
Molecular Food Technology
University of Bonn, Germany

Wine Active Compounds and enological processes 5

SULFUR METABOLOME OF BOTTLED WHITE WINES HOLDS A MEMORY OF SO_2 ADDED TO THE MUST

Sulfur dioxide is commonly added to must and wine in order to protect it from oxidation [1]. Consumption of high contents of SO_2 is potentially detrimental to human health [2]. In a context of societal concern about food and wine preservation, along with the search for environmentally friendly productions, the reduction of sulfites is a major concern for the wine industry. The impact of the added SO_2 concentration (0, 4 and 8 g.hL-1) to chardonnay musts at pressing on the metabolomics signature of the related bottle-aged wines has been investigated using a combination of non-targeted EEMF and FT-ICR-MS analyses along with multivariate statistical methods [3]. Different metabolite classes, including amino acids and phenolic compounds, were affected by SO_2 and significant dose-dependent molecular changes were observed, with the production of a diversity of sulfonated compounds, which witness to the SO2 concentration initially added to the must. Spearman rank correlation was applied to link the statistically modelled EEMF components (parallel factor analysis (PARAFAC)) and the exact mass information from FT-ICR-MS, thus revealing the extent of sulfur-containing compounds, which are correlated to fluorescence fingerprints. Additionaly, metabolic fingerprints also revealed that this bottle-aged SO_2-related chemistry could differ depending on the type of bottle closure.
Further controlled oxidation experiments on the same wines provided unprecedented metabolic pictures of the SO_2-related resistance efficiency of bottle-aged wines towards oxidation. Together these results provide unprecedented insights into the white wines chemistry related to the reduction of oenological sulfites.

[1] Nikolantonaki et al. Measuring protection of aromatic wine thiols from oxidation by competitive reactions vs wine preservatives with ortho-quinones. 2014. Food Chemistry 163, 61–67.
[2] Cohen et al. Molecular Basis of the Biological Function of Molybdenum. The Relationship between Sulfite Oxidase and the Acute Toxicity of Bisulfite and SO2. 1973, PNAS 70, 3655–3659.
[3] Roullier-Gall et al. Integrating analytical resolutions in non-targeted wine metabolomics. 2015. Tetrahedron 71, 2983–2990.

Chloé Rouiller-Gall

Chair of Analytical Food Chemistry c.roullier.gall@gmail.com
Technische Universität München, Alte Akademie
Freising-Weihenstephan, Germany
Research Unit Analytical BioGeoChemistry
Department of Environmental Sciences
Helmholtz Zentrum München, Neuherberg, Germany

Daniel Hemmler, Yan Li, Philippe Schmitt-Kopplin

Chair of Analytical Food Chemistry, Germany
Research Unit Analytical BioGeoChemistry
Helmholtz Zentrum München, Neuherberg, Germany

Michael Gonsior

University of Marylan Center of Environmental Science
Chesapeake Biological Laboratory
Solomons, Maryland, USA

Maria Nikolantonak, Christian Coelho, Régis D. Gougeon

UMR PAM Université de Bourgogne, AgroSupDijon
IUVV Jules Guyot, Dijon, France

Wine Active Compounds and enological processes 6

RELATION BETWEEN QUALITY, TYPICALITY, ATTRIBUTES AND CHEMICAL COMPOSITION OF CONVENTIONAL AND BIODYNAMIC PROTECT DESIGNATION OF ORIGIN (PDO) WINES

The aim of this research was to verify the impact of the enological biodynamic and conventional process on the quality and typicality of the most famous PDO Tuscan wine (Chianti). Since quality and typicality are expression of the characteristics of the raw material [1], the biodynamic enological protocol, allowing less practice during vinification, should provide a more "natural" product, closer as perceived quality, to the original characteristics of grape. Three estates producing biodynamic wine and a conventional one participated to the project. In the biodynamic wineries, three vinifications were conducted using Sangiovese grape and following a biodynamic winemaking protocol. Instead, in the conventional winery, three vinifications were conducted using the same Sangiovese grape collected from each biodynamic winery, but following a conventional winemaking protocol.
The six wines obtained were compared with other seven Chianti PDO wines (three of which were obtained by a conventional process, and four by a biodynamic process). All the wines were submitted to descriptive analysis by trained judges. The Quality and Typicality of the wines was evaluated by experts. For all the wines, the chemical profile (base analysis, aromatic and phenolic profile) was determined.
Multivariate analysis of the data provided information about relationship between Quality, Typicality and Attributes, putting in evidence the "driver" that connected them. Relationship between chemical data and attributes at one side, Quality, and Typicality at the other, provided information about their relation. The samples of the two different kind of wines did not show differences in terms of perceived quality. Actually, there were different quality and typicality levels but they were not related to the two different enological processes.
The experiment is still going on for the last vintage and the wines produced from the grape of four biodynamic estates are treated with the same experimental design.

[1] Canuti, V., Picchi, M., Zanoni, B., Fia, G., Bertuccioli, M. (2017) A Multivariate Methodological Approach to Relate Wine to Characteristics of Grape Composition: the Case of Typicality. American journal of enology and viticulture, 68:1/January (in press).

Monica Picchi

GESAAF, Dipartimento Gestione dei Sistemi Agrari Alimentari e Forestali
Università degli Studi di Firenze, Firenze, Italia
monica.picchi@unifit.it

Valentina Canuti, Bruno Zanoni

GESAAF, Dipartimento Gestione dei Sistemi Agrari Alimentari e Forestali
Università degli Studi di Firenze, Firenze, Italia

Leonello Anello

Agronomist www.viticoltuabiodinamica.it

Wine Active Compounds and enological processes 7

OXYGEN MANAGMENT DURING AND AFTER WINE BOTTLING WITH REGARD TO REDUCTING SO_2 ADDITION

Due to its antiseptic and antioxidant properties, sulfur dioxide or SO_2 allowed a better control of wine making steps, and subsequent wine quality. Its petrochemical origin and allergenic character was criticized by consumers as well as some winemakers. The trend therefore tends to call for a large reduction or even complete elimination of its use. Making wine without adding sulfur dioxide is difficult and risky, but possible. In fact, the biggest challenge for wines without SO_2 are encountered at the bottling line and later during bottle ageing.

The present work intends to study available technologies for reducing oxygen levels in wine during bottling and bottle ageing and, in addition, to link it to a possible reduction of SO_2 levels in wine.

Among the mentioned techniques, membrane contactors manage wine gases in-line. Used at the bottling line, membrane contactors adjust CO_2 levels in wines while reducing their oxygen levels simultaneously [1].

Also, electroluminescent devices [2] are able to measure easily the total amount of oxygen trapped during bottling (TPO), without opening the packaging material. The technique simplifies measuring the performance of the packaging material and the inerting system. This same technology can also measure the oxygen transfer rate (OTR) through the packaging material during bottle ageing. It is then possible to measure the performance of the sealing locks taking into account the permeability, the variability for a batch of locks, the evolution of the permeability over time, or the evolution as a function of climatic conditions.

If these technologies are combined, they help to reduce the amount of oxygen trapped during the packaging process by a few mg / L down to less than 0.5 mg / L. In addition, some closure types, like screw caps, allow to further reduce the sulphur dioxide levels because of their very low permeability for oxygen (160 µg / year).

[1] SCHONENBERGER Patrik, BAUMANN Ignaz, JAQUEROD Axel and DUCRUET Julien, 2014. Membrane Contactor: A Non-Dispersive and Precise Method to Control CO2 and O2 Concentrations in Wine. Am. J. Enol. Vitic., Vol. 65:4.

[2] Diéval, J.B.; Veyret, M.; Vidal, J.C.; Aagaard, O.; Vidal, S.; 2009; Validation of noninvasive measurement of total package oxygen; Final papers of the 32nd world congress of vine and wine; Bulletin de l'O.I.V.; 78; 12-25.

[3] BACH Benoit, BLIND Mélissa, PEYCHES-BACH Aurélie, MARTINE Eric, LOUVIER Didier, DUCRUET Julien, 2014. Development of analytical methods for determination of oxygen ingress in Bag-In-Box®. Wine Active Compounds 26-28 Mach, Beaunes, France.

Julien Ducruet

CHANGINS, Viticulture and Œnologie
University of Applied Sciences and Arts
Western Switzerland, Nyon, Switzerland
julien.ducruet@changins.ch

Patrick Schonenberger, Pascale Deneulin, Benoir Bach, Carole Koestel, Johannes Rösti

CHANGINS, Viticulture and Œnologie
University of Applied Sciences and Arts
Western Switzerland, Nyon, Switzerland

Wine Active Compounds and enological processes 8

THE OZONE, A SUSTAINABLE TOOL IN THE PREVENTION OF MICROBIAL SPOILAGE IN TRADITIONAL WINERIES

The production of high-quality wines occurs frequently in traditional cellars with a large employment of traditional materials having technological relevance but, at the same time, some serious problems in the prevention of microbial spoilage. Among these “old” materials, wood represents a typical case. Wood is employed in the fabrication of instruments involved in the production of wines, such as vats for alcoholic fermentation or barrels for wine aging. The sanitization of these apparatus is today performed by empirical practices based on chemical sanitizers with the risk of poor efficacy and/or cross-contamination due to the residues of chemicals.
The use of ozone could be a promising alternative. This molecule has some attractive features and, thanks to the generators based on the Dielectric Barrier Discharge (DBD), it possible a cheap and in-situ production of ozone that results active against all microbiological forms. Furthermore, the high reactivity of ozone ensures the complete disappearance of residues after few minutes of treatment.
In this work we present some applications of ozone in the prevention of proliferation of spoilage microbes trough the winemaking process. For each application we describe the modification of the microflora due to the action of ozone combining traditional (plate count) and innovative (flow cytometry, pyro sequencing) analytical techniques. When the interaction between ozone and oenological matrices has a relevant impact for the composition of materials and/or wines, we evaluated the effects of ozone on the nature of most relevant components by specific tests and high-resolution analytical techniques (GC and UHPLC/MS).
Obtained results confirmed that ozone is a valuable alternative to chemical agents today used for sanitization, able to guarantee a complete sanitization in the technological interval of microbial contamination. The obtained results not showed alterations of the nature of oenological matrices, excluding interferences with the productive process.

Raffaele Guzzon
Edmund Mach Foundation raffaele.guzzon@fmach.it
San Michele all’Adige, Italy

Elena Franciosi, Roberto Larcher
Edmund Mach Foundation
San Michele all’Adige, Italy

Wine Active Compounds and enological processes 9

CHITOSAN AS BENTONITE REPLACEMENT FOR WHITE WINE FINING

Alternative methods have been proposed to counteract the drawbacks [1, 2] of bentonite, traditionally used to lower the risk of wine haze. Enzymatic degradation of wine proteins [3], ultrafiltration [4] and novel fining agents such as negatively charged polysaccharides like carragenans [5] have been proposed. The addition of chitin [7] as a specific agent for the removal of chitinase proteins would be a good choice for wine fining, but chitin is not allowed by EU regulation. Chitosan [8] from Aspergillus niger is the only type of chitosan accepted in winemaking to control Brettanomyces spp population [9], and to remove ochratoxin A and metals [10]. The effects of chitosan on wine have been so far focused on evaluating antioxidant activity [9] and removal of procyanidins and cinnamic acids [11]. Due to its structural similarity with chitin and the activity of chitinases under wine conditions [12], chitosan could be capable to interact with grape chitinases and to remove them. This work aims to fill the lack of data concerning the effect of chitosan on the removal of proteins from wines. One Moscato wine was treated with two chitosan powders, which were characterized for the deacetylation degree, the molecular weight and the solubility. After filtration, the wine was analysed for its haze potential, proteins, total phenol index, Folin-Chocalteu. HPLC analyses were carried out to outline any interaction with organic acids and phenolics. Finally, GS-MS analysis quantified the free and glycosylated aroma compounds. The results showed a significant reduction of protein content and haze potential, thus indicating a positive action of chitosan as fining agent. Negligible reductions interested the total polyphenols, while significant depletions of flavons, flavan-3-ols and cinnamic acids occurred. Tartaric and malic were affected also, as like as free aroma compounds, whilst no difference interested the glycosylated forms.

[1] Lambri, M., Dordoni, R., Silva, A., & De Faveri, D. M. (2013). Odor-active compound adsorption onto bentonite in a model white wine solution. Chem. Eng. Trans, 32, 1741-1746.
[2] Dordoni, R., Colangelo, D., Giribaldi, M., Giuffrida, M. G., De Faveri, D. M., & Lambri, M. (2015). Effect of bentonite characteristics on wine proteins, polyphenols, and metals under different pH conditions. American Journal of Enology and Viticulture, ajev-2015.
[3] Moreno-Arribas, M. V., & Polo, M. C. (2005). Winemaking biochemistry and microbiology: current knowledge and future trends. Critical reviews in food science and nutrition, 45(4), 265-286.
[4] Sarmento, M. R., Oliveira, J. C., & Boulton, R. B. (2000). Selection of low swelling materials for protein adsorption from white wines. International journal of food science & technology, 35(1), 41-47.
[5] Marangon, M., Stockdale, V. J., Munro, P., Trethewey, T., Schulkin, A., Holt, H. E., & Smith, P. A. (2013). Addition of carrageenan at different stages of winemaking for white wine protein stabilization. Journal of agricultural and food chemistry, 61(26), 6516-6524.
[6] Waters, E. J., Alexander, G., Muhlack, R., Pocock, K. F., Colby, C., O'neill, B. K., ... & Jones, P. (2005). Preventing protein haze in bottled white wine. Australian Journal of Grape and Wine Research, 11(2), 215-225.
[7] Vincenzi, S., Polesani, M., & Curioni, A. (2005). Removal of specific protein components by chitin enhances protein stability in a white wine. American journal of enology and viticulture, 56(3), 246-254.
[8] Santos, H., Veiga, F., Pina, M., Podczeck, F., & Sousa, J. (2002). Physical properties of chitosan pellets produced by extrusion e spheronisation : influence of formu- lation variables. International Journal of Pharmaceutics, 246, 153e169.
[9] Chinnici, F., Natali, N., & Riponi, C. (2014). Efficacy of Chitosan in Inhibiting the Oxidation of (+)-Catechin in White Wine Model Solutions. Journal of agricultural and food chemistry, 62(40), 9868-9875.
[10] Quintela, S., Villaran, M. C., De Armentia, I. L., & Elejalde, E. (2012). Ochratoxin A removal from red wine by several oenological fining agents : bentonite, egg albumin, allergen-free adsorbents, chitin and chitosan. Food Additives & Contaminants: Part A, 29(7), 1168-1174.
[11] Spagna, G., Pifferi, P. G., Rangoni, C., Mattivi, F., Nicolini, G., & Palmonari, R. (1996). The stabilization of white wines by adsorption of phenolic compounds on chitin and chitosan. Food Research International, 29(3), 241-248.
[12] Vincenzi, S., Bierma, J., Wickramasekara, S. I., Curioni, A., Gazzola, D., & Bakalinsky, A. T. (2014). Characterization of a Grape Class IV Chitinase. Journal of agricultural and food chemistry, 62(24), 5660-5668

Donato Colangelo

Institute of Enology and Agro-food Engineering donato.colangelo@unicatt.it
Università Cattolica del Sacro Suore
Piacenza, Italy

Wine Active Compounds and enological processes

CHITOSAN AS BENTONITE REPLACEMENT FOR WHITE WINE FINING

Fabrizio Torchio, Milena Lambri

Institute of Enology and Agro-food Engineering
Università Cattolica del Sacro Suore
Piacenza, Italy

Wine Active Compounds and enological processes 10

OXYGEN, AN ACTIVE COMPOUND OF WINE
STUDY OF THE KINETICS OF OXYGEN CONSUMPTION BY RED WINES

The central role of oxygen in the process of wine maturation has been long known. In recent years, a number of studies have described the influence of oxygen exposure on wine chemical and sensory characteristics, including modulation of wine aroma, color, and mouthfeel.
In the present study, the oxygen consumption rate of different wines has been measured under condition of carefully controlled oxidation. Eight different red wines have been subjected to 3 different controlled oxidation procedures (R1, R2, R3) with two independent replicates. A controlled volume of wine was contacted with a perfectly known amount of air and enclosed in a completely air-tight tube containing oxygen sensors. The tubes were incubated at controlled temperatura in a shaker.
Kinetic segments. Oxygen comsumption data were logarithmically transformed and the logarithm of the quotients [O2]t/[O2]i were then plotted versus time. Red wine consumption kinetics, can be interpreted by pseudo-first order kinetic models in at least 4 different consecutive time segments whose corresponding kinetic constants change with time: initial, average, prefinal and final rate. A particularly special case is the oxygen consumption at time 0. In fact, in all the experiments we could observe that wines can consume between 4 and 7 mg/L in just 30 minutes (explosive rate).
Dimensions of the kinetics of red wine oxygen consumption. Using PCA and Cluster Analysis, there are 6 dimensions in the whole dataset: R1 explosive, R1 initial, R1 average, R3 average, R3 prefinal and R3 final rate. With R1 and R3 procedures is possible to measure the kinetics of red wine oxygen consumption.
Good PLS models have been obtained to explain the dimensions of kinetics of red wine oxygen consumption, based on the initial composition of wines (polyphenols, metals, color parameters, acetaldehyde, sulfur dioxide). Only the last dimension (R3 final rate) could not be explained satisfactorily.

Ana Escudero

Laboratory for Flavor Analysis ans Enology escudero@unizar.es
Instituto Agroalimentario de Aragòn
Department of Analytical Chemistry
Faculty of Sciences, Universidad de Zaragoza
Zaragoza, Spain

Almudena Marrufo, Vanesa Carrascòn, Vicente Ferreira

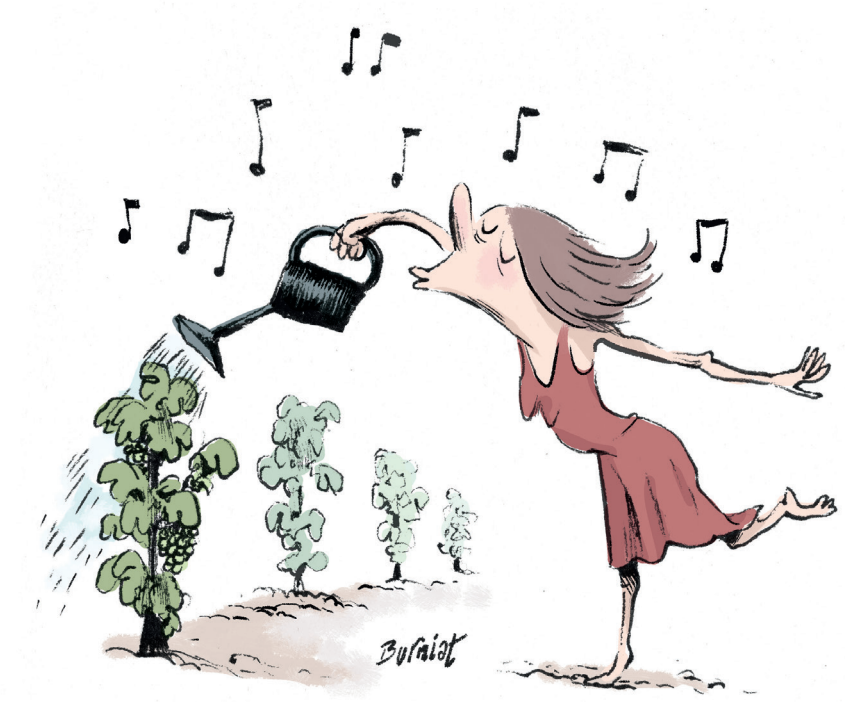
Laboratory for Flavor Analysis ans Enology
Instituto Agroalimentario de Aragòn
Department of Analytical Chemistry
Faculty of Sciences, Universidad de Zaragoza
Zaragoza, Spain

Mònica Bueno

Instituto de Ciencias de la Vid y del Vino
Universidad de La Rioja-CSIC-Gobierno de La Rioja
Logronno, Spain

POSTER SESSION I

Wine Active Compounds and Vineyard Practices
Molécules actives du vin et pratiques viticoles



Wine Active Compounds And Vineyard Practices

FROM THE VINEYARD TO THE GLASS : HOW TO ASSESS RED GRAPE AROMATIC MATURITY WITH SIMPLE PHYSIOLOGICAL INDICATORS

One of the most challenging aspects of winemaking is the prediction of harvest date to optimise wine quality and help produce consumer preferred wine styles.
To achieve these goals, technical measurements in addition to assessments of phenolic and flavour maturity are required. Whilst wine aroma is considered one of the most important components of wine quality, harvest decisions are often made according to criteria which are not directly related to aroma. It has become increasingly problematic as global warming has modified the maturity patterns that have been traditionally observed.
This study aimed to validate the use of grape physiological indicators to determine harvest windows for the production of specific wine styles. The investigation was carried out over two consecutive vintages for both Shiraz and Cabernet Sauvignon. Eight vineyards were chosen across two different climatic regions (warm-hot and cool-temperate) of New South Wales, Australia. Sequential harvests were performed based on the measurement of sugar accumulation per berry and berry fresh mass. For each harvest, 30L wines were made in triplicate according to a standardized protocol. Chemical analyses were performed on both the grapes and wines, which also were described by sensory descriptive analyses.
For both cultivars, a clear separation of samples was noted according to the harvest stage. Wines from first harvest (H1) were associated with red fruit descriptors and were perceived as more herbaceous. Wines from third harvest (H3) were correlated to dark and stewed fruit attributes with a higher perception of alcohol, whereas wines from second harvest (H2) had less distinct sensory attributes. Grape maturity influenced varietal and fermentative wine components, and the trends were cultivar specific.
Using sugar accumulation per berry and berry fresh mass as physiological indicators, we observed a synchronized evolution of wine styles during grape ripening irrespective of the cultivar, environment and sugar concentration.

Guillaume Antalick

NWGIC-Charles Sturt University
Wagga Wagga, NSW, Australia
Wine Research Centre
University of Nova Gorica, Vipava, Slovenia
guillaume.antalick@ung.si

John W. Blackman, Leigh Schmidtke

NWGIC-Charles Sturt University
Wagga Wagga, NSW, Australia
School of Agricultural and Wine Sciences
Charles Sturt University
Wagga Wagga, NSW, Australia

Katja Suklje

NWGIC-Charles Sturt University
Wagga Wagga, NSW, Australia
Wine Research Centre
University of Nova Gorica, Vipava, Slovenia

Wine Active Compounds And Vineyard Practices

FROM THE VINEYARD TO THE GLASS : HOW TO ASSESS RED GRAPE AROMATIC MATURITY WITH SIMPLE PHYSIOLOGICAL INDICATORS

Campbell Meeks

NWGIC-Charles Sturt University
Wagga Wagga, NSW, Australia

Alain Deloire

NWGIC-Charles Sturt University
Wagga Wagga, NSW, Australia
SupAgro, Montpellier, France

Wine Active Compounds And Vineyard Practices

THE INTEREST OF THE RENEWABE ENERGY FOR THE SPANISH WINE SECTOR

Climate change, depletion of non-renewable resources in the current energies, pollution from them, the greater ecological awareness of the population, are factors that suggest the change of energy sources in business. The agri-food industry is a growth sector, concerned about product innovation, process and with a clear awareness of what climate change may mean for it. This sector is supposed to have a high receptivity to the implementation of clean energy, as this favours not only the environment but also the essence of its business. Within the agri-food industry, the vineyards, for their peculiar characteristics are more innovative than the rest of sector and can serve as a model of how the use of renewable energy on a small scale can be profitable.
This work pretends to be a demonstration of the interest of the renewable energy for the wine sector, both wineries and vineyards. To this end, it has developed a questionnaire for those responsible for these companies in order to characterize the sector in terms of its geographical typologies, their activity levels, their perception of environmental issues, the degree of implementation of measures to mitigate climate change and improve energy efficiency, and its uses and energy consumption.

Javier Carroquino

Escuela de Ingenierìa y Arquitectura
Universidad de Zaragoza, Spain

Nieves Garcìa-Casarejos, Pilar Gargallo

Facultad de Economìa y Epresa
Universidad de Zaragoza, Spain
pigarga@unizar.es

Wine Active Compounds And Vineyard Practices

COMPARAISON QUALITATIVE DES MÔUTS ISSUS DE CEPS EXPRIMANTS DIFFÉRENTS NIVEAUX DE SYMPTÔMES FOLIAIRES D'ESCA

Le dépérissement généralisé du vignoble, conséquent aux maladies du bois (MDB), fait l'objet de préoccupations majeures pour la filière viti-vinicole [1]. Dans le cadre du projet Henessy-GTDfree (Influence de facteurs environnementaux et de pratiques culturales sur l'expression des maladies du bois et interaction plante-microbiote) un consortium de chercheurs et de professionnels proposent de réaliser une étude multicritères et multi-échelle afin d'apporter plus de connaissance sur ces maladies, et des solutions à court et moyen terme aux viticulteurs. Le travail présenté a pour objectif de réaliser un premier état des lieux de l'état de maturité à la récolte de raisins, issus de ceps de vigne exprimant des symptômes foliaires, plus ou moins marqués, d'une MDB qui est la plus fréquente en France, l'Esca.
L'évaluation, pied par pied, des symptômes d'Esca a été réalisée au niveau de 2 parcelles, une de Sauvignon blanc (33410 Beguey/Bordeaux-France) et une de Cabernet Sauvignon (33360 Latresne/Bordeaux-France). Au moment de la récolte, pour chaque parcelle, un lot de grappes a été prélevée sur trois modalités : les plants « Témoins » à priori sains ; les plants avec des symptômes foliaires « faibles » ; les plants avec des symptômes foliaires « forts » mais sans apoplexie. Pour chaque modalité, le poids moyen de 100baies a été mesuré et l'évaluation qualitative des moûts a été réalisée via les critères de maturité technologique.
Les résultats obtenus montrent clairement l'impact de la présence de l'Esca sur la qualité des baies. Quelles que soient les modalités ou le cépage, dès que les symptômes sont visibles, il est possible d'observer une baisse quantitative et qualitative. Plus les symptômes sur feuillage sont forts, plus les baies sont petites. La végétation étant peu efficiente et les réserves n'étant plus suffisantes pour assurer une maturation correcte, il en résulte un mûrissement des fruits qui est fortement modifié.

[1] Bertsch C., M. Ramirez-Suero, M. Magnin-Robert, P. Larignon, J. Chong, E. Abou-Mansour, A. Spagnolo, C. Clément and F. Fontaine. 2013. Grapevine trunk diseases: complex and still poorly understood. Plant Pathology, 62: 243-265.

Céline Cholet
EA 4577, Unité de recherche œnologie
INRA, USC 1366, ISVV, Univesité de Bordeaux
Villenave d'Ornon, France

Pascal Lecomte, Barka Diarra, Patrice Rey
UMR 1065 Santé et Agroécologie du Vignoble
INRA Bordeaux Sciences Agro, ISVV
Villenave d'Ornon, France

Tommaso Martignon, Massimo Giudici,
SIMONIT&SIRCH, MAITRES TRAVAILLEURS DE VIGNE
Cadillac, Bordeaux, France

Laurence Geny
EA 4577, Unité de recherche œnologie
INRA, USC 1366, ISVV, Univesité de Bordeaux
Villenave d'Ornon, France

Wine Active Compounds And Vineyard Practices

EVOLUTION OF MAJOR NITROGEN CONTAINING SUBSTANCES DURING RIPENING IN REPSONSE TO THE FOLIAR UREA TREATMENT

Foliar-urea treatment at veraison-time on vineyard increases the yeast available nitrogen (YAN) in the grape and may prevent quality alteration of wine due to N deficiency. In this study we investigated the influence of vine varieties on the evolution of the major N containing substances and the amino acid profile of grape until harvest after foliar-urea application. The results were correlated to the concentration of proline and higher alcohols in the wine.

The concentration of ammonium (NH_4^+), primary (PAA) and secondary (SAA) amino acids were followed weekly in four white vine varieties (Chasselas, Chardonnay, Sauvignon Blanc and Gewürztraminer) during the ripening in 2012, 2014 and 2015. Experimentations were conducted on a parcel known to produce N deficient grapes and foliar-urea treatments were applied (4x5N) on a part of the parcel. The concentration of proline and higher alcohols were measured in the wines. An increase was observed in the level of YAN in the treated grapes. During the ripening YAN values were decreasing and SAA increasing in all variants. The distribution of N between the NH_4^+, PAA and SAA depends strongly from vine variety. The report SAA/PAA is 0.9-2.0 in Chardonnay and 0.1-0.5 in the other varieties. We found systematically lower values for this report in the treated variants. It suggests that at N deficient condition the biosynthesis of proline from the PAA continues to the detriment of the Arg, Glu and Ala. Indeed these AA are in significantly higher level than others in the treated variants.

At the harvest the main increase, due to the treatment, was observed in the PAA concentration, followed by the SAA and the NH_4^+. An important effect of the vine variety and the millesim was noticed which was reflected already in the wine. These results confirm that the vine variety should be taken into account when proline and higher alcohols are used as markers for the N deficiency.

Àgnes Dienes-Nagy

Agroscope, Nyon, Switzerland agnes.dienes-nagy@agroscope.admin.ch

Frederic Vuichard, Jean-Laurant Spring, Fabrice Lorenzini

Agroscope, Nyon, Switzerland

Wine Active Compounds And Vineyard Practices

USE OF REFLECTANCE SPECTRA OF VINE LEAVES AS INDICATORS OF CHEMICAL ELEMENTS IN SOILS AND VINES

Non-destructive analytical techniques as remote sensing and spectroradiometry have been used on vineyards to reveal spectral characteristics, with applications on mappings of grape variety and vineyard quality [1]. It has also been shown that field radiometric measurements can be helpful in vineyard monitoring [2]. We report results from reflectance measurements, in vivo and in situ, performed in visible and infrared wavelengths, using a portable spectroradiometer, in seven vineyards of Cabernet Sauvignon and Merlot in south Brazil. The objective was to search for sets of wavelengths in the reflectance spectra of vine leaves which can act as indicators of abundances of chemical elements present in leaves or soil. Chemical analysis of vine leaves and soil of the selected vineyards were performed for the elements B, Ca, Cu, S, Fe, P, Mg, Mn, N, Zn. Average reflectance spectrum for each parcel (data from 24 leaves) were derived, each spectrum with 2101 reflectance values between 400nm and 2500nm. Linear regressions correlated chemical abundances and reflectances at each wavelength for the seven vineyards. For each chemical element we obtained 2101 values of R2 covering the measured spectral range. Regions of the spectra where wavelengths are associated with a higher R2 were supposed to indicate a sensitivity of the reflectance measurement to the chemical abundance of a certain element, in vine leaves or in soil. Values of R2 as high as 0.90 where found. These results suggest that, for wavelengths corresponding to higher R2 values, it is possible to define a linear function between reflectance and elemental abundance. Applications of this research include the monitoring of vineyards on content of toxicity levels of controlled elements.

[1] Ducati , J.R., Bombassaro, M.G., Fachel, J.M.G. 2014. Classifying vineyards from satellite images: A case study on Burgundy's Côte d'Or. J. Internat. des Sciences de la Vigne et du Vin 48, 247-260.
[2] Da Silva, P.R., Ducati, J.R. 2009. Spectral features of vineyards in south Brazil by ASTER imaging. Internat. J. of Remote Sensing 30:23, 6085-6098.

Jorge Ricardo Ducati

Remote Sensing Center
Federal University of Rio Grande do Sul
Porto Alegre, Brazil
ducati@if.ufrgs.br

Adriane Brill Thum

Centro de Ciências Exatas e Tecnològicas
Universidade do Vale do Rio dos Sinos
São Leopoldo, Brazil
Remote Sensing Center
Federal University of Rio Grande do Sul
Porto Alegre, Brazil

Wine Active Compounds And Vineyard Practices

KNOWLEDGE IMPROVEMENT OF GRAPESEED TANNINS : A PERSPECTIVE TO ADAPT WINEMAKING METHODS ?

The tannins are involved in the aromatic quality of wines and their conservation in time. The tannins are fairly well characterized chemically [1] [3] and we know that they come from the skin[4] and seeds of grapes [5] [2], [3]. For winemaking, the whole part of grape berry is considered. It is commonly known that tannins from skin have an impact on wine sensory perception (astringency and bitterness) [6], [7] and conservation (colours maintains), a little is known about those from seeds. That fact conducts us to give an interest on seed tannins. Aim of this work is to highlight what part of seed tannins could be extracted during the 2 important steps of winemaking: alcoholic fermentation and maceration time. Nine sampling condition of grapeseed, from our partner "Chateau Lafite - Domaines Barons de Rothschild ", and wine during microvinification of Cabernet sauvignon vintage in 2016 showed that tannins evolution might depend of seed maturity. Those results, combined to those of sensory perception analysis drive us to conclude that detection of seed maturity by a panel of taster is directly linked and partly due to seed tannins composition. Moreover, this seed quality could be correlated to extraction capacity during winemaking.
Take altogether, these information allows us to give new indications to improve process and quality of winemaking.

[1] J. Bogs, M. O. Downey, J. S. Harvey, A. R. Ashton, G. J. Tanner, and S. P. Robinson, "Proanthocyanidin Synthesis and Expression of Genes Encoding Leucoanthocyanidin Reductase and Anthocyanidin Reductase in Developing Grape Berries and Grapevine Leaves," Plant Physiol., vol. 139, no. 2, pp. 652–663, Oct. 2005.
[2] M. O. Downey, J. S. Harvey, and S. P. Robinson, "Analysis of tannins in seeds and skins of Shiraz grapes throughout berry development," Aust. J. Grape Wine Res., vol. 9, no. 1, pp. 15–27, Apr. 2003.
[3] J. A. Kennedy, M. A. Matthews, and A. L. Waterhouse, "Changes in grape seed polyphenols during fruit ripening," Phytochemistry, vol. 55, no. 1, pp. 77–85, Sep. 2000.
[4] F. K. Cerpa-Calderón and J. A. Kennedy, "Berry Integrity and Extraction of Skin and Seed Proanthocyanidins during Red Wine Fermentation," J. Agric. Food Chem., vol. 56, no. 19, pp. 9006–9014, Oct. 2008.
[5] Y. Cadot, M. T. Miñana-Castelló, and M. Chevalier, "Anatomical, Histological, and Histochemical Changes in Grape Seeds from Vitis vinifera L. cv Cabernet franc during Fruit Development," J. Agric. Food Chem., vol. 54, no. 24, pp. 9206–9215, Nov. 2006.
[6] K. Chira, G. Schmauch, C. Saucier, S. Fabre, and P.-L. Teissedre, "Grape Variety Effect on Proanthocyanidin Composition and Sensory Perception of Skin and Seed Tannin Extracts from Bordeaux Wine Grapes (Cabernet Sauvignon and Merlot) for Two Consecutive Vintages (2006 and 2007)," J. Agric. Food Chem., vol. 57, no. 2, pp. 545–553, Jan. 2009.
[7] W. Ma, A. Guo, Y. Zhang, H. Wang, Y. Liu, and H. Li, "A review on astringency and bitterness perception of tannins in wine," Trends Food Sci. Technol., vol. 40, no. 1, pp. 6–19, Nov. 2014

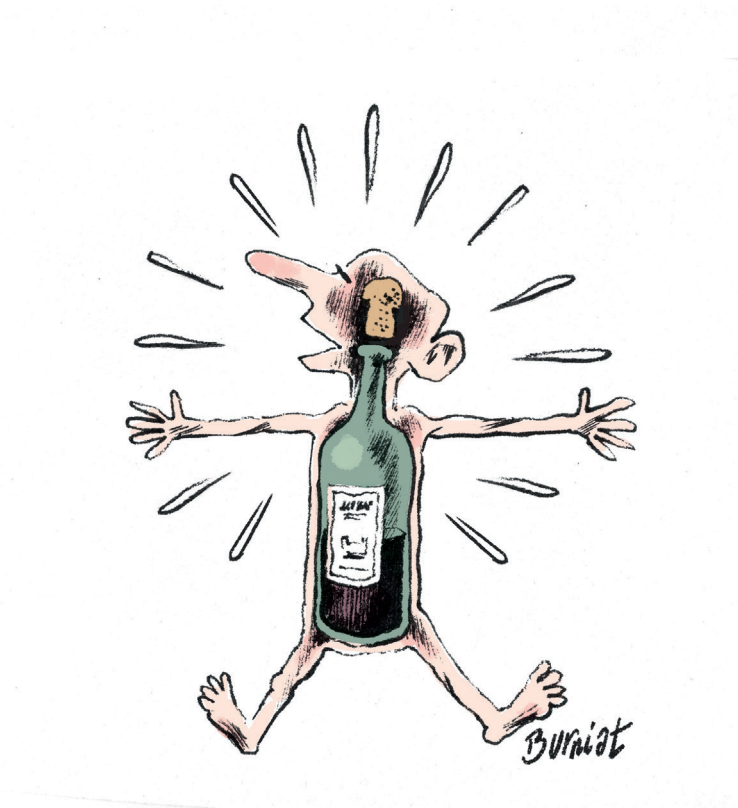
Amélie Rabot
ISVV, Unité de Recherche Œnologie
INRA, USC1366 Œnologie
Université de Bordeaux, Villenave d'Ornon, France

Saito Taku
ISVV, Unité de Recherche Œnologie
INRA, USC1366 Œnologie
Université de Bordeaux, Villenave d'Ornon, France
Suntory Wine International Limited, 13-2
Imaikami-cho, Kanagawa, Japan

Geny Laurence
ISVV, Unité de Recherche Œnologie
INRA, USC1366 Œnologie
Université de Bordeaux, Villenave d'Ornon, France

POSTER SESSION II

Health & Wine Active Compounds
Santé et molécules actives du vin



Health & Wine Active Compounds

RESERVATOL AND PEROXISOME PROLIFERATOR-ACTIVATED RECEPTOR GAMMA ($PPAR_\gamma$) A DUAL LINK TO INDUCE PROGRAMMED CELL DEATH IN COLON TUMORAL CELLS

Resveratrol (*trans*-3,4',5-trihydroxystilbene), a main wine microcomponent, has been widely described as a chemopreventive agent. Researches performed since the last decades *in vitro*, in animal models and in (pre)clinical studies have pointed out its pleiotropic health benefits by acting on multiple signaling pathways which go beyond its originally described direct antioxidant activity. One of its potential intracellular targets, as suggested in a neuronal model, is peroxisome proliferators activated receptors (PPARs). In this study, we sought to determine in colorectal cancer cells whether PPARs could be involved in resveratrol-induced cell death.

We showed that PPARs agonists strongly decreased tumoral cell proliferation and contributed to resveratrol-induced cell cycle arrest. In addition, PPARγ agonist rosiglitazone enhanced resveratrol-induced cell death. Inhibition of PPARγ with its specific antagonist GW9662 or by transient transfection of cancer cells with a dominant-negative PPARγ mutant abrogated resveratrol-induced effects. Tumor cells death was also potentiated by combining resveratrol with rosiglitazone.

Altogether our data show that PPARγ contributes to resveratrol-induced colon cancer cells death and suggest that the combination of this polyphenol with PPARγ agonists could be relevant as a new therapeutic approach to treat digestive cancers.

Virginie Aires

Centre de Recherche INSERM U866
Equipe Chimiothérapie, Métabolisme Lipidique
et Réponse Immunitaire Antitumorale, Dijon
Université de Bourgogne, Dijon, France
virginie.aires02@u-bourgogne.fr

B. Brassard, A. Carlier, L. Martinu, M. Tarpin

Université de Reims Champagne Ardenne
UMR CNRS/URCA 7369 MEDyC
Laboratoire SiRMa UFR SEN, Reims, France

A. Scagliarini, D. Delmas

Centre de Recherche INSERM U866
Equipe Chimiothérapie, Métabolisme Lipidique
et Réponse Immunitaire Antitumorale, Dijon
Université de Bourgogne, Dijon, France

Financial Support :
This work was supported by the «Ligue Inter-Régionale Grand-Est contre le Cancer».

Health & Wine Active Compounds

ANTIOXIDANT ACTIVITY AND STORAGE REGIME OF DEFATTED GRAPE SEED FLOUR

By means of four different methods, the present study determines the antioxidant activity of defatted grape seed flour after alcoholic fermentation. The flour was packed in co-extruded barrier film with thermosealing copolymer coating applied in the food industry and was stored for six months. During storage, the microbial load, granulometric composition, and humidity of the grape seed flour were determined. The six-month storage conditions of the product were optimized at a temperature of 250C and relative humidity of the air amounting to 75%.

A. Bogoeva

Process Engineering Department, doctoral student
University of Food Technologies
Plovdiv, Bulgaria

A. Durakova

Process Engineering Department
University of Food Technologies
Plovdiv, Bulgaria

V. Yanakieva

Microbiology Department
University of Food Technologies
Plovdiv, Bulgaria

A. Pavlov, R. Vrancheva

Analytical Chemistry Department
University of Food Technologies
Plovdiv, Bulgaria

K. Choroleeva

Centre for Language Education
University of Food Technologies
Plovdiv, Bulgaria

Health & Wine Active Compounds

INTERACTIONS AMONG MICROORGANISMS AND POTENTIAL LIMITATION OF BIOGENIC AMINES ACCUMULATION IN WINE

Yeasts and bacteria are the main microorganisms related to the must/wine microbial consortium and generally grapes, vineyard and wine cellar equipment represent their habitat. The interactions among yeasts and bacteria throughout the winemaking process are susceptible to influence wine quality and safety. In this study, forty-five microbial strains, belonging to fifteen different species of enological interest, have been tested for their interactions using both *in vitro* and *in vivo* approaches. A total of 45 microbial strains, belonging to 15 different species of enological interest, have been used in this work (yeasts: *Saccharomyces cerevisiae, Torulaspora delbrueckii, Hanseniaspora uvarum, Metschnikowia pulcherrima, Pichia fermentans, Hanseniaspora guillermondii, Issatchenkia terricola, Candida zemplinina, Brettanomyces bruxellensis; lactic acid bacteria: Oenococcus oeni, Lactobacillus plantarum, Lactobacillus brevis, Pediococcus parvulus, Lactobacillus hilgardii*). These strains came from different sources (i. public collections, ii. Apulian spontaneous fermentations, and *iii.* enological commercial starter culture), and are representative of the main classes of microorganisms of interest in enology (protechnological strains, spoilage strains, strains producer of compounds toxic for human health). In particular, we assess the presence of biogenic amines microbial producers, using preliminary screening on plate and HPLC analysis. Alcoholic beverages containing these nitrogen organic compounds can have toxicological consequences for humans. Several inhibitions have been detected, belonging to all the interaction categories (yeast-yeast, yeast-bacteria, bacteria-yeast and bacteria-bacteria), in some cases for the first time. The results suggest the potential exploitation of these inhibition in enology in order to reduce the content of biogenic amines in wine. This work was supported by the Apulian Region in the framework of “FutureInResearch” program (practice code 9OJ4W81).

Vittorio Capozzi

Department of the Sciences of Agriculture Food and Environment
University of Foggia, Foggia, Italy
vittorio.capozzi@unifg.it

Marianna De Gioia, Pasquale Russo, Giuseppe Spano

Department of the Sciences of Agriculture Food and Environment
University of Foggia, Foggia, Italy

Health & Wine Active Compounds

AUTOCHTHONOUS MICROBIODIVERSITY IN WINE, THREATS AND OPPORTUNITIES FOR WINE PRODUCT AND PROCESS INNOVATION

Microbial starter cultures represent a fundamental lever of innovation in the wine sector. Selected strains of yeasts are used to achieve the needed biomass preparation to accelerate and steering alcoholic fermentation in grape must. Starter cultures to induce malolactic fermentation in wine rely on the selection and propagation of suitable strains of lactic acid bacteria. In each of these two categories, the selection of new strains, the renovate management of microbial resources, and the new applications led to continuous improvements in oenology, susceptible to increase the added value of wine. In particular, among these variables, the autochthonous microbiodiversity associated with vineyards, grapevines, and wineries offer a precious reservoir of biotechnological innovation, especially in the light of recent insights in the field of the so-called 'microbial terroir'. With this contribution, with the aim to stimulate microbial-driven consumer-oriented advances in the oenological sector, we propose an overview of the recent trends in the field of microbiodiversity exploitation, following the classical separation in 'product innovation' and 'process innovation'. In particular, we highlight i) the possible positive innovative impacts of microbial resources on the safety and on the sensorial and functional properties of wine (product innovation) and ii) the potential microbial-based improvements susceptible to reduce time/costs and the environmental impacts associated with wine-making. This work was supported by the Apulian Region in the framework of "FutureInResearch" program (practice code 9OJ4W81).

Vittorio Capozzi

Department of the Sciences of Agriculture Food and Environment
University of Foggia, Foggia, Italy
vittorio.capozzi@unifg.it

Pasquale Russo, Giuseppe Spano

Department of the Sciences of Agriculture Food and Environment
University of Foggia, Foggia, Italy

Health & Wine Active Compounds

EFFECT OF HIGH-FAT DIET AND GRAPE JUICE CONSUMPTION ON ANTIOXIDANT ENZYMATIC ACTIVITY AND PROTEIN DAMAGE IN DAMS

The greater exposure to oxidative stress, that occurs during pregnancy, is responsible to pathological processes developmental, and it can affect the female reproductive tract [1,2]. The aim of this work was to evaluate the influence of the high-fat diet associated or not the purple grape juice consumption on the antioxidant enzymatic and nonenzymatic activities of female *Wistar* rats during pregnancy and lactation times. This experimental study in a gestational model used 49 Wistar rats. The rats were divided into 4 groups: control group (GC), control group grape juice (GCS), high fat diet group (GHFD) and high fat diet with grape juice group (GSHFD). The dams had free access to their respective diets for ± 21 days of gestation + 21 days of lactation. Subsequently, the animals were euthanized by guillotine and the cortex; cerebellum and hippocampus were removed, homogenized in 1.5% KCl and frozen until the analysis. The enzymatic activity of Superoxide dimutase (SOD) [3] and Catalase (CAT) [4] was evaluated. Also, the total sulfhydryl groups (non-enzymatic defense activity) in the tissues were quantificaded [5]. Statistical analysis was performed by two-way ANOVA using the SigmaPlot 11.0 program, where $p < 0.05$ was considered significant. About the results, we observed that the purple grape juice consumption reduced SOD activity in hippocampus and cerebellum, no differences were observed in cortex. Regarding the CAT activity, no significant differences were observed between the groups in all tissues. At the non-enzymatic activity, SH content, we observed that the grape juice consumption increased this content in cerebellum. We believe that the gestational consumption of purple grape juice could provide benefits to the dams, protection against the oxidative stress damage, showing a neuroprotective effect, possibly attributed by its already recognized antioxidant properties [6,7,8,9].

[1] Agarwal, A., Allamaneni, S.S. 2004. Role of free radicals in female reproductive diseases and assisted reproduction. Reproductive Biomedicine Online. 9, 338-347.
[2] Agarwal, A., Gupta. S., Sikka, S. 2006. The role of free radicals and antioxidants in reproduction. Current Opinion in Obstetrics and Gynecology, 18, 325 – 332.
[3] Bannister, J. V., Calabrese, L. Assays for SOD. 1987. Methods of Biochemical Analysis. 32, 279-312.

Caroline Dani

Laboratory of Biochemistry
Methodist University Center IPA
Porto Alegre, Brazil
caroline.dani@ipa.metodista.br

Luciana Kneib Gonçalves, Clàudia da Silva Funchal, Fàbia Andrade, Leena Hilakivi-Clarke

Laboratory of Biochemistry
Methodist University Center IPA
Porto Alegre, Brazil

Health & Wine Active Compounds

A ROLE FOR A PRO-OXIDANT ACTIVITY OF A RED WINE POLYPHENOL, RESVERATROL, IN THE INDUCTION OF OXIDATIVE DNA DAMAGES IN COLON CANCER MODELS

Various studies have shown that trans-resveratrol can induce cell death of various tumour cells through apoptosis. Restoring a normal apoptotic homeostasis or inducing cell death or other cytostatic mechanisms like senescence in cancer cells might be interesting for preventive and therapeutic interventions.
Resveratrol has also been shown to induce DNA damage-related responses (DDR). The initiation of the DDR is mediated by ataxia-telangiectasia mutated (ATM), ataxia-telangiectasia-Rad3-related kinase (ATR) and DNA-dependent protein kinase (DNA-PK), subsequent activations of the downstream checkpoint kinases Chk1/2 and p53. Activation of these pathways could explain the pleiotropic effects of resveratrol since they have been widely described to regulate the balance between cell survival and cell death of cancer cells.
The aim of this study was to precisely characterize the effects of resveratrol on the rat PRObe (DHD-K12-TRb, ECACC) and human SW620 colon cancer cells in vitro. We studied the involvement of the DDR in resveratrol anticancer properties and also made a parallel with the response of these models in vivo.
Our results highlight that the transient anticancer activity of resveratrol towards these models of colon cancer is related to its ability to promote the production of Reactive Oxygen Species responsible for: i) an induction of the DDR; ii) an early induction of a cell cycle delay in S phase, correlated with a replicative stress; iii) transient apoptosis and senescence phenomena. The activation of these pathways and consequences were further confirmed in vivo and highlight the pro-oxidant activity of resveratrol as a key of its anticancer properties.

Dominique Delmas

Université de Bourgogne, Dijon, France
Centre de Recherche INSERM U866
«Lipids, Nutrition, Cancers», Dijon, France
ddelmas@u-bourgogne.fr

D. J. Colin, B. Chauffert, N. Latruffe

Université de Bourgogne, Dijon, France
Centre de Recherche INSERM U866
«Lipids, Nutrition, Cancers», Dijon, France
EA7270 - Bio-PeroxIL Biochimie du peroxysome, inflammation et métabolisme lipidique
Dijon, France

E. Limagne,

Université de Bourgogne, Dijon, France
Centre de Recherche INSERM U866
«Lipids, Nutrition, Cancers», Dijon, France

Health & Wine Active Compounds

A ROLE FOR A PRO-OXIDANT ACTIVITY OF A RED WINE POLYPHENOL, RESVERATROL, IN THE INDUCTION OF OXIDATIVE DNA DAMAGES IN COLON CANCER MODELS

K. Ragot, G. Lizard

Université de Bourgogne, Dijon, France
EA7270 - Bio-PeroxIL Biochimie du peroxysome, inflammation et métabolisme lipidique
Dijon, France

G. Ghiringhelli

Université de Bourgogne, Dijon, France
Centre de Recherche INSERM U866
«Lipids, Nutrition, Cancers», Dijon, France
Centre de Lutte Contre le Cancer G.F. Leclerc
Dijon, France

E. Solary

INSERM UMR 1009, Institut Gustave Roussy
Villejuif, France

Health & Wine Active Compounds

QUANTITAVE ANALYSIS OF COMPLEX STILBENES IN WINE

Stilbenes are a non-flavonoid group of phenolic compounds that have shown to possess valuable neuroprotective effects. Wine is one of the main sources of stilbenes, which could be related to the well known existence of a positive correlation between moderate wine consumption and lower rates of cardiovascular and neurological diseases. Because of its relevance in health effects, resveratrol is the most studied stilbene in wine, but other stilbenoids that have been described include glucosides, dimers, trimers, and tetramers. However, because of their complex structures and the difficult availability of pure standards, there is lack of adequate methods for quantifying simultaneously all these compounds in wine.
Our goal has been to develop a method for the analysis of stilbenes in red, white and rosé wines. In order to obtain analytical standards, pure stilbenes were isolated from grape sarments by CPC and preparative HPLC and identified by their mass and NMR spectra. Wines from different regions and different vintages were then extracted by liquid / liquid extraction. Analyses were performed by liquid chromatography with UV diode array detection or fluorescence detection. A calibration curve was constructed for each one of the standards. We have determined which detection method is the most suitable for the analysis of each compound. We have also described the stilbene composition of 15 wines, including the proportions of the isomeric forms trans- and cis-, which can be of importance since it has been shown that the antioxidant activity of trans-resveratrol is 7 times greater than the cis-.

Louis Gougeon, Tristan Richard

Université de Bordeaux
Œnologie EA 4577, USC 1366 INRA, INP
Molécules d'Intérêt Biologique (Gesvab), ISVV
Villenave d'Ornon, France
tristan.richard@u-bordeaux.fr

Josep Valls, Benoit Biais, Grégory Da Costa, Jean-Michel Merillon

Université de Bordeaux
Œnologie EA 4577, USC 1366 INRA, INP
Molécules d'Intérêt Biologique (Gesvab), ISVV
Villenave d'Ornon, France

Health & Wine Active Compounds

BIOACTIVE PHENOLS AND OENOLOGICAL PARAMETERS FOR RED WINE CLASSIFICATION ON GEOGRAPHICAL APPROACH

Chemometrics was used to classify red wines from *Campanha Gaúcha* region, in Southern Brazil, which were previously analyzed through bioactive phenols (BPs) and oenological parameters (OPs). Wines (71 in total) were made from ten grape varieties (Arinarnoa, Barbera, Cabernet Sauvignon, Malbec, Merlot, Rebo, Syrah, Tannat, Tempranillo, and Teroldego), from vineyards placed in three sub-regions (occidental, central and meridional *Campanha Gaúcha*) in five vintages (2011 to 2015), from wineries of the region and on a standard small-scale winemaking. The BPs (*trans*-resveratrol, *trans*-ε-viniferin, quercetin, myricetin, and kaempferol) were analyzed by high-performance liquid chromatography; the OPs (pH, titrable acidity and fixed acidity, alcoholic strength, reducing sugars) were determined by physicochemical methods. The chemometric tools included hierarchical cluster and principal component analyses. The results revealed high BP contents in Arinarnoa, Syrah, Tannat, Teroldego, and Tempranillo wines, and also certain samples of the Cabernet Sauvignon and Malbec varieties, as well as in wines of the central *Campanha Gaúcha*. Vintage 2013 generated wines richest in BPs. Low correlations were found between OPs and BPs. However, OPs allowed the classification of the Cabernet Sauvignon variety, while this and other four varieties were classified by their BP contents (Arinarnoa, Malbec, Syrah, and Teroldego). So, chemometric tools for red wine classification on *Campanha Gaúcha* using BPs and OPs aid strongly the characterization on geographical approach and they are being used to obtain geographical origin status for the region.

Celito Crivellaro Guerra

LACEM - Laboratòrio de Cromatografia e Espectrometria de Massas
Embrapa Uva e Vinho
Bento Gonçalves, RS, Brazil
LAENO - Laboratòrio de Enoquìmica
Embrapa Uva e Vinho
Bento Gonçalvez, RS, Brazil

celito.guerra@embrapa.br

Letìcia Flores da Silva

LACEM - Laboratòrio de Cromatografia e Espectrometria de Massas
Embrapa Uva e Vinho
Bento Gonçalves, RS, Brazil
Laboratòrio de Quìmica Farmacêutica
Faculdade de Farmàcia
Universidade Federal do Rio Grande so Sul
Porto Alegre, Brazil

Health & Wine Active Compounds

BIOACTIVE PHENOLS AND OENOLOGICAL PARAMETERS FOR RED WINE CLASSIFICATION ON GEOGRAPHICAL APPROACH

Gisele Eliane Perissutti

LAENO - Laboratòrio de Enoquìmica
Embrapa Uva e Vinho
Bento Gonçalvez, RS, Brazil

Marco Flôres Ferrão, Marcelo Caetano Alexandre Marcelo

Instituto de Quìmica
Universidade Federal do Rio Grande do Sul
Porto Alegre, RS, Brazil

Ana Maria Bergold

Laboratòrio de Quìmica Farmacêutica
Faculdade de Farmàcia
Universidade Federal do Rio Grande so Sul
Porto Alegre, Brazil

Health & Wine Active Compounds

HISTAMINOL(HISTIDINE METABOLITE) EVOLUTION DURING WINE ALCOHOLIC FERMENTATIONS AND ROLE OF YEAST STRAIN

Amino acids, together with proteins and peptides, play an important role as nitrogen sources for yeast and lactic acid bacteria during alcoholic and malolactic fermentations, respectively. At the same time, the bio products of nitrogen sources made by microbes have a strong impact on the wine quality. The metabolic pathways of the amino acids are particularly correlated to both the sensorial traits and the safety of wines. Among these, the histidine is one of the most studied free amino acids in wines, due to the capacity to be converted by enzymatic decarboxylation to histamine, a toxic biogenic amine for humans. The risk of histamine accumulation in wine is particularly high in the Mediterranean area, such as South of Italy, due to the peculiar features of these wines and the occurrence of microbial contamination.
According to the Ehrlich pathway, the conversion of histidine into histaminol during alcoholic fermentation was previously observed and reported in literature. This study started by the synthesis of histaminol, followed by the complete characterization of its chemical structure by ESI-MS and NMR measurements. Moreover, we developed and validated in-house a specific HPLC-MS method useful to study the conversion of histidine into histaminol during alcoholic fermentations as well as to quantify the target analyte.
The research was then redirected investigating the performance of different selected yeast strainsregarding the capacity to convert histamine to histaminol during the alcoholic fermentation in a modelgrape must (Chardonnay). Ten commercial Active Dry Yeast strains (ADY) were considered. Samplings and histamine/histaminol analyses were performed after 5 days (Exponential growth) from the beginning of the fermentation and after 13 days (Stationary phase) and 35 days (Yeast Death time). On average the content of histaminol was in the range of 40-500 µg/L (minimum and maximum values were obtained for 5 days and 13 days sampling, respectively).

Raffaele Guzzon

Edmund Mach Foundation
San Michele all'Adige, Italy
raffaele.guzzon@fmach.it

Matteo Bordiga, Fabiano Travaglia, Marco Arlorio, Jean Daniel Coïsson

Università degli Studi del Piemonte Orientale
«A Avogadro»
Dipartimento di Scienze del Farmaco & Drug and
Food Biotechnology (DFB)
Center Lardo Donegani, Novara, Italy

Health & Wine Active Compounds

WINE-DERIVED PHENOLIC METABOLITES AND AROMA COMPOUNDS ARE EFFECTIVE AT PROTECTING NEURONS FROM NITROSATIVE STRESS INJURY *IN VITRO*

Moderate wine consumption has shown the potential to delay the onset of neurodegenerative diseases, although the mechanisms implied behind this effect still remain unclear. Wine polyphenols are metabolized in the colon by gut microbiota, originating active and bioavailable metabolites [1]. Recent evidences link wine components and interactions with different signalling routes, such as the mitogen-activated protein kinase (MAPK) pathway involved in neuroprotection. In the present study, a human dopaminergic neuronal cell line (SH-SY5Y) was used as a model of a neuroinflammation, to study the protective effects of wine–derived human phenolic metabolites and wine aroma compounds on neuronal survival, as well as their ability to interact with MAPK pathways (ERK1/2, JNK, p38) and pro-apoptotic signaling processes (STAT 1, caspase-3). SIN-1 (3-morpholinosydnonimine) has been used as a neuronal damage inductor. Gut-derived metabolites 3,4-dihydroxyphenylacetic (3,4DHPA), 3- hydroxyphenylacetic (3HPA) and salicylic β-D-O-glucuronide at physiologically relevant concentrations (0.1-10 μM) resulted in increased cell viability ($p < 0.05$) when compared to control. A significant decrease in MAPK p38 and ERK1/2 phosphorylation was also observed following pretreatment with 3,4DHPA, 3-(4-hydroxyphenyl) propionic acid (4HPP), 3HPA and 1,8-cineole; and with 3-(4-hydroxyphenyl) propionic (3HPP), 4HPP, 3HPA, linalool and 1,8-cineole, respectively. In a similar manner, a significant reduction in downstream pro-apoptotic caspase-3 activity was further observed following pre-incubation with 3HPP and linalool ($p < 0.05$), counterbalancing the increase produced by SIN-1. Moreover, specific MEK, ERK1/2 and p38 inhibitors which have a phenolic-like structure, also resulted in an increase on cell survival and a reduction on caspase-3 levels. These results demonstrate for the first time that specific wine-derived human metabolites and aroma compounds are effective at protecting neurons from nitrosative stress injury by inhibiting neuronal MAPK ERK 1/2 and p38, as well as downstream caspase 3 activity.

[1] Muñoz-González I, Jiménez-Girón A, Martín-Álvarez PJ, Bartolomé B, Moreno-Arribas MV. Profiling of microbial-derived phenolic metabolites in human feces after moderate red wine intake. J Agric Food Chem. 2013 Oct 2;61(39):9470–9

Laura Laguna

Instituto de Investigaciòn en Ciencias
de la Alimentaciòn (CIAL) (CSIC-UAM)
Universidad Autònoma de Madrid, Madrid, Spain

Adelaida Esteban-Fernàndez

Instituto de Investigaciòn en Ciencias
de la Alimentaciòn (CIAL), CSIC-UAM
Campus de Cantoblanco, Madrid, Spain
Department of Food and Nutritional Sciences
School of Chemistry, Food and Pharmacy
University of Reading, Whiteknights Campus RG6 6AP
Reading, United Kingdom

Health & Wine Active Compounds

WINE-DERIVED PHENOLIC METABOLITES AND AROMA COMPOUNDS ARE EFFECTIVE AT PROTECTING NEURONS FROM NITROSATIVE STRESS INJURY *IN VITRO*

J.P.E. Spencer

Department of Food and Nutritional Sciences
School of Chemistry, Food and Pharmacy
University of Reading, Whiteknights Campus RG6 6AP
Reading, United Kingdom

D. Gigorro del Coso, D. Gonzàlez de Llano, B. Bartolomé, M.V. Moreno-Arribas

Instituto de Investigaciòn en Ciencias
de la Alimentaciòn (CIAL), CSIC-UAM
Campus de Cantoblanco, Madrid, Spain

C. Rendeiro

Beckman Institute for Advanced Science
and Technology
University of Illinois, Urbana-Champaign, IL, USA

Health & Wine Active Compounds

WINE POLYPHENOLS AND PROBIOTICS MIGHT RECIPROCALLY ENHANCE THEIR BENEFITS AT INTESTINAL LEVEL

Wine polyphenols seems to exert an impact on intestinal microbiota growth and functionality [1]. Polyphenols are minimally absorbed at the small intestine but they are extensively metabolized at the large intestine by microbiota, giving rise to numerous low molecular weight metabolites (benzoic acids, cinnamic acids, phenylacetic acids, phenylpropionic acids, valerolactones, among others). It is to these metabolites -more than the original forms present in foods- that the biological activity and health effects associated to dietary polyphenols are attributed to. Consumption of specific probiotic strains might improve the metabolism and bioavailability of wine polyphenols and, in turn, enhances the health effects attributed to them. On the other hand, wine polyphenols might enhance the growth and beneficial properties of probiotics in relation to intestinal health.
Based on this background, this communication investigates reciprocal benefits between wine polyphenols and probiotics in relation to the metabolism of wine polyphenols by probiotics, and to the influence of wine polyphenols in probiotic viability and in probiotic capacity to inhibit the adhesion of potential pathogens (i.e., E. coli) to intestinal cells. Among the commercial probiotic preparations (n=8) and isolated lactic acid bacteria (LAB) tested (n=3), two probiotic preparations and one LAB strain were able to release different phenolic metabolites after their incubation with a wine phenolic extract. For these three active probiotics, loss of bacteria viability was attenuated in the presence of the wine extract. On the other hand, wine phenolic compounds [i.e., (+)-catechin] and wine-derived phenolic metabolites (i.e., 3,4- dihydroxypheylacetic acid) showed a certain stimulatory effect on bacterial growth. Both phenolic compounds were also found to enhance LAB adherence to Caco-2 cells. Moreover, LAB strains and phenolic compounds seem to act synergistically to inhibit the adherence of E. coli CIAL-153 to Caco-2 cells.
These in vitro results support the statement that benefits of wine polyphenols and probiotics may be enhance by their concomitant interaction at intestinal level, which could be used in future nutritional developments [2].

[1] Dueñas, M.; Cueva, C.; Muñoz-González, I.; Jiménez-Girón, A.; Sánchez-Patán, F.; Santos-Buelga, C.; Moreno-Arribas, M.V.; Bartolomé, B. Studies on Modulation of Gut Microbiota by Wine Polyphenols: From Isolated Cultures to Omic Approaches. Antioxidants 2015, 4, 1–21
[2] González de Llano, D.; Gil-Sánchez, I; Esteban-Fernández, A.; Ramos, M.A.; Fernández Díaz, M; Cueva, C.; Moreno-Arribas, M.V.; Bartolomé, B. Reciprocal beneficial effects between wine polyphenols and probiotics: An exploratory study. Eur. Food Res. Technol. 2016, doi:10.1007/s00217-016-2770-5.

Laura Laguna

Instituto de Investigaciòn en Ciencias
de la Alimentaciòn (CIAL) (CSIC-UAM)
Universidad Autònoma de Madrid, Madrid, Spain

Irene Gil-Sànchez, Adelaida Esteban-Fernàndez, Marta Fernàndez-Dìaz, Carolina Cueva, M. Victoria Moreno-Arribas, Begoña Bartolomé

Instituto de Investigaciòn de Ciencias
de la Alimentaciòn (CIAL) (CSIC-UAM)
Universidad Autònoma de Madrid, Madrid, Spain

Health & Wine Active Compounds

WINE POLYPHENOLS AND PROBIOTICS MIGHT RECIPROCALLY ENHANCE THEIR BENEFITS AT INTESTINAL LEVEL

Alba M. Ramos

Grupo de Investigaciòn en Polifenoles
Facultad de Farmacia
Campus Miguel de Unamuno
University of Salamanca, Salamanca, Spain

Dolores Gonzàlez de Llano

Instituto de Investigaciòn de Ciencias de la Alimentaciòn (CIAL) (CSIC-UAM)
Universidad Autònoma de Madrid, Madrid, Spain
d.g.dellano@csic.es

Health & Wine Active Compounds

STUDY OF MALOLACTIC FERMENTATION AND THE ROLE OF ASSIMILIABLE NITROGEN IN SUBSTITUTED ESTER AND ACID FORMATION

Among red wine ethyl esters, substituted esters constitute a family with a particular behavior and sensory importance, strongly involved in the fruity aroma of red wines [1]. Several parameters, such as the wine lactic acid bacteria metabolism [2] and nitrogen composition of the must [3] may strongly influence the levels of a range of volatile compounds, including esters and fatty acids. The aim of this work was to determine the role of assimilable nitrogen in the must during alcoholic fermentation (AF) and malolactic fermentation (MLF) on concentrations of these esters, as well as the corresponding precursors- substituted acids. For this study, microvinifications were performed, using a must with low assimilable nitrogen content and supplemented with 2 different nitrogen concentrations. After alcoholic fermentation, each experimental wine was inoculated. Two lactic acid bacteria strains were used for malolactic fermentation. Analytical methods were used to quantify substituted esters, as well as the corresponding acids, including, where applicable, the various enantiomeric forms. Nitrogen supplementation was found to affect the production of substituted acetates during AF and hydroxylated esters during MLF. Nitrogen supplementation significantly impacted substituted acid formation only after MLF and not during AF. The impact of MLF on the production of hydroxylated acids was independent of must nitrogen supplementation, whereas that of alkyl substituted acids increased only after high nitrogen supplementation of the must. Sensory profiles revealed a significant increase in black-berry-fruit and fresh-fruit aromas during MLF. A very strong correlation was observed between the variations of these aromas and the production of substituted ester after nitrogen supplementation and MLF realization.

[1] Lytra, G., Tempere, S., Le Floch, A., de Revel, G., & Barbe, J. C. 2013. Study of sensory interactions among red wine fruity esters in a model solution. Journal of agricultural and food chemistry, 61(36), 8504-8513.
[2] Sumby, K. M., Grbin, P. R., & Jiranek, V. 2010. Microbial modulation of aromatic esters in wine: current knowledge and future prospects. Food Chemistry, 121(1), 1-16.
[3] Hernández-Orte, P., Ibarz, M. J., Cacho, J., & Ferreira, V. 2006. Addition of amino acids to grape juice of the Merlot variety: Effect on amino acid uptake and aroma generation during alcoholic fermentation. Food Chemistry, 98(2), 300-310.

Georgia Lytra
Université de Bordeaux, ISVV, EA 4577 geolytra@yahoo.gr
Unité de recherche ŒNOLOGIE
Villenave d'Ornon, France
INRA, ISVV, USC 1366 ŒNOLOGIE
Villenave d'Ornon, France

Cécile Miot-Sertier, Jean-Christophe Barbe
Université de Bordeaux, ISVV, EA 4577
Unité de recherche ŒNOLOGIE
Villenave d'Ornon, France
INRA, ISVV, USC 1366 ŒNOLOGIE
Villenave d'Ornon, France

Virginie Moine, Joana Coulon
Biolaffort, Bordeaux, France

Health & Wine Active Compounds

MELATONIN PRODUCTION BY SACCHAROMYCES AND NON-SACCHAROMYCES YEASTS

Melatonin is a bioactive compound found in wine and is synthesized by yeast during alcoholic fermentation. Its function is unknown in yeast whereas in other organisms, and specifically in vertebrates, it is involved in the regulation of circadian rhythms and anti-oxidant responses. The purpose of this study was to determine the capacity of different yeasts to synthesize melatonin during alcoholic fermentation. A selection of *Saccharomyces* yeasts (Enoferm QA23, Instaferm RED, Levucell SC20 y Diamond), used either for industrial fermentations (wine, bread or beer) or as nutritional complements, and non-*Saccharomyces* yeasts (*Torulaspora delbrueckii, Metschnikowia pulcherrima, Starmerella bacillaris, Hanseniaspora uvarum*) were tested to analyze intracellular and extracellular melatonin production in synthetic grape must. At the beginning of the fermentation, melatonin was detected either in Saccharomyces and non-*Saccharomyces* strains in the intracellular compartment. Production levels differed among strains, being Levucell SC20 and *S. bacillaris* the microorganisms the presented the highest concentration in each group. Afterwards, intracellular melatonin either disappeared or remained constant at lower levels. By contrast, extracellular melatonin was detected at different time-points over the fermentation process, depending on the yeast strain: four hours in *H. uvarum* or 24 and 48 hours in Diamond, as examples. These results point out that melatonin may play a role as a signal molecule in yeast.

Mª Àngeles Morcillo

Universitat Rovira i Virgili ,Facultad de Enologìa maangeles.morcillo@urv.cat
Dept. de Bioquìmica y Biotecnologìa
Biotecnologìa enològica
Tarragona, Spain

Beatriz Gonzàlez, Gemma Beltràn, Mª Jesùs Torija, Albert Mas

Universitat Rovira i Virgili ,Facultad de Enologìa maangeles.morcillo@urv.cat
Dept. de Bioquìmica y Biotecnologìa
Biotecnologìa enològica
Tarragona, Spain

Health & Wine Active Compounds

PREVENTIVE EFFECT OF ε-VINIFERIN AGAINST α-SYNUCLEIN TOXICITY

Parkinson's disease (PD) is a long-term degenerative disease that affects nerve cells. One of its main hallmarks is the Lewy Bodies, which are mainly constituted of α-synuclein (αS). Accumulation and aggregation of α-synuclein are thought to be directly linked to the disease. Small αS oligomers seem to be the most toxic species instead of fibrils. Several studies have attempted to identify compounds that could inhibit αS aggregation, as the latter is linked to its toxicity.
We have recently reported inhibitory capacities of piceatannol and some other wine stilbenes against αS aggregation and toxicity [1]. Stilbenes are molecules deriving from resveratrol and naturally present in vine and wine. We observed that piceatannol inhibited the formation of αS fibrils and was able to destabilize preformed filaments. It seems to induce the formation of small soluble complexes protecting membranes against αS-induced damage. Finally, piceatannol protected cells against αS-induced toxicity.
In the present study, we report the preventive effects of the ε-viniferin against αSinduced toxicity. The ε-viniferin is a resveratrol dimer naturally present in vine and wine [2]. Thioflavin T fluorescence, transmission electronic microscopy and SDSPAGE analysis were used to study the inhibitory effects against α-synuclein aggregation. Protection against membrane damage induced by aggregated α-synuclein was performed using lipid vesicle permeabilization assays. Cell Viability was examined using MTT assays. Finally, NMR complex formation was investigated by NMR. All these data indicated that ε-viniferin could prevent αS toxicity.

[1] Temsamani, H., Krisa, S., Decossas-Mendoza, M., Lambert, O., Mérillon, J. M., Richard, T. 2016. Piceatannol and other wine stilbenes: A pool of inhibitors against α-synuclein aggregation and cytotoxicity. Nutrients, 8.
[2] Vitrac, X., Bornet, A., Vanderlinde, R, Valls, J., Richard, T., Delaunay, J.C., Mérillon, J.M., Teissédre, P.L. 2005. Determination of stilbenes (δ-viniferin, trans-astringin, trans-piceid, cis- and trans-resveratrol, ε-viniferin) in brazilian wines. Journal of Agricultural and Food Chemistry. 53, 5664-5669.

Tristan Richard
Université de Bordeaux, Œnologie EA 4577 tristan.richard@u-bordeaux.fr
USC 1366 INRA, INP, Molécules d'Intérêt Biologique
ISVV, Villenave d'Ornon, France

Grégory Da Costa, Hamza Temsamani, Arnaud Courtois, Jean-Michel Merillon, Stéphanie Krisa
Université de Bordeaux, Œnologie EA 4577
USC 1366 INRA, INP, Molécules d'Intérêt Biologique
ISVV, Villenave d'Ornon, France

Health & Wine Active Compounds

EFFICIENCY OF AN ANTIOXIDANT FUNGAL EXTRACT AGAINST ENZYMATIC BROWNING OF WHITE GRAPE JUICE

Food industry is constantly seeking natural compounds with antioxidant activity for a potential use against enzymatic browning of processed fruits. In this study, we tested the impact of an antioxidant fungal extract on the preservation of a fresh white grape juice. This extract, obtained from a black Aspergilli isolated in our laboratory, free of mycotoxins, presents strong antioxidant properties through TEAC assay. Color evolution of the juice was assessed by colorimetry in presence of different concentrations of the fungal extract compared to ascorbic acid and sulfites. Our results show that the antioxidant fungal extract is able to reduce browning from 100 mg/L. Compared to ascorbic acid, half the amount of the fungal extract provides the same inhibition level. Besides, our results suggest that sulfites input during grape crushing could be reduced by the addition of a small quantity of the fungal extract. Finally, in vitro experiments on commercial mushroom tyrosinase suggest an effect of the natural extract on enzymatic browning.

Patricia Taillandier

Université de Toulouse
Laboratoire de Génie Chimique
UMR 5503 CNRS/INPT/UPS, INP-ENSAT
Castanet-Tolosan, France
patricia.taillandier@ensiacat.fr

José Raynal, Florence Mathieu, Elodie Choque

Université de Toulouse
Laboratoire de Génie Chimique
UMR 5503 CNRS/INPT/UPS, INP-ENSAT
Castanet-Tolosan, France

Health & Wine Active Compounds

CHARACTERIZATION OF POLYPHENOLS AND ANTIOXIDANT POTENTIAL OF RED AND WHITE POMACE BY-PRODUCT EXTRACTS USING SUBCRITICAL WATER EXTRACTION

Grape by-products (including skins, seeds, stems and vine shoots) are rich in health promoting polyphenols. Their extraction from winery waste and their following purification are of special interest to produce extracts with high added value compounds.
Meanwhile, the growing concern over environmental problems associated with economic constraints, require the development of environmentally sustainable extraction technologies. The extraction using semi-continuous subcritical water, as a natural solvent at high temperature and high pressure a technology is promising "green" technology that is environmentally friendly, energy efficient and improve the extraction process in plant tissues. The suitable feature of subcritical water leaching agent is its capacity to decrease dielectric constant as a function of increase in temperature, allowing a better solubility of the compounds of interest. In our study subcritical water extraction of polyphenols from red and white grape pomace from Dunkelfelder, Cabernet Franc, Merlot, and Chardonnay was performed. In semi-continuous extraction lead to crude extracts rich in different families of polyphenols.
A detailed assessment of the high added value compounds content in grape pomace varieties, after the subcritical water extraction, was done. High amounts of anthocyanins and Flavan-3-ols were recovered from fermented grape pomace using differential temperatures with a high variability between by-products. Contrary to anthocyanins, high extraction temperatures (about 200 °C) yielded higher amounts of tannins. Overall, we found that grape pomace antioxidant activity and total polyphenols quantified by Folin Ciocalteu method were not directly related to the main polyphenol content in SWE extracts. The data obtained here using laboratory-scale equipment will be useful to develop an industrial scale SWE process. Finally as observed, grape pomace by-products can be considered as an important source of polyphenols. In this regard, this global characterization may potentially provide the basis for a sustainable process of integrated exploitation of winemaking by-products as potential, inexpensive, and easily available sources of bioactive compounds for the pharmaceutical, cosmetic, and food industries.

Sami Yammine

Institut des Sciences de la Vigne et du Vin, EA 4577sami.yammine@u-bordeaux.fr
Unité de recherche œnologie
Université de Bordeaux
Villenave d'Ornon, France
INRA, ISVV, USC 1366 Œnologie
Villenave d'Ornon, France

Xavier Vitrac

Laboratoire PHENOBIO SAS, Centre Montesquieu
Martillac, France

Health & Wine Active Compounds

CHARACTERIZATION OF POLYPHENOLS AND ANTIOXIDANT POTENTIAL OF RED AND WHITE POMACE BY-PRODUCT EXTRACTS USING SUBCRITICAL WATER EXTRACTION

Robin Rabagliato, Cristèle Delsart, Martine Mietton Peuchot, Rémy Ghidossi

Institut des Sciences de la Vigne et du Vin, EA 4577
Unité de recherche œnologie
Université de Bordeaux
Villenave d'Ornon, France
INRA, ISVV, USC 1366 Œnologie
Villenave d'Ornon, France

Health & Wine Active Compounds

New flavanol Glycosides in grapes and wines

Polyphenols are present in a wide variety of plants and foods such as tea, cocoa and grape [1]. Among these compounds, flavanols are an important subclass present in grapes and wines as monomers (e.g. (+)-catechin or (-)-epicatechin), or polymers also called proanthocyanidins. They have important therapeutic and organoleptic properties [2] but their biosynthesis remains partly unknown. Some recent studies have focused on the role of epicatechin 3'-O-glucoside that is involved in the transport of the monomers and may serve as precursor in the polymerization mechanism [3]. The global objective is to identify flavanol glycosides in grapes or wines, describe their structure and determine their accumulation kinetics during grape development and in wine. Different varieties of grapes (Syrah, Merlot...) and a Tannat red wine were used to make polyphenol extracts by using different preparative techniques (silica gels, liquid-liquid extraction and solid phase extraction). The different fractions obtained were analyzed by UPLC-ESI-IT_MS (Waters Acquity, negative and positive scan and targeted mode). Specific molecular ions corresponding to monomeric and polymeric flavanol hexosides were targeted with specific m/z values: 451 (epi) catechin hexoside, 467 epigallocatechin hexoside, 603 epicatechin gallate hexoside and 739 procyanidin dimer hexoside. The existence of flavan-3-ol monomers hexoside in wine and grape seeds have already been reported based on MS/MS experiments [4]. Our results confirmed their presence in our samples but additional new ions corresponding to glycosylated proanthocyanidin dimers were detected with specific MS/MS fragments like an ion at m/z = 449 (quinone-methide cleavage) and at m/z = 587 Da (Retro Diels Alder reaction). Further work is on the way to elucidate the exact structure of these compounds (hexose nature and position) by NMR and to investigate their exact role in proanthocyanidin biosynthesis.

[1] Quideau, S., Deffieux, D., Douat-Casassus, C. and Pouysegu, L. (2011), «Plant polyphenols: chemical properties, biological activities, and synthesis,» Angew Chem Int Ed Engl, 50 (3), 586-621.
[2] Corder, R., Mullen, W., Khan, N. Q., Marks, S. C., Wood, E. G., Carrier, M. J. and Crozier, A. (2006), «Oenology: Red wine procyanidins and vascular health,» Nature,444 (7119), 566-566.
[3] Pang Y, Cheng X, Huhman DV, Ma J, Peel GJ, Yonekura-Sakakibara K, Saito K, Shen G, Sumner LW, Tang Y, Wen J, Yun J, Dixon RA. (2013), «Medicago glucosyltransferase UGT72L1: potential roles in proanthocyanidin biosynthesis», Planta, 238 139-154.

Marie Zerbib

Université de Montpellier, UMR 1083 INRA Supagro Sciences pour l'Œnologie, Centre de Formation et de recherche en Œnologie
Montpellier, France
INRA, UMR 1083 Supagro, Sciences pour l'Œnologie
Université de Montpellier, Montpellier, France

Chloé Puech, Mauve Abelanet

Université de Montpellier, UMR 1083 INRA Supagro Sciences pour l'Œnologie, Centre de Formation et de recherche en Œnologie
Montpellier, France

Health & Wine Active Compounds

NEW FLAVANOL GLYCOSIDES IN GRAPES AND WINES

Cédric Saucier

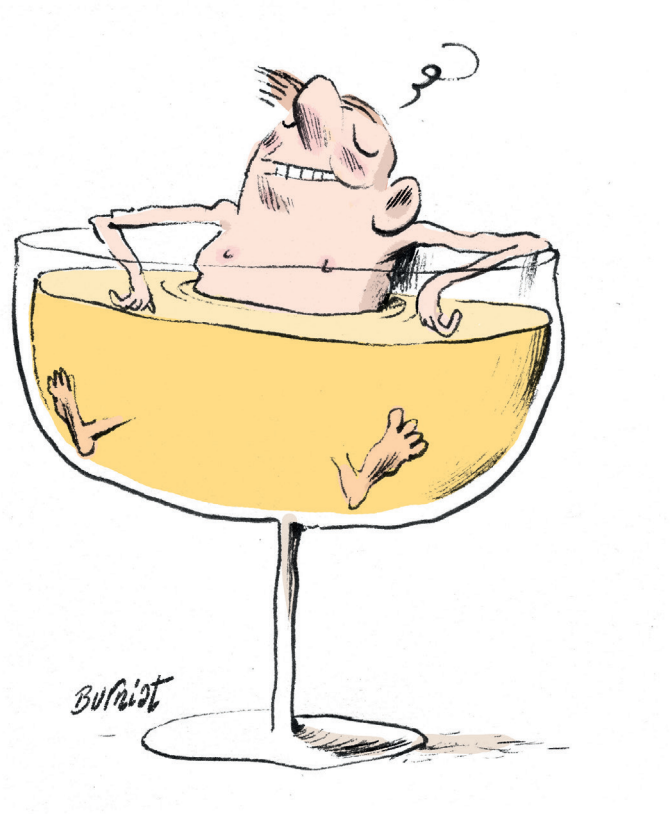
Université de Montpellier, UMR 1083 INRA Supagro Sciences pour l'Œnologie, Centre de Formation et de recherche en Œnologie
Montpellier, France
INRA, UMR 1083 Supagro, Sciences pour l'Œnologie
Université de Montpellier, Montpellier, France

Jean-Paul Mazauric, Emmanuelle Meudec, Véronique Cheynier, Nancy Terrier

INRA, UMR 1083 Supagro, Sciences pour l'Œnologie
Université de Montpellier
Montpellier, France

POSTER SESSION III

Wine Active Compounds and Sensoriality
Molécules actives du vin et sensorialité



Wine Active Compounds and sensoriality

IMPACTS SENSORIELS DES AMINES BIOGENES SUR LA DÉGUSTATION DE VINS

Présentes dans notre alimentation, des fruits jusqu'aux poissons en passant par les produits fermentés tels que les fromages et les vins, les amines biogènes font partie de notre quotidien. Ces molécules sont largement étudiées sur le plan sanitaire car elles peuvent produire, si elles se retrouvent en quantités importantes, des réactions physiologiques incommodantes. Dans les vins, les amines biogènes se retrouvent le plus souvent en quantités négligeables. Néanmoins, si leur impact sanitaire à ce niveau n'est pas à craindre, leur impact organoleptique ne pourrait pas être anodin. Sur ce point, très peu d'études ont été réalisées. Ce travail s'est donc intéressé à l'incidence sensorielle de ces composés actifs du vin. Pour répondre à cette question, deux matrices, une matrice vin blanc (Sauvignon blanc) et une matrice vin rouge (assemblage de cépages : Gamaret, Syrah, Merlot et Cabernet Franc) furent choisies. Parmi la diversité des amines biogènes présentes dans le vin, plusieurs de ces composés ont été sélectionnés pour mener à bien cette étude: la putrescine et la cadavérine. Afin de mesurer leur seuil de détection par ajouts dosés, des séances de tests sensoriels ont été réalisées par le panel experts de Changins. Puis des séances de profil sensoriel ont eu lieu avec huit échantillons par matrice préparés et dégustés selon un plan expérimental. Pour le Sauvignon blanc, une tendance a été observée en ce qui concerne les descripteurs olfactifs de «l'intensité» et la «complexité» qui se sont trouvés diminués. Ces résultats vont dans le même sens que ceux obtenus par l'étude menée par Pic-Blateyron [1] à noter que pour leur étude les concentrations employées étaient nettement supérieures (x10). Pour la matrice vin rouge, un impact significatif a également été obtenu pour les descripteurs «complexité olfactive» ainsi que «complexité aromatique en bouche» affectés négativement à des seuils de 1 à 5 mg/L.

[1] Pic-blateyron, L., Granés, D., Cavailles, M., Bontemps, E. 2014. Identification des seuils de detection et de l'impact organoleptique des principales amines biogènes dans les vins méditerraneéns. Revue Française d'oenologie 262, 1–10

Benoît Bach

Changins, Viticulture and Enology
University of Applied Sciences
and Arts Western Switzerland
Nyon, Switzerland

Delphine Thieblemont, Pierrick Rébénaque

Changins, Viticulture and Enology
University of Applied Sciences
and Arts Western Switzerland
Nyon, Switzerland

Wine Active Compounds and sensoriality

DOES FAMILIARITY AFFECT FRENCH SHIRAZ EXPERTS' PERCEPTION AND COMMUNICATION ON SHIRAZ WINES ?

The main aim of this study was to compare how French Shiraz' experts perceive and communicate on South African (SA) and French (FR) Shiraz wines. Because FR experts were more familiar with FR Shiraz, we expected that they would better discriminate FR wines than SA wines and would be more efficient in terms of communication efficiency when describing FR wines. Six FR and six SA Shiraz wines have been selected varying on price, age and style. Thirty FR Shiraz experts participated in two sessions. In the first session, performed a free sorting task followed by free description of each wine for which they were asked to describe each wine so that their description could be understood by another person. In the second session, experts performed two matching tasks. The first one consisted in matching a wine with a description. Experts received the same wines as in the first session together with the free descriptions written by another expert and they were asked to match each wine with the corresponding description. The second matching task consisted in matching two descriptions. Experts received two sets of 12 cards containing the descriptions produced by two different experts and they were asked to match the two descriptions corresponding to each wine. Globally, FR experts discriminated better FR wines than SA wines but this might be due to the wines themselves. To check this interpretation we asked SA experts to perform the same task and they also discriminated better French wines. Concerning the matching task FR experts tend to obtain more correct associations for FR wines than for SA wines both in the wine-description and in the description-description matching tasks. However, the communication task was shown to be very difficult, with quite low number of correct matches. This result can be interpreted in terms of familiarity but also in terms of a higher sensory heterogeneity among FR wines. Further research with SA experts on the same samples is needed.

Jordi Ballester

Centre des Sciences du Goût et de l'Alimentation
AgroSup Dijon, CNRS, INRA
Université de Bourgogne Franche Comté, Dijon
IUVV Jules Guyot
Université de Bourgogne, Dijon, France

Mihaela Minhea, Jeanne Brand, Wessel du Toit

Department of Viticulture and Œnology
Stellenbosch University, Stellenbosch, South Africa

Dominique Peyron, Dominique Valentin,

Centre des Sciences du Goût et de l'Alimentation
AgroSup Dijon, CNRS, INRA
Université de Bourgogne Franche Comté
Dijon, France

Wine Active Compounds and sensoriality

ISOLATION OF NATURALLY OCCURING PRECURSORS FOR THE KEROSENE OFF-FLAVOR IN RIESLING WINE

The hydrocarbon 1,1,6-Trimethyl-1,2-dihydronaphthalene (TDN) contributes to the bottle aged bouquet of Riesling wine. In higher concentrations it is responsible for a "petrol or kerosene" off-flavor. Especially Riesling wines grown in warmer climate with high sunlight exposure are affected and reach TDN levels up to 255 µg/L [1]. Due to the global warming, the TDN level in Riesling wine also increases in European countries. After identification of TDN in 1978, Simpson determined the flavor threshold to 20 µg/L [2], which was revealed to a factor of 10 below 34 years later by Sacks et al. [3]. Already in 1990, Winterhalter et al. analyzed a Riesling extract by separation with droplet countercurrent chromatography (DCCC). The pooled fractions were hydrolyzed and monitored with GC. It was shown that the volatile TDN is formed by at least three precursor classes with different polarity [4]. In 1991, the aglycon of a nonvolatile progenitor for TDN was identified as the 3,6-dihydroxy-7,8-dihydro-α-ionone, which is in a chemical equilibrium with a diastereomeric hemiacetal and with an allylic rearranged dihydroxyketone form [5]. For further research and to develop strategies reducing the TDN level in Riesling wines the whole formation pathway has to be clarified [6]. Hence, the intact glycoconjugates have to be isolated and structurally characterized. The main problem is the high complexity of the Riesling extract together with the small concentration of the individual conjugates and the many possible sugar moieties.

In this work an isolation strategy was developed and intact glycoconjugates were isolated and characterized. Therefore a screening method by GC-MS was established to locate TDN generating fractions.

[1] Black, C. et al. 2012. Aged Riesling and the development of TDN. Wine Vitic. J. 27, 20–26.
[2] Simpson, R. F. 1978. 1,1,6-Trimethyl-1,2-dihydronaphthalene: an important contributor to the bottle aged bouquet of wine. Chem. Ind. 1978, 37.
[3] Sacks, G. L. et al. 2012. Sensory threshold of 1,1,6-trimethyl-1,2-dihydronaphthalene (TDN) and concentrations in young Riesling and non-Riesling wines. J. Agric. Food Chem. 60, 2998–3004.
[4] Winterhalter, P., Sefton, M. A. & Williams, P. J. 1990. Volatile C13-norisoprenoid compounds in Riesling wine are generated from multiple precursors. Am. J. Enol. Vitic. 41, 277–283.
[5] Winterhalter, P. 1991. 1,1,6-trimethyl-1,2-dihydronaphthalene (TDN) formation in wine. 1. Studies on the hydrolysis of 2,6,10,10-tetramethyl-1-oxaspiro[4.5]dec-6-ene-2,8-diol rationalizing the origin of TDN and related C13 norisoprenoids in Riesling wine. J. Agric. Food Chem. 39, 1825–1829.
[6] Winterhalter, P. & Gök, R. 2013. TDN and β-damascenone: Two important carotenoid metabolites in wine. ACS Symp. Ser. 1134, 125–137.

Pia Bechtloff

TU Braunschweig, Institut of Food Chemistry p.bechtloff@tu-bs.de
Braunschweig, Germany

Recep Gök, Mats Kiene, Peter Winterhalter

TU Braunschweig, Institut of Food Chemistry
Braunschweig, Germany

«This IGF Project of the FEI is supported via AiF within the programme for promoting the Industrial Collective Research (IGF) of the German Ministry of Economics and Energy (BMWi), based on a resolution of the German Parliament.»

Wine Active Compounds and sensoriality

First identification and quantification of γGlucys-3MH in grape must, a potential thiol precursor

Varietal thiols, are considered as key compounds for the wine aroma and widely studied since twenty years in several grapes, especially Sauvignon [1]. Among those compounds, the 4-mercapto-4-methyl-2-one (4MMP) is responsible of box tree and blackcurrant buds notes [2], the 3-mercapto-1-ol (3MH) and its corresponding acetate contribute to the grapefruit and passion fruit scents in wine [3]. These compounds are issued from various precursors that have been identified in grapes and musts. However, amounts of these precursors can't explain total amounts of thiols in wines. Thus, nowadays, we have only an incomplete picture of thiols precursors and a lack of knowledge of pre-fermentative mechanisms that could impact them [3-6]. Our work focuses on the formal identification and quantification of new varietal thiols precursors in must. For this purpose, we developed new synthesis strategies in order to provide the natural and deuterated compounds. They were used to adapt the SIDA of aromatic thiols [7] and thiol precursors [8], by LC-MS/MS proposed by Roland et al, including the CysGly- and γGluCys- dipeptide conjugates, that are putative precursors. The use of this analytical method on Melon B. and Sauvignon musts allowed us to confirm the presence of CysGly conjugates previously reported by Capone et al [6]. We also formally identified and quantified for the first time the γGluCys-3MH. The amounts of this precursor were ranged from 3.5 µg/l to 35 µg/l according to the must origin and the pre-fermentative operations performed, in the same order of magnitude than the CysGly conjugates.

[1] Darriet, P., Tominaga, T., et al. 1995. Flavour Frag. J., 10, 385.
[2] Du Plessis, C. S.. Augustyn, O. P. H. 1981. S. Afr. J. Enol. Vitic, 2, 101.
[3] Tominaga, T., Peyrot des Gachons, C.. Dubourdieu, D. 1998. J. Agric. Food Chem., 46, 5215.
[4] Peyrot Des Gachons, C., Tominaga, T.. Dubourdieu, D. 2002. J. Agric. Food Chem., 14, 4076.
[5] Schneider, R., Charrier, F., Razungles, A.. Baumes, R. 2006. Anal Chim Acta, 563, 58.
[6] Capone, D. L., Pardon, K. H., Cordente, A. G.. Jeffery, D. W. 2011. J. Agric. Food Chem., 59, 11204.
[7] Roland, A., Deplech, S., et al. 2016. J. Chrom. A, 1468, 154.
[8] Roland, A., Vialaret, J., et al. 2010. J. Chrom. A, 1217, 1626.

Hugo Bonnaffoux

Institut Français de la Vigne et du Vin — hugo.bonnaffoux@vignevin.com
Montpellier, France

Aurélie Roland, Stéphane Delpech

NYSEOS, Montpellier, France

Florine Cavelier

Institut des Biomolécules Max Mousseron, IBMM
UMR-5247, CNRS,
Université de Montpellier, ENSCM
Montpellier, France

Rémi Schneider

Institut Français de la Vigne et du Vin
Montpellier, France

Wine Active Compounds and sensoriality

THIOL LEVELS IN YOUNG SOUTH AFRICAN CHENIN BLANC WINE AND THEIR IMPACT ON SENSORY PERCEPTION

In view of the increased interest in the Chenin Blanc wines of South Africa, new research is focused on various aspects related to wine composition and cultivar characteristics. Since recently the presence of thiols was demonstrated in Chenin Blanc wines, the impact and relevance of these compounds are of outmost importance for the local wine industry. The attributes that thiols impart to the sensory aspects of wine are considered positive, and the winemakers want to preserve them for as long as possible.
Since thiols are sensitive to degradation, it is important to see from which level these compounds start in young wines, and if the attributes associated to these levels play a role and make a difference in the young wine character. Therefore, 20 young South African Chenin Blanc wines (not older than one month from bottling), commercially available, were selected. The choice was based on the winemakers' recommendations and tasting notes for attributes associated with thiols, such as 'guava', 'passion fruit', 'gooseberry', and 'grapefruit'.
All 20 wines were analysed for thiol content, which was found to be 189-1649 ng/L for 3MH and 26-936 ng/L for 3MHA, respectively. Fifteen of the wines were chosen for sensory evaluation using check-all-that-apply (CATA) method from a comprehensive list of attributes associated with Chenin Blanc. Even though the chosen method does not evaluate intensities, a general list of descriptors was generated for the entire sample set and for individual wines. Differences based on thiol levels were not found to always reflect in the frequency of descriptors used by the assessors.

Astrid Buica

Department of Viticulture and Œnology
Stellenbosch University
Stellenbosch, South Africa
abuica@sun.ac.za

Valeria Panzeri

Institute for Grape and Wine Sciences
Stellenbosch University
Stellenbosch, South Africa

Wine Active Compounds and sensoriality

INTERACTION OF 3MH ETHYL, HEXANOATE, AND LINALOOL IN DEAROMATIZED CHENIN BLANC BY DESCRIPTIVE ANALYSIS

An important aspect of the Chenin Blanc research is to study the sensory relevance of thiols for the wines. The approach in this study was looking at the sensory interaction of thiols with other aroma compounds in a Chenin wine base while at the same time observing possible correlations of thiol levels with descriptors.
Additionally to 3MH, whose presence in Chenin Blanc wines was demonstrated recently, one ester (ethyl hexanoate) and one terpene (linalool) were included. These two compounds have been proven to be typically present in commercial wines. Unlike previous interaction experiments, partially dearomatised Chenin Blanc was chosen as base in order to preserve, if possible, cultivar characteristics. Descriptive Analysis (DA) was performed to observe enhancing and suppressing effects of the three compounds in the wine, alone and in combinations, using Central Composite design. The statistical analysis was done using ANOVA and STATIS, and the data interpretation was aided by the use of response surface plots.
The attributes generated by single compounds varied from typical compound-associated ('guava', 'passion fruit', 'grapefruit', 'tomato leaf' for 3MH, 'orange blossom' and 'bergamot/Early Grey' for linalool) to general Chenin Blanc attributes ('pineapple', 'peach', 'apple', 'lemon', 'honey', *etc.*). The combinations were characterised by the same attributes, but the intensities varied differently, indicating enhancing and suppressing effects. For example, for 'guava', there was an enhancing effect between the 3MH and ethyl hexanoate. Conversely, there was a suppressing effect between 3MH and linalool.
Expanding the list of compounds used for interaction studies is important for understanding the mechanisms ruling the perception of such wine constituents. Additionally, the choice of base wine for spiking is a subject that requires more attention since it can influence the perception in both nature and intensity of attributes.

Astrid Buica

Department of Viticulture and Œnology abuica@sun.ac.za
Stellenbosch University
Stellenbosch, South Africa

Christine Wilson, Jeanne Brand, Wessel du Toit

Department of Viticulture and Œnology
Stellenbosch University
Stellenbosch, South Africa

Wine Active Compounds and sensoriality

THIOL INTERACTION IN DIFFERENT CHENIN BLANC MATRICES BY PROJECTIVE MAPPING (PM) WITH INTENSITY : MATRIX EFFECT

In interaction studies, it is important to consider the goal of the experiment when selecting a base matrix to use. If the goal is simply to explain the fundamental interaction of the compounds with one another, then model wine can be appropriate. If the goal is to explain the behaviour of these compounds together in wine, then a dearomatized wine can a more fitting matrix. Aroma reconstitution is another possibility, but presents its own challenges. In our study, three matrices have been considered: model wine, partially dearomatized wine, and commercial wine, all containing the same levels of 3-mercaptohexan-1-ol (3MH) and 3-mercaptohexyl acetate (3MHA). The evaluation was performed using Projective Mapping (PM) modified to include intensity ratings.
Though model wine is not the most realistic matrix, it allowed for easier differentiation between samples. This experiment allowed us to see that, at the selected levels, when analysed in a simple model wine solution, 3MHA was a more powerful driver of sensory difference than 3MH. In a partially-dearomatized wine, there was a general continuum, with both 3MHA and 3MH driving the differences between wines. A similar differentiation was seen for commercial wines, with high-thiol and low-thiol wines forming clusters. These different conclusions illustrate the importance of the effect of spiking matrix in interaction studies, as trends that are clear in simple base solutions may not be relevant to a real wine. Though PM is not the ideal technique for sample sets with subtle differences, some useful conclusions could be drawn from this work. PM cannot replace DA for interaction studies, still, it did prove to be of use. It could be a helpful accompaniment to descriptive analysis, or be appropriate in situations where a more general analysis of the samples is sufficient.

Astrid Buica

Department of Viticulture and Œnology
Stellenbosch University
Stellenbosch, South Africa
abuica@sun.ac.za

Christine Wilson, Wessel Du Toit, Jeanne Brand

Department of Viticulture and Œnology
Stellenbosch University
Stellenbosch, South Africa

Wine Active Compounds and sensoriality

OENOCOCCUS OENI STRAINS FROM BURGUNDY ARE GENETICALLY DISTINCT AND CONTRIBUTE DIFFERENTLY TO WINE VOLATILES

Oenococcus oeni is the bacteria most often associated with spontaneous malolactic fermentation (MLF) of wine. During MLF, malic acid is transformed into lactic acid and several metabolites are modified, modulating wine's stability, total acidity and improving its sensory properties. Previous works have revealed that certain genetic groups of *O. oeni* strains are adapted to different kinds of wines. In the present study, we have spotted two groups of strains isolated from Burgundy wines, one associated to red wines and the other to white wines. Red and white-wine strains were compared at the genomic level by sequencing and analysing 14 genomes. Their capacity to perform malolactic fermentation and to release aromatic compounds were determined by fermenting a chardonnay wine and analysing the obtained wines with a non-targeted metabolomics approach. The analysis of genomic and metabolomic data shows that both groups descend from a recent common ancestor, and that the adaptation of each genetic group to their respective niches influences the composition to the volatile fraction of wines. We shed a new light on the existence of specific bacterial components associated with given regions and products, and on the possible repercussions of the highlighted microbial genomic diversity on the typical quality traits of regional wines. These results show the importance of the genetic diversity among malolactic starters, and are promising for their rational utilisation

Hugo Campbell-Sills

Université de Bordeaux, ISVV, Unité Œnologie hugo.campbell-sills@u-bordeaux.fr
INRA, ISVV, EA 4577, USC 1366 INRA
Villenave d'Ornon, France

Mariette El Khoury, Marine Gammacurta, Cécile Miot-Sertier, Lucie Dutilh, Olivier Caisse, Gilles de Revel, Patrick Lucas

Université de Bordeaux, ISVV, Unité Œnologie
INRA, ISVV, EA 4577, USC 1366 INRA
Villenave d'Ornon, France

Jochen Vestner

Université de Bordeaux, ISVV, Unité Œnologie
INRA, ISVV, EA 4577, USC 1366 INRA
Villenave d'Ornon, France
Department of Microbiology and Biochemistry
Hochschule Geisenheim University
Geisenheim, Germany

Wine Active Compounds and sensoriality

OENOCOCCUS OENI STRAINS FROM BURGUNDY ARE GENETICALLY DISTINCT AND CONTRIBUTE DIFFERENTLY TO WINE VOLATILES

David Sherman

INRIA, Project team MAGNOME
Université de Bordeaux, Talence, France
UMR 5800 LaBRI (CNRS, Université de Bordeaux)
Talence, France

Giuseppe Spano

Department of Agriculture, Food
and Environment Sciences
University of Foggia, Foggia, Italy

Wine Active Compounds and sensoriality

BRETTANOMYCES BRUXELLENIS AND VOLATILE PHENOLS CONTROL DURING WINEMAKING PROCESS USING MICROBIAL RESOURCES

Brettanomyces spp. (main *B. bruxellensis*) is generally recognized as one of the main oenological spoilage microbes. These yeasts negatively affect wine organoleptic properties, due to volatile phenols production. In particular, 4-ethylphenol led to undesirable flavours, described as “phenolic”, “horse sweat”, “stable”, “leather” or “animals” [1]. Usually contamination of *B. bruxellensis* is low during the first steps of winemaking, due to slow growth, furthermore the metabolic activity of stronger fermenters inhibits its development and its population remains low. Nevertheless, it may proliferate during ageing [2].
Several studies focus attention on control of *B. bruxellensis*, developing several methods to prevent wine depreciation, using chemicals such as of SO_2, organic acids, dimethyldicarbonate (DMDC) [3]. Nevertheless, some strains of *B. bruxellensis* can tolerate SO_2, high ethanol and low sugar concentrations, making difficult its control in wine. To counteract to these tendencies, several studies investigated the efficacy of biological methods to control *B. bruxellensis* in wine [2-4].
The current study presented the assessment of several autochthonous microbial resources in order to control *B. bruxellensis* growth and volatile phenols release in wine. Several yeasts, both *Saccharomyces* spp. and non-*Saccharomyces*, can produced killer toxins that should be investigated as an alternative tool for *B. bruxellensis* control during winemaking and wine aging. In addition, we selected a *Lactobacillus plantarum* strain displaying strain-specific inhibitory activities on *B. bruxellensis*, suggesting potential application in wineries. This work was supported by the Apulian Region i) with the Project cod. QCBRAJ6 “Biotecnologie degli alimenti per l’innovazione e la competitività delle principali filiere regionali: estensione della conservabilità e aspetti funzionali - BIOTECA.”and i) in the framework of “FutureInResearch” program(practice code 9OJ4W81).

[1] R. Suárez, J.A. Suárez-Lepe, A. Morata , F. Calderón, 2007. The production of ethylphenols in wine by yeasts of the genera Brettanomyces and Dekkera: A review. Food chemistry. 102, 10-21.
[2] Mehlomakulu NN, Setati ME, Divol B. 2014. Characterization of novel killer toxins secreted by winerelated non-Saccharomyces yeasts and their action on Brettanomyces spp. Int J Food Microbiol.188:83-91.
[3] Divol B, du Toit M, Duckitt E. 2012. Surviving in the presence of sulphur dioxide: strategies developed by wine yeasts. Appl Microbiol Biotechnol. 95(3):601-13.
[4] S. Benito, F. Palomero, A. Morata, F. Calderón, J.A. Suárez-Lepe. 2009. A method for estimating Dekkera/Brettanomyces populations in wines. J Applied Microbiol. DOI: 10.1111/j.1365-2672.2008.04137.x

Vittorio Capozzi

University of Foggia, Department of Sciences of Agriculture, Food and Environement
Foggia, Italy
vittorio.capozzi@unifg.it

Carmela Garofalo, Mattia Pia Arena, Giuseppe Spano

University of Foggia, Department of Sciences of Agriculture, Food and Environement
Foggia, Italy

Francesco Grieco

Consiglio Nazionale delle Ricerche
Institute of Sciences of Food Production
Lecce, Italy

Wine Active Compounds and sensoriality

LE (Z)-1,5-OCTADIEN-3-OL MARQUEUR DANS LES EAUX-DE-VIE DE VIN D'UNE ALTÉRATION DE LA VENDANGE

Dans le cadre de l'étude des déviations sensorielles de type « Champignon – Goût, Moisi, Terreux », une eau-de-vie a été produite à l'échelle pilote à partir d'une vendange fortement contaminée par l'oïdium (36%) mais aussi par le botrytis (6%). L'arôme de cette eau-de-vie a été décrit comme « champignon, sous bois », jugé différent de celui lié à la 1-octen-3-one : « champignon frais ».
L'analyse olfactométrique a permis d'identifier le (Z)-1,5-octadien-3-ol comme responsable d'une zone "Champignon" parfois détectée dans les eaux-de-vie. Deux autres zones mentionnées par DARRIET et al. [1] sur un vin issu de vendange altérée par l'oïdium ont également été détectées aux indices DBWax de :

- 1360, "feuille de géranium", qui peut correspondre à la cétone : (Z)-1,5-octadien-3-one,
- 1680, "champignon".

Une dernière zone odorante inhabituelle a été détectée à l'indice 2050, "phénol-écurie" qui correspond vraisemblablement au para-crésol.
Le (Z)-1,5-octadien-3-ol a été semi-quantifié par rapport au 1-octen-3-ol et différents constats ont pu être établis :

- les concentrations en (Z)-1,5-octadien-3-ol et en 1--octen--3--ol sont bien corrélées, sur eaux-de-vie nouvelles et eaux-de-vie vieillies, avec un ratio (Z)-1,5-octadien-3-ol/1-octen-3-ol proche de 0.1,
- l'eau-de-vie issue de vendange altérée par l'oïdium possède un ratio de (Z)-1,5-octadien-3-ol/1-octen-3-ol plus important.

Le (Z)-1,5-octadien-3-ol peut être utilisé comme marqueur d'altération de la vendange en complément du 1-octen-3-ol, dont la concentration s'explique essentiellement par la présence de botrytis sur grappes. La plus forte teneur en (Z)--1,5--octadien--3--ol associée à l'oïdium doit être confirmée.

[1] Darriet Ph., Pons M., Henry R., Dumont O., Findeling V., Cartolaro PH., Calonnec A., Dubourdieu D., 2002. Impact Odorants Contributing to the Fungus Type Aroma from Grape Berries Contaminated by Powdery Mildew (Uncinula necator); Incidence of Enzymatic Activities of the Yeast Saccaromyces cerevisiae. JAFC, 50,pp 3277-3282.

Sylvie Estreguil

Station Viticole du Bureau National Interprofessionnel du Cognac
Cognac, France
SEstreguil@bnic.fr

Claudie Roulland, Lara Boulesteix, Guillaume Snakkers, Gerald Ferrari, Luc Lutron

Station Viticole du Bureau National Interprofessionnel du Cognac
Cognac, France

Wine Active Compounds and sensoriality

CHECK-ALL-THAT APPLY (CATA), RATE-ALL-THAT APPLY (RATA) AND NAPPING® AS TOOLS FOR DISCRIMINATING REDUCTIVE OFF-ODORS IN WINES

Among the most frequent off-odors, reduction is one of the most commonly found in wines. This defect is caused by Volatile Sulfur Compounds (VSCs). It is not infrequent that VSCs appear during bottle aging most likely if the closure is quite hermetic [1]. Therefore, it is paramount to dispose of rapid sensory methods to discriminate among samples with reduction off-odors. CATA, RATA and Napping® are sensory methods with a point in common, they do not require panel training, being cost effective tools in terms of both time and money.

Due to the common interactions between wine matrices and VSCs [2], synthetic wines were chosen as matrix to spike with H2S, MeSH and DMS at different concentration levels. Wine models were spiked with concentrations found in commercial wines [1, 3]. These synthetic wines were provided to panelists (fifteen oenology students selected on the basis of their interest and availability during 7 weeks). All of them had extensive wine tasting experience, but none of them had previously taken part in descriptive analysis panels. They evaluated orthonasally synthetic wines by means of three sensory methods, CATA, RATA and Napping®.

Results showed that the three sensory techniques used were able to discriminate among wines with different concentration levels of H2S, MeSH and DMS. Panelists could differentiate between wines with only H2S, MeSH and DMS and with different combinations of them.

In conclusion, this study can be taken as the starting point for implementing these sensory techniques as control of wines with possible reductive off-odors in wine cellars.

[1] Franco-Luesma, E., & Ferreira, V. (2016). Food Chem., 199, 42–50
[2] Franco-Luesma, E., & Ferreira, V. (2014). Journal Chrom. A, 1359, 8–15
[3] Ferreira, V. et al. (2014). J. Agric. Food Chem. 14, 62, 10015–10027

Ernesto Franco-Luesma

Laboratorio de Anàlisis del Aoma y Enologìa (LAAE) Department of Analytical Chemistry
Universidad de Zaragoza, Zaragoza, Spain
Centre ses Sciences du Goût et de l'Alimentation
Université de Bourgogne Franche-Comté
UMR 6265, CNRS, UMR 1324 INRA
Dijon, France
efranco@unizar.es

Marìa-Pilar Sàenz-Navajas, Vicente Ferreira

Laboratorio de Anàlisis del Aoma y Enologìa (LAAE)
Department of Analytical Chemistry
Universidad de Zaragoza, Zaragoza, Spain

Heber Rodrigues

Centre ses Sciences du Goût et de l'Alimentation
Université de Bourgogne Franche-Comté
UMR 6265, CNRS, UMR 1324 INRA
Dijon, France

Wine Active Compounds and sensoriality

CHECK-ALL-THAT APPLY (CATA), RATE-ALL-THAT APPLY (RATA) AND NAPPING® AS TOOLS FOR DISCRIMINATING REDUCTIVE OFF-ODORS IN WINES

Dominique Valentin

Centre ses Sciences du Goût et de l'Alimentation
Université de Bourgogne Franche-Comté
UMR 6265, CNRS, UMR 1324 INRA
Dijon, France
AgroSup, Université de Bourgogne,Dijon, France

Jordi Ballester

Centre ses Sciences du Goût et de l'Alimentation
Université de Bourgogne Franche-Comté
UMR 6265, CNRS, UMR 1324 INRA
Dijon, France
IUVV Jules Guyot, Université de Bourgogne
Dijon, France

Wine Active Compounds and sensoriality

QUANTIFICATION OF TDN AND VITISPIRAN IN RIESLING WINES BY STABLE ISOTOPE DILUTION ASSAY

Riesling belongs to the most important grape varieties in Germany with a cultivated area of 22,837 ha, which corresponds to 22.4% of German wine-growing area. Thus, Germany has 57.8% of the world Riesling cultivations followed by United States (4,557 ha, 11.5%), Australia (4,184 ha, 11.5%), France (3,524 ha, 8.9%) and Austria (1863 ha, 4.7%) [1]. The varietal character of Riesling grapes/wines depends on a number of substances including monoterpenes and volatile norisoprenoids. These volatiles usually contribute to pleasant aroma notes. A counter-example is the key aroma compound 1,1,6-trimethyl-1,2-dihydronaphthalene (TDN) with a “kerosene” or “petrol like” note, which is known to be present at high concentrations in bottle aged Riesling wines [2]. The occurrence of TDN at higher concentrations especially in Riesling wines is still not completely understood. It is known that this compound is absent in grapes or young wines and its concentration steadily increases during fermentation as well as during aging of wine by hydrolysis and rearrangements of acid-labile glycosylated carotenoid metabolites [2–4]. There are evidences for the (bio)chemical reduction of the ketone function of the glycosidically bound TDN progenitors by yeasts to give precursors of vitispiranes, which are less sensory relevant [4,5]. The quantitative determination of these precursors is conventionally carried out by means of SDE (simultaneous distillation-extraction), which is a time- and solvent-consuming method for a high number of samples. For this reason, in this study a standardized rapid acid hydrolysis method was developed. Subsequently, Riesling wines from different regions and wineries were analyzed. The concentrations of TDN and vitispiranes in Riesling wines were determined directly and together with their bound precursors after a standardized acid hydrolysis by means of stable isotope dilution assay using HS-SPME-GC-MS.

[1] Deutsches Weininstitut. Deutscher Wein: Statistik 2013/2014. URL: http://www.deutscheweine.de
[2] Simpson, R. F. 1978. 1,1,6-Trimethyl-1,2-dihydronaphthalene: an important contributor to the bottle aged bouquet of wine. Chem. Ind., 1, 37.
[3] Winterhalter, P. 1991. 1,1,6-Trimethyl-1,2-dihydronaphthalene (TDN) formation in wine. 1. Studies on the hydrolysis of 2,6,10,10-tetramethyl-1-oxaspiro[4.5]dec-6-ene-2,8-diol rationalizing the origin of TDN and related C13 norisoprenoids in Riesling wine. J. Agric. Food Chem. 39, 1825–1829.
[4] Winterhalter, P., Gök, R. 2013. TDN and b-Damascenone: Two Important Carotenoid Metabolites in Wine. ACS Symposium Series. 1134, 125–137.
[5] Gök, R., 2015. Einfluss von Hefen auf die glykosidisch gebundenen Aromavorstufen und Untersuchungen zur Vermeidung der TDN-Fehlnote in Riesling. PhD Thesis, TU Braunschweig.

Recep Gök

TU Braunschweig, Institut of Food Chemistry
Braunschweig, Germany
r.goek@tu-braunschweig.de

Pia Bechtloff, Peter Winterhalter

TU Braunschweig, Institut of Food Chemistry
Braunschweig, Germany

Ulrich Fischer

DLR Rheinpfalz, Institute for Viticulture and Enology
Neustadt, Germany

«This IGF Project of the FEI is supported via AiF within the program for promoting the Industrial Collective Research (IGF) of the German Ministry of Economics and Energy (BMWi), based on a resolution of the German Parliament.»

Wine Active Compounds and sensoriality 1

ANALYSIS OF POLYPHENOLIC COMPOSITION IN RED SPARKLING WINES ELABORATED FOLLOWING DIFFERENT TREATMENTS AND IN TWO MATURITY DEGREE

The production of red sparkling wines is suffering an increase in Spain, for this reason is interesting carry out the study of new winemaking to produce red base wine adequate to elaborate red sparkling wines. A red base wine adequate should have moderate alcohol content, high acidity and adequate color intensity. To achieve this there are two strategies, elaborate wines with premature grapes, this base wines will have alcoholic degree and acidity adequate, but color and the content of polyphenols will be low while the astringency will be high; or use ripe grapes, the red base wines will present an adequate mouth-feel, an equilibrate content of polyphenolic compounds but a high alcoholic degree. We studied as is affected the content of the proanthocyanidins and monomeric phenolic compounds in base and red sparkling wines by four treatments, cold pre-fermentative maceration, delestage on wines elaborated with premature grapes; nanofiltration and reverse osmosis on wines elaborated with ripe grapes. Red sparkling wines of Tempranillo were elaborated following the traditional method. Phenolic compounds were analyzed by HPLC-DAD [1].
The total content of resveratrol and flavonoids in red base wines was lower in wines elaborated with premature grapes than mature ones. The same trend was observed in anthocyanin content in red base wines, except in red base wine treated by reverse osmosis that had a similar content as prematures. It is noteworthy that the treatment of cold pre-fermentative maceration increased the concentration of resveratrol, flavonoids and anthocyanins while the treatment of reverse osmosis decreased all of them. In general, the content of hydroxycinnamic acids and catechin in red sparkling wines was higher than in red base wines. Anthocyanin content showed a decrease in red sparkling wines, being the wine elaborated by reverse osmosis which obtained the lowest concentration. The content of tannins in red sparkling wines elaborated with mature grapes were lower than premature ones.

[1] Gómez-Alonso, S., García-Romero, E., Hermosín-Gutiérrez. I. (2007). HPLC analysis of diverse grape and wine phenolics using direct injection and multidetection by DAD and fluorescence. Journal of Food Composition and Analysis. 20, 618-626.

Miriam Gonzàlez-Làzaro

Instituto de Ciencias de la Vid y del Vino
Universita de la Rioja, Gobierno de la Rioja y CSIC
Logroño, Spain

Belén Ayestaràn, Leticia Martìnez-Lapuente, Zenaida Guadalupe

Instituto de Ciencias de la Vid y del Vino
Universita de la Rioja, Gobierno de la Rioja y CSIC
Logroño, Spain

Marta Bueno-Herrera, Pedro Lòpez de la Cuesta, Silvia Pérez-Magariño

Instituto Tecnològico Agrario de Castilla y Leon
Consejeria de Agricultura y Ganaderia
Valladolid, Spain

The authors would like to thank the Spanish Ministry of Economy and Competitiveness and the "Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria" (INIA) for the funding provided for this study through project RTA2012-00092-C02-02 (with FEDER funds).

Wine Active Compounds and sensoriality

EFFECT OF FINING AND FILTRATION ON THE POLYSACCHARIDE AND PROANTHOCYANIDIN COMPOSITION OF RED WINES

The aim of this work was to study the effect of clarification and filtration treatments on the polysaccharide and proanthocyanidin composition of red varietal wines. Vinifications were carried out using the red grapes Vitis vinífera cv. Merlot, Tempranillo, Graciano and Garnacha. Wines were racked after malolactic fermentation. The corresponding untreated wines were employed as control (C) in each monovarietal wine. Then, 300 litres of wines (located in three stainless-steel tanks of 100 L) were clarified with 10 egg albumin/HL (EA). After wine fining, one filtration treatment was performed. Wines were filtered over a plate filter (CF). Others 300 litres (located in three stainless-steel tanks of 100 L) were subjected to cross-flow microfiltration (CFMF). Samples for analysis were taken from control, clarified and filtered wines. Wine polysaccharides were recovered by precipitation [1] and the monosaccharide composition of the total soluble polysaccharides was determined by GC–MS [1]. For analyzing proanthocyanidins, wine samples were fractionated [2] and phloroglucinol adducts were analyzed by reversed-phase HPLC [3]. Stepwise discriminant analysis (SDA) were carried out to determine the compounds analyzed most useful for differentiating wines according to treatment and grape variety. In general, EA and CF treatments affect polysaccharide and proanthocyanidin content of wines. CFMF had significant effect on the decrease of polysaccharides rich in arabinose and galactose, mannoproteins and total proanthocyanidin content in all wines. SDA allowed to discriminate wines according to the treatment applied and the grape variety used.

[1] Guadalupe, Z., Martínez-Pinilla, O., Garrido, A., Carrillo, J. D., Ayestarán, B. (2012). Quantitative determination of wine polysaccharides by gas chromatography–mass spectrometry (GC–MS) and size exclusion chromatography (SEC). Food Chemistry. 131, 367-374.
[2] Guadalupe, Z., Soldevilla, A., Sáenz-Navajas, M. P., Ayestarán, B. (2006). Analysis of polymeric phenolics in red wines using different techniques combined with gel permeation chromatographyfractionation. Journal of Chromatography A. 1112, 112-120.
[3] Kennedy, J. A., Jones, G. P. (2001). Analysis of proanthocyanidin cleavage products following acidcatalysis in the presence of excess phloroglucinol. Journal of Agriculture and Food Chemistry. 49, 1740- 1746.

Miriam Gonzàlez-Làzaro

Instituto de Ciencias de la Vid y del Vino
Universita de la Rioja, Gobierno de la Rioja y CSIC
Logroño, Spain

Leticia Martìnez-Lapuente, Belén Ayestaràn, Zenaida Guadalupe

Instituto de Ciencias de la Vid y del Vino
Universita de la Rioja, Gobierno de la Rioja y CSIC
Logroño, Spain

Wine Active Compounds and sensoriality

AMINO ACIDS AND BIOGENIC AMINES IN SPARKLING WINES : THE ROLE OF GRAPE VARIETY, TIME AND TYPE OF AGING

The free amino acids present in sparkling wines may be of different origins. Those from the grape may be partially or totally metabolized by the yeasts during fermentation. Other free amino acids are released by yeasts at the end of fermentation or by proteolysis processes during yeast autolysis. Amino acids have influence on foam quality and can also be precursors of biogenic amines and of some of the volatile compounds present in sparkling wines. Consequently, the variables grape variety that the wines are made from and their aging time in bottle can affect amino acidic and biogenic amines composition and sensory quality of sparkling wines. Therefore, this work addresses to evaluate the role of grape variety and aging in presence and absence of yeast lees on amino acid and biogenic amines composition of sparkling wines. For this purpose different autochthonous grape varieties from Spain (Verdejo, Viura, Malvasía, Albarín, Godello, Garnacha and Prieto Picudo) were used to elaborate monovarietal sparkling wines. Samples for analysis were taken after 9 and 18 months of aging on yeast lees in bottle (T9M and T18M) and after those 12 months of aging in bottle in absence of yeast lees (T9M+12MB and T18M+12MB). Amino acids and biogenic amines of sparkling wines were determined by HPLC-DAD [1]. In general, amino acid content increase during the aging on yeast lees but no clear trend was observed during the aging without lees. An increase in biogenic amines was observed during the aging without less after nine months of aging in all samples analyzed. Applying the discriminant analysis, an accurate classification of sparkling wines by grape variety and aging in presence and absence of yeast lees was obtained.

[1] Gómez-Alonso, S., Hermosín-Gutiérrez, I., García-Romero, E. (2007). Simultaneous HPLC analysis of biogenic amines, amino acids, and ammonium ion as aminoenone derivatives in wine and beer samples. Journal of Agriculture and Food Chemistry. 55, 608–613.

Miriam Gonzàlez-Làzaro

Instituto de Ciencias de la Vid y del Vino
Universita de la Rioja, Gobierno de la Rioja y CSIC
Logroño, Spain

Leticia Martìnez-Lapuente, Belén Ayestaràn, Zenaida Guadalupe

Instituto de Ciencias de la Vid y del Vino
Universita de la Rioja, Gobierno de la Rioja y CSIC
Logroño, Spain

Silvia Pérez-Magariño

Instituto Tecnològico Agrario de Castilla y Leon
Consejeria de Agricultura y Ganaderia
Valladolid, Spain

The authors would like to thank the Spanish Ministry of Economy and Competitiveness and the "Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria" (INIA) for the funding provided for this study through project RTA2012-00092-C02-02 (with FEDER funds).

Wine Active Compounds and sensoriality

ISOLATION, IDENTIFICATION AND CHARACTERIZATION OF A NEW FLAVAN-3-OL FOUND IN (*VITIS VINIFERA* L.CV.) CABERBET SAUVIGNON GRAPE SEED

Condensed tannins is one of the most important classes of active compounds derived from grapes. They make a great contribution to wine organoleptic characteristics involving astringency and bitterness perceptions1. Belonging to the flavonoid class of polyphenols, condensed tannins generally exist as oligomers and polymers of flavan-3-ols units. Until now, the flavan-3-ols found in grape include catechin, epicatechin, epigallocatechin and epicatechin-3-O-gallate2.

In the present study, a new flavan-3-ol was discovered in (*Vitis Vinifera* L. cv.) Cabernet Sauvignon grape seed. Both non-solid and solid phase separation strategies were combined to achieve the isolation and purification process of the target compound. Centrifugal partition chromatography were applied twice with the solvent systems of both ethyl acetate: ethanol: water (6: 1: 5, v/v/v) and hexane: ethyl acetate: methanol: water (1: 4: 3: 1, v/v/v/v). Preparative HPLC was used to complete the purification of the target compound. The identification of the target compound was performed by the techniques of both UHPLC-ESI-Q-ToF and NMR. In LC-MS/MS, [M-H]- ion at m/z = 439.1011 and fragment ions at m/z = 289.0703, m/z = 271.0594 and m/z = 167.0335 were discovered in negative mode. Moreover, the configuration of target compound was analyzed by NMR. Finally, the targeted compound was determined as epicatechin-3-O-vanilate.

[1] Ma, W.; Guo, A.; Zhang, Y.; Wang, H.; Liu, Y.; Li, H., A review on astringency and bitterness perception of tannins in wine. Trends in Food Science and Technology 2014, 40, 6-19.
[2] Chira, K.; Schmauch, G.; Saucier, C.; Fabre, S.; Teissedre, P. L., Grape variety effect on proanthocyanidin composition and sensory perception of skin and seed tannin extracts from Bordeaux wine grapes (cabernet Sauvignon and merlot) for two consecutive vintages (2006 and 2007). Journal of Agricultural and Food Chemistry 2009, 57, 545-553.

Wen Ma

Université de Bordeaux, ISVV, EA 4577
Unité de Recherche ŒNOLOGIE
INRA, ISVV, USC 1366 ŒNOLOGIE
Villenave d'Ornon, France
College of Enologyn Northwest A&F University
Shaanxi, China

Pierre Waffo-Teguo, Michäel Jourdes, Pierre-Louis Teissedre

Université de Bordeaux, ISVV, EA 4577
Unité de Recherche ŒNOLOGIE
INRA, ISVV, USC 1366 ŒNOLOGIE
Villenave d'Ornon, France

Hua Li

College of Enologyn Northwest A&F University
Shaanxi, China

Wine Active Compounds and sensoriality

IMPACT OF MONOMERIC ANTHOCYANIN CONVERSION TO INTERSPECIFIC HYBRID WINE COLOR

Little is known about anthocyanin content and color evolution in wines produced from interspecific hybrid grapes, despite their growing importance in cool- and cold-climate wine regions. When compared to wines produced from Vitis vinifera, 'hybrid' wines show a wider range of color and hue as young wines, and do not undergo the transition from purple-red to the characteristic brick-red during aging. These differences are due in large part to pigment content; V. vinifera cultivars produce anthocyanin monoglucosides almost exclusively, and their pigment profile is dominated by malvidin. Interspecific hybrid grapes contain varying mixtures of anthocyanin mono- and diglucosides, often weighted towards diglucosides, and unique ratios of the anthocyanidins malvidin, cyanidin, delphinidin, peonidin, and petunidin. Anthocyanin monoglucosides play an essential role in the formation of polymeric pigment and pyranoanthocyanins, the compounds that impart color stability and aged-induced color change to V. vinifera wines. Anthocyanin diglucosides are thought to be less reactive than monoglucosides in polymeric pigment reactions, and are unable to form pyranoanthocyanins at all, since the second glucose molecule blocks the reaction. To better understand the type and speed of reactions involved in the development of hybrid wine color, the rate of decrease of 10 monomeric anthocyanins and their formation of polymeric pigment in a model wine was measured using HPLC. Change in visible color, hue angle, and L*, a*, and b* values were measured via colorimetry. As expected, diglucosides concentrations decreased more slowly than monoglucosides, and the reaction rate of monoglucosides was slower when a diglucoside was present than when tested alone. Hue angles in all reactions transitioned from red to red-orange, orange, or orange-yellow, and color varied by anthocyanindin. These results suggest that hybrid wines, with their high concentrations of diglucosides, will form fewer polymeric pigments than V. vinifera wines, and will develop different colors with age.

Anna Katharine Mansfield

New York State Agricultural Experiment Station akm87@cornell.edu
Cornell University, Geneva, NY, USA

Claire E. Burtch, David C. Manns

New York State Agricultural Experiment Station
Cornell University, Geneva, NY, USA

Wine Active Compounds and sensoriality

SENSORY STUDY OF THE EFFECT OF POST-FERMENTATION MACERATION AND GRAPE SEEDS ON THE TASTE OF RED WINES

Taste balance of dry wines is mainly based on sourness, bitterness, and sweetness. To a large extent, it depends on the grape composition and it can also be modulated by enological practices. Indeed, winemaking consists of a selective extraction of grape constituents. During red winemaking, a key-step generally unfolds during and after alcoholic fermentation. In particular, some winemakers note the importance of the post-fermentation maceration on the organoleptic properties of wine.
This study uses sensory techniques to specify the organoleptic modifications consecutive to post-fermentation maceration of red wines. Experiments were carried out in cellar with Cabernet-Sauvignon and Merlot grapes coming from various kinds of soils over two vintages. Different modalities were obtained by collecting wines before, during and at the end of the post-fermentation maceration. Sensory analysis revealed that sweetness increased during this step whereas astringency decreased. To clarify the relative contribution of compounds coming from yeast and grapes, some of these modalities underwent model yeast autolysis in laboratory. The results showed that the gain of sweetness was not only due to the release of sweet compounds from yeast lees, which suggests the existence in dry wines of sweet molecules coming from grapes.
Finally, based on previous observations reported by Emile Peynaud, microvinifications were carried out with grape berries which seeds were removed in comparison with whole grape berries. Paradoxically, wines obtained after post-fermentation maceration of whole grape berries were perceived sweeter and less astringent than “seedless” wines. These results suggest the existence of sweet compounds in seeds. They open up promising perspectives for a better understanding of the molecular phenomena associated to winemaking process and modeling the sensory shape of wine.

Axel Marchal

Université de Bordeaux, ISVV, EA 4577 axel.marchal@u-bordeaux.fr
Unité de Recherche ŒNOLOGIE
Villenave d’Ornon, France
INRA, ISVV, USC 1366 ŒNOLOGIE
Villenave d’Ornon, France

Blandine Cretin, Denis Dubourdieu

Université de Bordeaux, ISVV, EA 4577
Unité de Recherche ŒNOLOGIE
Villenave d’Ornon, France
INRA, ISVV, USC 1366 ŒNOLOGIE
Villenave d’Ornon, France

Wine Active Compounds and sensoriality

GASEOUS CO_2 MEASUREMENTS IN THE HEADSPACE OF CHAMPAGNE GLASSES BY DIODE LASER SPECTROMETRY

Champagne and sparkling wines are multicomponent hydroalcoholic systems supersaturated with carbon dioxide (CO_2), formed together with ethanol during a second fermentation process [1]. Under standard tasting conditions, gaseous CO_2 invades the headspace above glasses, thus progressively modifying the chemical headspace perceived by the consumer [2,3], and causing sometimes a very unpleasant tingling sensation perturbing both ortho- and retronasal olfactory perception. Actually, during carbonated beverage tasting, gaseous and dissolved CO_2 acts on both trigeminal receptors [4], and gustatory receptors, via the conversion of dissolved CO_2 to carbonic acid [5].
Monitoring as accurately as possible the level of gas phase CO_2 above glasses is therefore a challenge of importance aimed at better understanding the close relationship between the release of gas phase CO_2 and a collection of various parameters such as glass-shape, and champagne temperature, for example. Recently, several major improvements to an instrument devoted to real-time monitoring of gas phase CO_2 above glasses (which combines two infrared lasers coupled with an optical fiber) were performed. A set of data showing the impact of champagne temperature and glass-shape on the release of gas phase CO_2 is presented, and discussed by using a model showing the crucial role of temperature on the kinetics of CO_2 diffusion across the air/champagne interface.

[1] Liger-Belair, G., Polidori, G., Jeandet , P. 2008. Recent advances in the science of champagne bubbles. Chem. Soc. Rev. 37, 2490-2511.
[2] Mulier, M., Zeninari, V., Joly, L., Decarpenterie, T., Parvitte, B. Jeandet, P., Liger-Belair, G. 2009. Development of a compact CO2 sensor based on near-infrared laser technology for enological application. Applied Physics B: Laser and Optics 94, 725-733.
[3] Cilindre, C., Conreux, A., Liger-Belair, G. 2011. Simultaneous monitoring of gaseous CO2 and ethanol above champagne glasses via micro gas chromatography. J. Agric. Food Chem. 59, 7317-7323.
[4] Dessirier, J.M., Simons, C., Carstens, M., O'Mahony, M., Carstens, E. 2000. Psychophysical and neurobiological evidence that the oral sensation elicited by carbonated water is of chemogenic origin. Chem. Senses, 25, 277-284.
[5] Dunkel, A., Hofmann, T. 2010. Carbonic anhydrase IV mediates the fizz of carbonated beverages. Angew. Chem. Int. Ed., 49, 2975-2977.

Anne-Laure Moriaux

Equipe Spectrométrie, Laser et Applications
Equipe Effervescence, Champagne et Applications
(GSMA-UMR CNRS 7331)
Université de Reims Champagne-Ardenne
Reims, France

Raphaël Vallon

Equipe Spectrométrie, Laser et Applications
(GSMA-UMR CNRS 7331)
Université de Reims Champagne-Ardenne
Reims, France

Clara Cilindre, Gérard Liger-Belair

Equipe Effervescence, Champagne et Applications
(GSMA-UMR CNRS 7331)
Université de Reims Champagne-Ardenne
Reims, France

Wine Active Compounds and sensoriality

GASEOUS CO_2 MEASUREMENTS IN THE HEADSPACE OF CHAMPAGNE GLASSES BY DIODE LASER SPECTROMETRY

Bertand Parvitte, Virginie Zeninari

Equipe Spectrométrie, Laser et Applications
Equipe Effervescence, Champagne et Applications
(GSMA-UMR CNRS 7331)
Université de Reims Champagne-Ardenne
Reims, France

Wine Active Compounds and sensoriality

QUANTIFICATION OF THE PEAR LIKE ODORANT ETHYL-TRANS2-CIS4-DECADIENOATE IN AUSTRIAN PINOT BLANC WINES WITH HS-SPME-GC-MS

Austria is the third largest Pinot-blanc producing country in the world. Vineyards of 1914 ha, which corresponds to 4.3% of the Austrian wine-growing area and 12.3% of world production of Pinot Blanc (15,493 ha). Only in Germany (4794 ha; 30.9%) and in Italy (3086 ha; 19.9%) more Pinot blanc is cultivated [1]. The bouquet of dry Austrian Pinot Blanc usually is discreet, with predomination of pear and apple flavors, these often come together with a wallnut aroma and a hint of flower and herbs. The taste is delicate and full-bodied, it shows fruity sweetness and slight acidity and the aftertaste is moderate lemony. Aged wine often reveals notes of honey and almond [2]. Ethyl-trans2-cis4-decadienoate is well known as impact compound in fresh and processed pear products [3]. This substance was not noticed in wine until now. In the course of this study the content of Ethyl-trans2-cis4-decadienoate and its cis-trans isomers in different Austrian Pinot blanc wine samples was analyzed directly with HSSPME-SIM-MS [4].
The results showed that there might be a correlation between the choice of yeast and the time of aging on the lees ("sur lie") with the content of Ethyl-trans2-cis4-decadienoate. In the analyzed Austrian Pinot blanc wines the odor activity value of the pear aroma ranged from 0.4 to 10. Odor thresholds of these compounds were determined by BET 3AFC method in synthetic wine.

[1] Deutsches Wininstitut. Deutscher Wein: Statistik 2015/2016. Mainz. http://www.deutscheweine.de/fileadmin/user_ upload/Website/Service/Downloads/Statistik_2015-2016.pdf (21.09.2016)
[2] Doschek, H. 2015. Charakterisierung von Lagen und Weinen der Sorte Weißburgunder in Klosterneuburg. In: Schuldiplomarbeit der HBLA und BA für Wein- und Obstbau. R. Eder (ed.), Klosterneuburg (2015)
[3] Heinz, D. E., Jennings, W. G. 1966. Volatile components of Bartlett pear. Journal of Food Science.31, 69–80.
[4] Guillaume, A., Perello, M. C., de Revel, G. 2010. Development, validation and application of a specific method for the quantitative determination of wine esters by headspace-solid-phase microextraction-gas chromatography-mass spectrometry. Food Chemistry. 121, 1236-1245.

Christian Philipp

Höhere Bundeslehranstalt und Bundesamt für Wein christian.philipp@weinobst.at
und Obstbau Klosterneuburg, Wienerstrasse
Klosterneuburg, Austria

Philip Eder, Walter Brandes, Barbara Zöch, Ferdinand Regner, Elsa Patzl-Fischerleitner, Reinhard Eder

Höhere Bundeslehranstalt und Bundesamt für Wein
und Obstbau Klosterneuburg, Wienerstrasse
Klosterneuburg, Austria

Wine Active Compounds and sensoriality

THREE NEW P-MENTHANE LACTONES IN RED BORDEAUX WINES : FIRST IDENTIFICATION AND SENSORY IMPACT ON MINTY AROMA

Deciphering the sought-after freshness perceived in old red Bordeaux wines accounts among the current challenges in oenology [1]. In that context, the contribution of piperitone to the minty nuances in red wines was recently investigated [2]. Because this monocyclic terpene was known to be a limonene secondary metabolite in peppermint, we assumed the relevance of other aromatically interesting monoterpene derivatives issued from the same biotransformation pathway.
The p-menthane lactones constitute a family of powerful odorants, including the isomers of mintlactone and menthofurolactone that occur naturally in peppermint oil, and are known for their potent, mint-like olfactory and fresh somesthesic properties. Using targeted GC-Olfactometry and GC-MS analyses, together with quantification methods, we were able to demonstrate, for the first time, the presence of the diastereoisomers of these two p-menthane lactones, as well as their common precursor, menthofuran, at ng/L concentration range in red wine. In addition, we linked the presence of those lactones to interesting odorant zones, reminiscent of mint, detected in the studied wine.
From a sensory standpoint, this research highlighted the contribution of these p-menthane lactones to mint and coconut odours. Importantly, it was also suggested for the first time that their combination at the levels found in the studied red wine resulted in a significant accentuation of freshness and mint notes [3].

[1] Picard, M., Tempere, S., de Revel, G., Marchand, S. 2015. A sensory study of the ageing bouquet of red Bordeaux wines: a three-step approach for exploring a complex olfactory concept. Food Quality and Preference, 42, 110-122.
[2] Picard, M., Lytra, G., Tempere, S., Barbe, J.C., de Revel, G., Marchand, S. 2016. Identification of piperitone as an aroma compound contributing to the positive mint nuances perceived in aged red Bordeaux wines. Journal of Agricultural and Food Chemistry, 64(2), 451-460.
[3] Picard, M., de Revel, G., Marchand, S. 2017. First identification of three p-menthane lactones and their potential precursor, menthofuran, in red wines. Food Chemistry, 217, 294-302.

Magali Picard

Université de Bordeaux, ISVV, EA4577 Œnologie magalipicard@hotmail.com
INRA, ISVV, USC 1366 Œnologie
Villenave d'Ornon, France

Gilles de Revel, Stéphanie Marchand

Université de Bordeaux, ISVV, EA4577 Œnologie
INRA, ISVV, USC 1366 Œnologie
Villenave d'Ornon, France

Wine Active Compounds and sensoriality

COMPOSÉS SOUFRES ET QUALITÉ SENSORIELLE DES VINS DE SAUVIGNON : RAISONNER LE SULFITAGE ET LA PROTECTION DES MOUTS

Deciphering the sought-after freshness perceived in old red Bordeaux wines accounts L'expression sensorielle des vins de Sauvignon repose sur la présence de thiols variétaux, composés actifs de la qualité. Leurs précurseurs, naturellement synthétisés dans le raisin, doivent être protégés des phénomènes oxydatifs pour être révélés au cours de la phase fermentaire. De nombreux travaux ont contribué, dans la pratique, à renforcer l'inertage et le sulfitage, dans cet objectif. Ces pratiques conduisent à de nombreux phénomènes de réduction.

La difficulté de l'élaborateur consiste à révéler le potentiel variétal sans favoriser l'apparition de la réduction, deux profils sensoriels reposant sur des composés soufrés.

Les travaux issus de quatre années de comparaison d'itinéraires préfermentaires, confirment le rôle essentiel d'un sulfitage modéré, associé à l'inertage, dans l'équilibre oxydo-réducteur, pour conserver le potentiel du moût (précurseurs) d'une part, pour révéler le côté variétal (thiols) d'autre part. Les vins issus des moûts non protégés sont beaucoup moins riches en thiols. S'il conduit à des vins riches en ces composés, le sulfitage important des moûts est à l'origine des vins les plus réduits.

C'est également le niveau modéré de sulfitage pendant l'élevage et jusqu'au conditionnement, qui permet de stabiliser cet équilibre, en évitant de basculer vers la réduction.

Ces observations sont confirmées par les résultats du panel expert pour caractériser les composantes « thiols », « végétal » et « réduction » de chacun des vins. Grâce à une approche textuelle et un consensus au niveau du vocabulaire utilisé, mais également à un travail de reconnaissance des molécules, les juges ont pu mesurer l'influence du niveau de protection sur chacune de ces composantes sensorielles. La description finale est ainsi rendue plus fiable et l'analyse statistique (composés soufrés, thiols, description sensorielle), plus pertinente pour attribuer un profil réducteur à un itinéraire d'élaboration.

Pascal Poupault

Institut Français de la Vigne et du Vin
Amboise, France
pascal.poupault@vignevin.com

Jean-Michel Durivault

COFDGustation, Tours, France

Wine Active Compounds and sensoriality

USING *SACCHAROMYCES CEREVISIAE* KILLER TOXINS TO IMPROVE THE QUALITY OF TRADITIONAL SPARKLING WINE

The sparkling wine made by the traditional (or champenoise) method requires two successive alcoholic fermentations. The second, an in-bottle fermentation of a base wine with sugar, is followed by an aging period in which the wine is in contact with dead yeast cells (lees). These cells undergo a slow autolysis process thereby releasing some compounds, mostly colloidal polymers such as polysaccharides and mannoproteins, which influence the wine's foam properties and mouthfeel. Overall, it is considered that the release of these compounds improves the quality of sparkling wine, but the specific effect of each one is still a subject of discussion. Following the proposal of using mixed killer-K2 and sensitive yeast inocula to accelerate the onset of yeast autolysis [1], we evaluated the use of new killer yeasts for base-wine second fermentation to promote cell death, autolysis, and cell component release in order to improve sparkling-wine quality. These yeasts killed sensitive strains in killer plate assays done under conditions of low pH and temperature similar to those used in sparkling-wine making, although some killer strains showed a different killer behavior during winery second fermentation. The fast killer effect improved the foam quality and mouthfeel of the mixed-inoculated wines, while the slow killer effect gave small improvements over single-inoculated wines. The effect was faster under high-pressure than under low-pressure conditions. These results confirm the usefulness of yeast killer strains for sparkling-wine making. However, unexpectedly, wine quality improvement did not correlate with the polysaccharide, protein, mannan, or aromatic compound concentrations, suggesting that the mouthfeel and foaming quality of sparkling wine are very complex properties influenced by other wine compounds and their interactions [2].

[1] Todd, B.E.N., Fleet, G.H., Henschke, P.A., 2000. Promotion of autolysis through the interaction of killer and sensitive yeasts: potential application in sparkling wine production. Am.J.Enol.Vitic. 51, 65-72.
[2] Velázquez, R, Zamora, E, Álvarez, ML, Álvarez, ML, Ramírez, M (2016). Using mixed inocula of new killer strains of Saccharomyces cerevisiae to improve the quality of traditional sparkling-wine. Food Microbiology. 59: 150–160. doi:10.1016/j.fm.2016.06.006.

Manuel Ramìrez

Departamento de Ciencias Biomédicas (Àrea de Microbiologìa), Facultad de Ciencias Universidad de Extremadura, Badajoz, Spain — mramirez@unex.es

Rocìo Velàzquez

Departamento de Ciencias Biomédicas (Àrea de Microbiologìa), Facultad de Ciencias Universidad de Extremadura, Badajoz, Spain

Emiliano Zamora, Marìa L. Àlvarez

Estaciòn Enològica, Junta de Extremadura Almendralejo, Spain

Manuel Àlvarez

Heral Enologìa, SL. C/Alfonso Iglesias Infante Almendralejo, Spain

Wine Active Compounds and sensoriality

OENOLOGICAL TANNINS : CHEMICAL CHARACTERIZATION AND APPLICATIONS IN WINEMAKING

The use of oenological tannins is authorized for many years by the OIV; they represent a wide range of choice for users. Available commercial tannins, deferred from each other according to their origins, chemical structures, purities and preparation process, which induce a large varieties of properties. However, to date, there is not a standard method to verify their compositions and properties. The aim of this research was to characterize and compare, in a first approach, the antioxidant capacity and the molecular composition of different oenological commercial tannins from different botanical origin. In this work, oenological tannins purity, molecular composition and tannins group of origins (hydrolysable and condensed tannins, % of galloylated units) was estimated by different methods (TPI, MEC, Bate-Smith and Phloroglucinolysis). Moreover, the antioxidant capacity of each oenological tannins was also investigated by different methods (Folin-ciocalteu, ORAC, DPPH, ABTS, FRAP and CUPRAC). Finally, the previously characterized oenological tannins were added during the winemaking process in order to confirm and compare their effects on the must. The obtained results from this work lead us to propose the MEC as an efficient method for the determination of the tannin richness. Hydrolysable tannins (ellagitannins and gallotannins) also appeared to be the most protecting tannins against wine oxidation. Moreover adding oenological tannins in the must before sulphur additions seems increase the antioxidant properties of the tannins than their adding in the must after sulphur additions.

TPI: Total phenolic indices
MEC: methylcellulose
ORAC: Oxygen Radical Absorbance Capacity
DPPH: 2, 2-diphenyl-1-picrylhydrazyl
ABTS: 2, 2'-azino-bis (3-éthylbenzothiazoline-6-sulphonique)
FRAP: Ferric reducing Ability of Plasma
CUPRAC: Cupric Reducing Antioxydant Capacity

Adeline Vignault

Unité de Recherche Œnologie, EA 4577, USC 1366-
INRA Institut de Sciences de la Vigne et du Vin
Université de Bordeaux, Villenave d'Ornon, France
Departament de Bioquìmica i Biotecnologìa
Facultat de Tarragona, Universitat Rovira i Virgili
Tarragona, Spain

Maria Reyes Gonzalez-Centeno, Michael Jourdes, Pierre-Louis Teissedre

Unité de Recherche Œnologie, EA 4577, USC 1366-
INRA Institut de Sciences de la Vigne et du Vin
Université de Bordeaux, Villenave d'Ornon, France

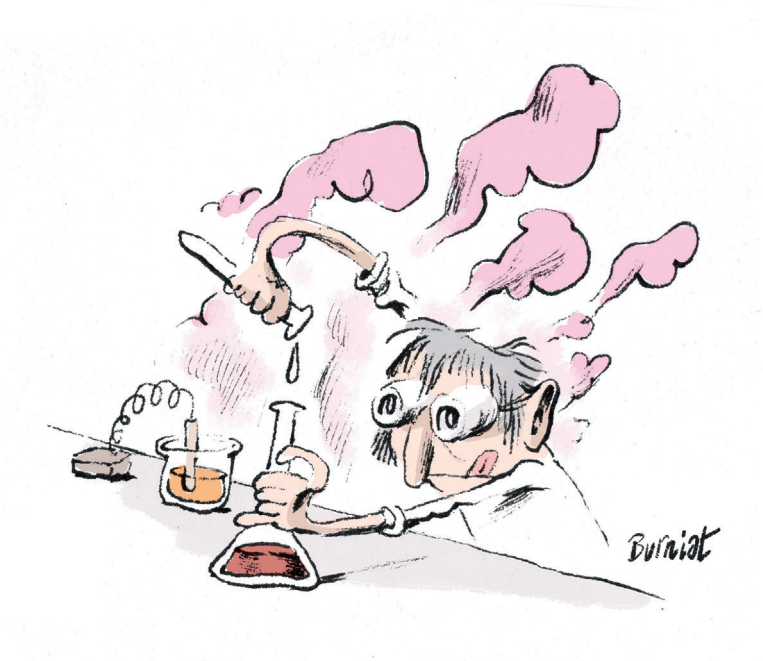
Fernando Zamora

Departament de Bioquìmica i Biotecnologìa
Facultat de Tarragona, Universitat Rovira i Virgili
Tarragona, Spain

POSTER SESSION IV

Wine Active Compounds and enological processes

Composés actifs du vins et procédés œnologiques



Wine Active Compounds and enological processes

CHARACTERIZATION OF THE INACTIVE DRY YEAST SOLUBLE FRACTION IN MODEL WINE

Ageing on lees is a well-known practice particularly dedicated to premium wines made for bottle ageing [1]. Nowadays, enological yeast derived preparations called inactive dry yeast (IDY) can benefit to ageing on lees without its drawbacks (cost and wine spoilage risks). IDY have indeed appeared to have a beneficial effect on flavour [2], colour and antioxidant stability of wine [3], through for instance the release of compounds like glutathione with high antioxidant potential [4].
Studies so far have largely focused on the modification of wine properties as a result of IDY addition, whereas much less is known concerning the chemical diversity of compounds released in the wine. Besides some well-known families of molecules (like amino acids, fatty acids, ...) most of the soluble fraction still remains unknown. In this work, through high-resolution mass spectrometry and HPLC/DAD-Fluorescence spectroscopy we have applied a combined targeted and non-targeted metabolomic approach to profile the compounds of IDY soluble fraction in wine like medium. This work provides unprecedented insights into the large diversity of IDY compounds released to a model wine, including peptides, saccharides or sugar adducts which are reported for the first time. A total of 26 compounds within the most abundant ones in the soluble fraction have been identified, with only half of them being already known to be present in IDY (amino acids, glutathione and related precursors). Such fine characterisation of the IDY soluble fraction opens new directions to discover yet unknown compounds for efficient oenological practices in a context of sustainable wine production.

Florian Bahut

Université de Bourgogne Franche-Comté
AgroSup Dijon
UMR Procédés Alimentaires et Microbiologiques
Dijon, France
florian.bahut@u-bourgogne.fr

Youzhong Liu, Christian Coelho, Hervé Alexandre, Maria Nikolantonaki, Régis Gougeon

Université de Bourgogne Franche-Comté
AgroSup Dijon
UMR Procédés Alimentaires et Microbiologiques
Dijon, France

Philippe Schmitt-Kopplin

Research Unit Analytical BioGeoChemistry
Helmholtz Zentrum Muenchen
Neuherberh, Germany
Technische Universität München
Analytical Food Chemistry, Freising, Germany

Nathalie Sieczkowski

Lallemand SAS, Blagnac, France

Wine Active Compounds and enological processes

TORULASPORA DELBRUECKII AND *SACCHAROMYCES CEREVISIAE* : EFFECT ON EVOLUTION OF GLUTATHION, VOLATILE THIOL AND ESTER LEVELS IN WINE

Thiols such as 3-mercaptohexan-1-ol (3MH), 3-mercaptohexyl acetate (3MHA) and glutathione (GSH) are of interest in winemaking. Sauvignon Blanc juice with a GSH level of 20 mg/L served as a control and compared to the same juice where the GSH levels were increased to around 90 mg/L. These treatments were then inoculated with either *Saccharomyces cerevisiae* strain (QA23) or a combination of *Torulaspora delbrueckii* (Biodiva) and the *S. cerevisiae* (QA23). GSH levels were then followed during fermentation, while 3MH, 3MHA and ester levels were also measured in the resulting wines made from juices with the lower level of GSH. The evolution of GSH was also followed in synthetic juices fermented with the same yeast and GSH treatments.
3MHA and 3MH concentrations were significantly higher in wines where *T. delbrueckii* was used in combination with *S. cerevisiae*. GSH levels did not vary drastically during alcoholic fermentation in the 20 mg/L must, with little difference observed between the two yeast treatments. However, in musts where the GSH level were increased more variance were observed during the course of alcoholic fermentation, but again with no difference between the yeast treatments. However, in musts made from synthetic juice with a higher initial GSH level, lower levels of GSH were observed at the end of fermentation where the two yeast were used in combination. Changes in ester levels in the wines will also be reported on.

Astrid Buica

Department of Viticulture and Œnology abuica@sun.ac.za
Stellenbosch University, Stellenbosch, South Africa

Wessel du Toit

Department of Viticulture and Œnology
Stellenbosch University, Stellenbosch, South Africa

Candice Stilwaney

Institute for Wine Biotechnology
Stellenbosch University, Stellenbosch, South Africa

Benoit Divol

Department of Viticulture and Œnology Institute for
Wine Biotechnology
Stellenbosch University, Stellenbosch, South Africa

Nathalie Sieczkowski

Lallemand SAS, R&D Enology Division
Blagnac, France

Wine Active Compounds and enological processes

AMINO ACIDS PROFILES OF SOUTH AFRICAN GRAPE WINE WHITE CULTIVARS

Fermentation kinetics and formation of aroma compounds are affected by the nitrogen status of the must, which can be manipulated in the winery as nutrients can be corrected in the cellar to a large extent. Both the amount and the form of Yeast Assimilable Nitrogen (YAN) have significant implications for wine quality. In normal conditions, yeast prefer the simpler forms of N, starting with ammonium, followed by amino acids, which are a major N source but of variable efficiency, like arginine, glutamine, asparagine – these can be considered "good" sources. On the other hand, "poor" sources are proline and urea, which the yeast uses only under constraint. Because of this, profiling amino acid composition of various cultivars of SA would benefit winemakers in their decision for the optimal additional nutrition.

A significant number of samples was collected from various grape-growing areas. In total, 364 settled juice samples from 17 white cultivars were collected from 35 wineries in the Western Cape, South Africa. The wineries contributed between 2 and 52 samples each. The grape cultivars represented the major local cultivars (Sauvignon Blanc, Chenin Blanc, Chardonnay, Viognier) and some more unusual ones (Marsanne, Ugni Blanc/Trebbiano), Verdelho, Grenache Gris). The analysis was performed by HPLC-FLD using the AccQTag kit (Waters).

The levels of individual amino acids were determined and classified according to yeast preference. Additionally, amino acid analysis is often used as a tool for cultivar identification in white grapes. The diversity of the samples reflected in the wide variety of levels for amino acids, but a more in-depth look at the data indicated that the cultivars were grouped according to amino acid composition using discriminant analysis. The hierarchical clustering analyses showed the complex relationships between samples and composition and is a good source of information for an exploratory/data mining approach to the results of the analysis.

Astrid Buica

Department of Viticulture and Œnology abuica@sun.ac.za
Stellenbosch University, Stellenbosch, South Africa

Noah Bieszczad

Vinifera EuroMaster programme

Wine Active Compounds and enological processes

DIFFERENT SKIN CONTACT TIMES IN *VITIS VINIFERA* SHIRAZ : ROLE IN WINE TANNIN CONCENTRATIONS AND COMPOSITION

The term "quality" in red wines is strongly associated with phenolic compounds. These molecules play an essential role throughout the entire winemaking process, as they contribute to the colour, taste and mouthfeel of young and aged red wines. The final wine phenolic composition is mainly affected by the extractability of grape phenolic compounds and subsequent chemical reactions occurring over time. Anthocyanins causes the colour of young red wines. Tannins are the principal contributors to the bitterness and astringency of the wines, as well as to colour stability due to the formation of new polymeric forms. With regards to the tannin fraction, little is known about the extractability of different polymers from skins and seeds during and after alcoholic fermentation.

The study aimed to better understand the phenolic extractability during and after alcoholic fermentation, particularly of tannins, in *Vitis vinifera* L. Shiraz. The experimental design was based on the idea of pressing the skins at three different stages of the alcoholic fermentation (middle of fermentation –MID-, end of fermentation –END- and after three weeks of extended maceration – EXTD). All wines were made in triplicate. Spectrophotometric and HPLC analysis were performed on the wines after malolactic fermentation. A new Hydrophilic Interaction Chromatography (HILIC) method developed by Terblanche et al. (2016) was used to quantify the tannin fraction in the wines.

Preliminary results showed a significantly lower amount of total red pigments, total phenolics and copigments in EXTD wines. Looking at the tannin concentration, the highest levels of tannins were found in END wines. However, HILIC results, showed more complex tannin polymers being found in wines made from longer skin contact times. Flavavoid derived monomers and procyanidins dimers were found in all three wine treatments. Trimers represented only 0.3% of the total concentration of tannins in MID wines, but increased to 3-4% in the END and EXTD wines. A tetramer was only detected in the EXTD wines.

Terblanche, E.; Garrido-Bañuelos, G.; Du Toit, W.J. & De Villiers, A. (2016). Development of Hydrophilic Interaction Chromatography (HILIC) and Reversed Phase LC (RP-LC) methods hyphenated to UV, fluorescence and high resolution mass spectrometry for the accurate quantification of grape and wine tannins. Conference Paper, Chromsaams 2016.

Astrid Buica

Department of Viticulture and Œnology abuica@sun.ac.za
University of Stellenbosch, Stellenbosch, South Africa

Gonzalo Garrido-Bañuelos, Wessel du Toit

Department of Viticulture and Œnology
University of Stellenbosch, Stellenbosch, South Africa

Elsa Terblanche

Department of Viticulture and Œnology
Department of Chemistry and Polymer Science
University of Stellenbosch, Stellenbosch South Africa

Wine Active Compounds and enological processes

STUDY OF THE INOCULATION TIME OF *LACTOBACILLUS PLANTARUM* IN COMBINATION WITH DIFFERENT YEASTS

The interactions among different microbial populations have interested the wine microbiology community with the final aim of understanding the impact on wines' quality. The main interaction occurs between yeast *Saccharomyces cerevisiae*, yeast non-*Saccharomyces* spp. and lactic acid bacteria (LAB) [1]. In last years, there is a special interest in the study of non-*Saccharomyces* yeasts as they are responsible for much of the aromatic complexity and its presence improves the final organoleptic characteristics of the wine [2]. Interactions between yeasts and LAB have been studied always combining *S. cerevisiae* with some LAB and in almost all cases *Oenococcus oeni*, but poor evidences have been reported for interactions between non-Saccharomyces and LAB in the wine environment. Lactobacillus plantarum selected strains have been receiving increasing attention as starter cultures for malolactic fermentation in wine. With the aim to design of mixed culture to perform AF and MLF simultaneously in a short period of time, with complex organoleptic properties, and also to control the indigenous microbiota and to protect wine against spoilage microorganisms, in this work we report the evaluation of the best inoculation time of L. plantarum strains (both commercial and autochthonous Apulian strains) in combination with autochthonous *S. cerevisiae* strains and non-*Saccharomyces* (*Hanseniaspora* sp. and *Candida* sp.). Interactions were also investigated monitoring cell viability on specific solid culture media. Microvinifications were performed using must from Apulian autochthonous grape varieties. Both, yeasts *S. cerevisiae* and non-*Saccharomyces*, were co-inoculated and L. plantarum strains were co-inoculated or sequentially inoculated during AF, when ethanol content was 2%, 4%, 6%, 8%, 10% or 12% (v/v). Ethanol formation, malic acid consumption and cell viability were monitored during the vinifications. This research was supported by the Apulian Region Project "Sviluppo di approcci microbiologici innovativi per il miglioramento della qualità di vini tipici regionali (NEWine)".

[1]Barata, A., Malfeito-Ferreira, M ., Loureiro, V. 2012. The microbial ecology of wine grape berries. International. Journal of Food Microbiology. 153, 243-259.

[2] Sadoudi, M., Tourdot-Maréchal, R., Rousseaux, S., Steyer, D., Gallardo-Chacón, J. J., Ballester, J., Vichi, S., Guérin-Schneider, R., Josep Caixach, J., Alexandre, H. 2012. Yeast-yeast interactions revealed by aromatic profile analysis of Sauvignon blanc wine fermented by single or co-culture of non-Saccharomyces and Saccharomyces yeasts. Food Microbiology. 32, 243-253.

Vittorio Capozzi

University of Foggia, Department of Sciences of Agriculture, Food and Environment
Foggia, Italy
vittorio.capozzi@unifg.it

Carmen Berbegal, Luciano Beneduce, Giuseppe Spano

University of Foggia, Department of Sciences of Agriculture, Food and Environment
Foggia, Italy

Francesco Grieco

Consiglio Nazionale delle Ricerche
Institute of Sciences of Food Production
Lecce, Italy

Wine Active Compounds and enological processes

STUDY OF THE INOCULATION TIME OF APULIAN AUTOCHTHONOUS *OENOCOCCUS OENI* IN A MULTI-STRAIN STARTER

The winemaking process includes two traditional steps performed by microorganisms, alcoholic fermentation (AF) and malolactic fermentation (MLF). The AF is essential; sugars from grape must are converted into ethanol. This fermentation is carried out by yeast, mainly by *Saccharomyces cerevisiae*, however is not the only yeast involved in the process. A few specific non-*Saccharomyces* species, as *Hanseniaspora uvarum* have been proved to positively modify the wine chemical composition, especially contribute to the sensory characteristics of wines [1]. Interactions between different microbial populations present in grape must are interesting from the point of view of their impact on the final quality of the wine. The main interaction occurs among *Saccharomyces* spp. yeasts, non-*Saccharomyces* yeasts, and lactic acid bacteria (LAB) [2]. In the light of the rising request for autochthonous starters tailored for given 'terroir'[3], the objective of this work was to select the best inoculation time of autochthonous of *Oenococcus oeni* strains in combination with two *S. cerevisiae* strains and one H. uvarum strain isolated from Apulian wines. Direct interactions were also investigated monitoring cell viability on specific solid culture media. Microvinifications were performed using must from Apulian autochthonous grape varieties. Both, yeasts *S. cerevisiae* and *H. uvarum*, were co-inoculated and *O. oeni* strains were co-inoculated or sequentially inoculated during AF, when ethanol content was 2%, 4%, 6%, 8%, 10% or 12% (v/v). Ethanol formation, malic acid consumption and cell viability were monitored during the vinifications. This research was supported by the Apulian Region Project cod. QCBRAJ6 "Biotecnologie degli alimenti per l'innovazione e la competitività delle principali filiere regionali: estensione della conservabilità e aspetti funzionali - BIOTECA."

[1] Liu, P.-T., Lu, L., Duan, C.-Q., Yan, G.-L. 2016. The contribution of indigenous non-Saccharomyces wine yeast to improved aromatic quality of Cabernet Sauvignon wines by spontaneous fermentation. LWT - Food Science and Technology. 71, 356-363
[2] Barata, A., Malfeito-Ferreira, M ., Loureiro, V. 2012. The microbial ecology of wine grape berries. International. Journal of Food Microbiology. 153, 243-259
[3] Capozzi, V., Garofalo, C., Chiriatti, M.A., Grieco, F., Spano, G. 2015. Microbial terroir and food innovation: The case of yeast biodiversity in wine. Microbiological Research. 181,75-83.

Vittorio Capozzi

University of Foggia, Department of Sciences of Agriculture, Food and Environment
Foggia, Italy
vittorio.capozzi@unifg.it

Carmen Berbegal, Anna Vernile, Giuseppe Spano

University of Foggia, Department of Sciences of Agriculture, Food and Environment
Foggia, Italy

Francesco Grieco

Consiglio Nazionale delle Ricerche
Institute of Science of Food Production
Lecce, Italy

Wine Active Compounds and enological processes

AUTOCHTHONOUS APULIAN YEASTS, PRIMARY FERMENTATION OF BASE WINE, AND RE-FERMENTATION OF SPARKLING APULIAN WINES

Sparkling wines contain high amount of CO_2 and are the result of re-fermentation of a still wine, usually called base wine. Several ingredients, such as sucrose, selected yeasts, bentonite and some nutrients, are added to base wine in order to induce the re-fermentation. Then wines can be bottled, fermented and aged for a long period (about 9-12 months). These wines represents an important percentage of the high-quality wine market and have an important economic impact due to its high added value [1-2], justifying the increasing attention to product improvements.
Modern biotechnologies can be used to improve quality of sparkling wines, and also to reduce their production time and cost. Starter cultures selected for sparkling wine production must satisfy several characteristics, in particular considering that re-fermentation is carried out in hostile environment due to several factors, such elevated ethanol content, low pH and increasing carbon dioxide pressure [3]. In addition starter cultures should have other important characteristics, such as autolysis (important for aging in close contact with lees) and flocculation (another important selection criterion that aim lees removal) [4]. Authochtonous starter cultures have an important rule on wine quality, because autochthonous yeasts i) might be well adapted to specific enviromental conditions and ii) might allow to obtain wines with typical organoleptic properties. In these context this study investigated the use of select autochthonous resources for sparkling wine production. We genetically characterized about 200 *Saccharomyces cerevisiae* autochthonous strains isolated from “Nero di Troia” spontaneous fermentation. After the evaluation of intraspecific diversity using interdelta analyis, we selected one represtative strain for each of the 15 genetic cluster. These strains were technological characterized at lab scale and, successively, tested in winery for both induce alcoholic fermentation in base wine and re-fermentation of sparkling wine. This research was supported by the Apulian Region Project “Innovazioni di processo e di prodotto nel comparto dei vini spumanti da vitigni autoctoni pugliesi” (IProViSP).

[1] González-Royo, E.; Pascual, O.; Kontoudakis, N.; Esteruelas, M.; Esteve-Zarzoso, B.; Mas, A.; Canals, J. M.; Zamora, F. 2014. Oenological consequences of sequential inoculation with non-Saccharomyces yeasts (Torulaspora delbrueckii or Metschnikowia pulcherrima) and Saccharomyces cerevisiae in base wine for sparkling wine production. Eur. Food Res. Technol., 240, 999–1012.
[2] Ody-Brasier, A.; Vermeulen, F. 2014. The Price You Pay Price-setting as a Response to Norm Violations in the Market for Champagne Grapes. Admin. Sci. Q.,59, 109–144.
[3] Ganss, S.; Kirsch, F.; Winterhalter, P.; Fischer, U.; Schmarr, H.-G. 2011. Aroma changes due to second fermentation and glycosylated precursors in Chardonnay and Riesling sparkling wines. J. Agricult. Food Chem., 59, 2524–2533.
[4] Alexandre, H.; Guilloux-Benatier, M. 2006. Yeast autolysis in sparkling wine – a review. Aust. J. Grape Wine Res., 12, 119–127.

Vittorio Capozzi

University of Foggia, Department of Sciences of Agriculture, Food and Environment
Foggia, Italy
vittorio.capozzi@unifg.it

Carmela Garofalo, Mattia Pia Arena, Giuseppe Spano

University of Foggia, Department of Sciences of Agriculture, Food and Environment
Foggia, Italy

Wine Active Compounds and enological processes

AUTOCHTHONOUS APULIAN YEASTS, PRIMARY FERMENTATION OF BASE WINE, AND RE-FERMENTATION OF SPARKLING APULIAN WINES

Francesco Grieco

Consiglio Nazionale delle Ricerche
Institute of Science of Food Production
Lecce, Italy

Wine Active Compounds and enological processes

SCHIZOSACCHAROMYCES JAPONICUS: A POLYSACCHARIDES OVERPRODUCING YEAST TO BE USED IN MIXED FERMENTATION

A strain of *Schizosaccharomyces japonicus*, previously characterized for its capacity to release a high quantity of polysaccharide in a synthetic medium (1), has been here evaluated for its fermentative capacity with respect to impact on wine composition following grape must fermentation in pure and mixed culture with a commercial strain of *Saccharomyces cerevisiae* (EC1118). Different *S.cerevisiae/non-Saccharomyces* inoculum ratios (1:1; 1:100; 1:10.000) were investigated. Pure cultures of EC1118 were also used as controls at each of the three levels of inoculation in the mixed cultures.
The influence of different inoculum ratios on the interactions between the two yeast strains and on the analytical profiles of the final wines was evaluated. *S.japonicus* affected the growth of *S. cerevisiae* only at an inoculum ratio 10.000 to 1. In agreement, the fermentation rates decreased in an inoculum-ratio-dependent fashion.
The release of high amounts of polysaccharide by *S.japonicus* was here confirmed. All experimental wines obtained with pure culture of *S. japonicus* or with mixed cultures showed concentrations of total polysaccharides significantly higher than those obtained with pure cultures of EC1118. Moreover, in mixed fermentations there was an inoculum-ratio-dependent increases in total polysaccharides.
Polysaccharides have been shown to improve wine 'mouthfullness', positively affect aroma persistence and contribute to protein and tartrate stability (2, 3, 4). Thus, this non-*Saccharomyces* yeast in combination with *S. cerevisiae* could enhance wine complexity and aroma and improve wine stability by increasing the final concentration of polysaccharides.
In addition, the analytical profiles of the wines produced by the mixed cultures indicated that, depending on the inoculum ratio, this non-*Saccharomyces* yeast can be used in mixed fermentation to modulate the final concentrations of malic and acetic acid and some of the most important volatile compounds, such as 2-phenyl ethanol.

[1] Domizio, P., Liu, Y., Bisson, L.F., Barile, D. 2017. Cell wall polysaccharides released during the alcoholic fermentation by Schizosaccharomyces pombe and S. japonicus: quantification and characterization. Food Microbiology. 61:136–149
[2] Feuillat, M., 1994. Origineetrôlesoenologiques des colloïdes de levures. Revue des Oenologues. 73, 15–19.
[3] Vidal, S., Francis, L., Williams, P., Kwiatkowski, M., Gawel, R., Cheynier, V., Waters, E. 2004. The mouth-feel properties of polysaccharides and anthocyanins in a wine like medium. Food chemistry. 85:519–525.
[4] Juega, M., Nunez, Y.P., Carrascosa, A.V., Martinez-Rodriguez, A.J. 2012. Influence of yeast mannoproteins in the aroma improvement of white wines. Journal of Food Science. 77:M499- M504

Paola Domizio

Dipartimento di Gestione dei Sistemi Agrari, Alimentari e Forestali (GESAAF)
Università degli Studi di Frenze
Firenze, Italy
Department of Viticulture & Enology
University of California-Davis
Davis, California, USA
paola.domizio@unifi.it

Cristina Romani, Livio Lencioni

Dipartimento di Gestione dei Sistemi Agrari, Alimentari e Forestali (GESAAF)
Università degli Studi di Frenze
Firenze, Italy

Wine Active Compounds and enological processes

SCHIZOSACCHAROMYCES JAPONICUS: A POLYSACCHARIDES OVERPRODUCING YEAST TO BE USED IN MIXED FERMENTATION

Mirko Gobbi, Maurizio Ciani

Dipartimento di Scienze della Vita e dell Ambiante
(DiSVA) Università Politecnica delle Marche
Ancona, Italy

Ilaria Mannazzu

Dipartimento di Agraria
Università degli Studi di Sassari
Sassari, Italy

Linda Bisson

Department of Viticulture & Enology
University of California-Davis
Davis, California, USA

Wine Active Compounds and enological processes

IMPACT OF FINING AGENT TYPE AND CONCENTRATION ON THE PHENOLIC COMPOSITION OF A CABERNET SAUVIGNON RED WINE

Clarity or limpidity is one of the leading consumer quality requirements.A suitable wine stabilization and limpidity is progressively obtained after winemaking due to physical and chemical phenomena that determine the precipitation of unstable compounds. Stabilization could be divided into physico-chemical and microbiological stabilization. Physico-chemical stabilization, insured by fining agents,prevents the formation of hazes and deposits after bottling.
Phenolic compounds are one of the most important quality parameters in red wines. These compounds contribute to organoleptic characteristics of wines such as color, bitterness and astringency. The phenolic composition of red wines is affected by the wine-making process and more precisely by the fining step. In this context, the aim of this workis to evaluate the effect of five different oenological fining practices (egg albumin, PVPP + casein, bentonite, gelatin and vegetable proteins) and two oenological additives (tannins and mannoproteins); as well as the effect of different fining concentrations on the phenolic composition and the antioxidant activity of a Cabernet Sauvignon red wine.
The results showed that all treatments affected the wine phenolic contents. The most remarkable effects on phenolic composition were produced by bentonite and PvPP + casein which significantly decreased anthocyanins and tannins concentrations respectively. The use of vegetable protein and gelatin has a less impact on the color and phenolic contents of red wines. The antioxidant activity was little affected by treatments except the addition of tannins that increased it.Principal components analysis demonstrates the importance of a low concentration of agents for high total polyphenol levels.

Youssef El Rayess

Faculty of Agricultural and Food Sciences
Holy Spirit University of Kaslik
Jounieh, Lebanon
youssefrayess@usek.edu.lib

Chantal Ghanem, Ziad Rizk

Lebanese Agricultural Research Institute
Fanar Station
Jdeidet El-Metn, Fanar, Lebanon

Jean-Pierre Souchard

Laboratoire des Interactions Moléculaures
et Réactivité Chimique et Photochimique
UMR CNRS 5623
Université de Toulouse
Toulouse, France

Wine Active Compounds and enological processes

IMPACT OF FINING AGENT TYPE AND CONCENTRATION ON THE PHENOLIC COMPOSITION OF A CABERNET SAUVIGNON RED WINE

Nancy Nehme

Faculty of Agricultural Engineering
and Veterinary Medicine, Lebanese University
Dekwaneh, Lebanon

Patricia Taillandier

Université de Toulouse, INPT, UPS, CNRS
Laboratoire de Génie Chimique
Toulouse, France

Wine Active Compounds and enological processes

STILBENES FROM *VITIS VINIFERA* L. WASTE : A SUSTAINABLE TOOL FOR CONTROLLING *PLASMOPARA VITTICOLA*

The oomycete *Plasmopara viticola* is the cause of downy mildew that is one of the most economically important diseases of cultivated grapevines worldwide [1]. Today the damage caused by downy mildew has generally been controlled using multiple fungicide applications [1][2]. Henceforth there is renewed interest in search for effective ecofriendly and sustainable natural agents to control diseases and pests because of changes in environment and food safety regulations associated with consumer demand. In this objective, antifungal activity against downy mildew of stilbene-enriched extracts from *Vitis vinifera* waste (cane, wood and root) were investigated. Eleven stilbenes were identified by UHPLC-MS and quantified as follows: ampelopsin A, E-piceatannol, pallidol, E-resveratrol, hopeaphenol, isohopeaphenol, E-ε-viniferin, E-miyabenol C, E-ω-viniferin, vitisin A and vitisin B. The main compounds in the extracts were then isolated by preparative HPLC. The fungicide concentration inhibiting 50% of growth of *Plasmopara viticola* sporulation (IC50) was determined for the extracts and also for the isolated compounds. Vitisin B followed by hopeaphenol and vitisin A showed low IC50, and thus high efficacy against *Plasmopara viticola*. Regarding stilbene-enriched extracts, root extract showed the highest antifungal activity. These data suggest that *Vitis vinifera* roots could be used as a cheap source of bioactive stilbenes for the development of natural fungicides.

[1] C. Gessler, I. Pertot, and M. Perazzolli, 2011. "Plasmopara viticola: a review of knowledge on downy mildew of grapevine and effective disease management," Phytopathol. Mediterr., vol. 50, no. 1, pp. 3–44.
[2] P. Leroux and M. Clerjeau, 1985."Resistance of Botrytis cinerea Pers. and Plasmopara viticola (Berk. & Curt.) Berl. and de Toni to fungicides in French vineyards," Crop Prot., vol. 4, no. 2, pp. 137–160.

Julien Gabaston

Université de Bordeaux, ISVV, EA 4577
Unité de Recherche Œnologie (GESVAB)
Villenave d'Ornon, France
julien.gabaston@u-bordeaux.fr

Emma Cantos-Villar

Instituto de Investigaciòn y Formaciòn
Agraria y Pesquera (IFAPA)
Càdiz, Spain

Benoît Biais, Pierre Waffo-Teguo, Elodie Renoue, Tristan Richard, Jean-Michel Merillon

Université de Bordeaux, ISVV, EA 4577
Unité de Recherche Œnologie (GESVAB)
Villenave d'Ornon, France

Marie-France Corio-Costet

UMR Santé Végétal, 1065, ISVV, IFR 103, INRA
Villenave d'Ornon, France

Wine Active Compounds and enological processes

COMPLETE QUANTITATIVE ANALYSIS OF WINE COLOR AND PHENOLIC AND ANTHOCYANIN PROFILES USING SIMULTANEOUS ABSORBANCE AND FLUORESCENCE EXCITATION-EMISSION MAPPING

This study describes the unique capacity of simultaneous absorbance and fluorescence excitation-emission mapping (EEM) spectral instrument and chemometric analysis technology for rapid, precise determination of a wide range of parameters important to commercial wine processing and quality characterization. The instrument method rapidly (< 1 min) acquires a complete UV-VIS spectrum including the industry standard absorbance wavelength values at 280, 420, 520 and 620 nm which are routinely used to evaluate a wine's phenolic content, hue and intensity. The method also reports the transmission spectrum which can be used to determine a complete array of CIELab Tri-Coordinate Color Descriptions, also valuable for wine color and flavor evaluation. Both the absorbance and CIE Lab analyses yielded significant spectral resolution of several red wine varieties as well as the effects of oxidation on the wine samples. The instrument method reports a National Institute of Standards and Technology (NIST) traceable EEM which can be evaluated using a variety of chemometric methods including Parallel Factor Analysis (PARAFAC), Principal Component Analysis (PCA), and Multiway Partial Least Squares Regression (MPLSR). For all wines evaluated, the EEM chemometric analyses resolved significant qualitative and quantitative composition parameters that were not discernable with the routine absorbance or CIE Lab data analyses. More significantly the MPLSR method can be calibrated to facilitate a complete quantitative phenolic and anthocyanin profile. In conclusion, it is proposed that the absorbance, transmission and EEM chemometric data can be used synergistically to evaluate lot-to-lot, regional, and varietal characteristics as well as sensing the effects of oxidation and sulfite treatment thus making the instrument and analysis methods potentially valuable tools for industrial wine characterization.

Adam M. Gilmore

HORIBA Instruments Inc
Edison, New Jersay, USA

adam.gilmore@horiba.com

Wine Active Compounds and enological processes

AMINO ACIDS AND AMMONIUM UTILIZATION BY NON-*SACCHAROMYCESYEASTS* FROM GRAPE JUICE

It is well established that non-*Saccharomyces* wine yeasts, considered in the past as undesired or spoilage yeasts, can enhance the analytical composition, and aroma profile of the wine. The use of mixed starters of selected non-*Saccharomyces* yeasts with strains of *Saccharomyces cerevisiae* represents an alternative to both spontaneous and inoculated wine fermentations, taking advantage of the potential positive role that non-*Saccharomyces* wine yeast species play in the organoleptic characteristics of wine. In this context mixed starters can meet the growing demand for new and improved wine yeast strains adapted to different types and styles of wine. But their use is still poorly mastered, by lack of knowledge about their needs and behaviours in fermentation andespecially in co-fermentation, including their consumption of amino acids and ammonium. To better control use of non-Saccharomyces in winemaking, the utilization of amino acids and ammonium by three strains of non-*Saccharomyces* was studied in grape juice. Both quantitative and qualitative differences, during the catabolism of 200 g/L of glucose, in the utilization of assimilable nitrogen were observed in various culture conditions.First with pure culture under aerobic condition and then with limited aeration, condition found in winemaking. The second culture condition is a sequential co-culture with *Saccharomyces cerevisiae* under limited aeration to understand the impact of thenon- *Saccharomyces*yeasts on the availability of assimilablenitrogen to *Saccharomyces cerevisiae*. Our results demonstrate that non-*Saccharomyces* yeast possess specific amino acid profile consumption never reported before. Our results also underline that nitrogen consumption by yeast might be a source of competition that could explain some observed interactions.

Antoine Gobert

UMRA 02 102 PAM laboratoire VALMIS
Institut Universitaire de la Vigne et du Vin
Jules Guyot
Univesité de Bourgogne, Dijon, France
antoinegobert1@gmail.com

Raphaëlle Tourdot Maréchal, Hervé Alexandre

UMRA 02 102 PAM laboratoire VALMIS
Institut Universitaire de la Vigne et du Vin
Jules Guyot
Univesité de Bourgogne, Dijon, France

Wine Active Compounds and enological processes

EFFECT OF GRAPE JUICE PRESS FRACTIONING AND *BOTRYTIS* BERRY INFECTION ON PROTEOLYTIC ACTIVITY OF CHAMPAGNE BASE WINES

The press fractioning is an important step in the production of sparkling base wines to segregate the grape juices with different qualities. A complete pressing cycle results in a large variation in juice composition. Particularly the protein contents of grape juices and Champagne base wines produced from Pinot meunier (PM) press fractions exhibited strong quantitative and qualitative differences. These could be partially explained by proteolytic activities arisen from the grape berry, fermentative yeast, or a grape fungus infection. The aim of this study was to better understand the protease activity change due to grape juice fractioning during the pressing cycle, according to the presence or absence of rotten bunches, and their impact on protein content. PM grape juice fractions (squeezes, S) were collected from a 8000 kg pneumatic press, and healthy or botrytized Chardonnay (CH) juice fractions from a 6 kg laboratory press. The juices were vinified separately. The wine proteolytic activity was assayed against BSA and followed by SDS-PAGE after gel staining. The results show significant changes in proteolytic activity of PM and CH base wine as the pressing cycle progressed. The specific proteolytic activity decreases by 40% between S1 and S4 for PM wines, and by 87.5% and 74% between S1 and S5 for healthy and botrytized wines respectively. Moreover, the proteolytic activity observed in S1 is 2.6, 2.4 and 1.4 times higher than S2 for PM, healthy and botrytized CH respectively. For CH wines, the proteolytic activity was higher in botrytized wines, from 35 to 110 fold according to squeeze. The wine proteolytic activity decreases during the pressing cycle as observed for wine protein level. The grape, fungus and yeast protease activity could not especially explain the protein content change. These could be impacted by the initial composition of the grape juice, the maturity stage or degradation of grape berry pulp and cell wall, and/or the protein solubility loss.

Sandrine Jégou

Laboratoire d'Oenologie et Chimie Appliquée sandrine.jegou@univ-reims.fr
URVVC EA 4707
Université de Reims Champagne-Ardenne

Thomas Salmon, Duc An Hoang, Richard Marchal

Laboratoire d'Oenologie et Chimie Appliquée
URVVC EA 4707
Université de Reims Champagne-Ardenne

Sandrine Jégou

Institut d'Œnologie de Champagne
Epernay, France

Wine Active Compounds and enological processes

IMPACT OF DIFFERENT NITROGEN LEVEL IN THE VINEYARD AND WINEMAKING PROCESSES ON THE CHEMICAL PROFILE OF CHASSELAS WINES

As reviewed by Bell and Henschke (2005), several studies showed that the terroir and particularly the vine nitrogen status can significantly impact the quality of the wine. A positive correlation between N concentration in Chasselas must and sensory expression of the wine has been highlighted by Spring (2002 & 2005). This study aims at a more thorough investigation of the interactions between N concentration in the must and the winemaking process, especially malolactic fermentation (MLF) and oxygen uptake by the wine, and their effects on the chemical profile of Chasselas wines. Their impact on the ageing potential of the wines will also be studied.
Chasselas grapes from two experimental vineyards (high and low N level) were processed according to a small scale standardized winemaking procedure varying MLF. The same grapes were also used to produce wines at industrial scale, following the winemaking procedure decided by our cellar master. Half of the small and industrial scale trials received 4mg/L oxygen one week before bottling, which was carried out similarly for both types of wine. Wines were stored under controlled conditions (temperature and humidity) and subsequently analyzed by GC/FID for volatile compounds and by FTIR and colorimetric methods for classical parameters (alcohol, acidity, pH, SO2...).
The first results obtained (millesim 2014) confirmed that the vine nitrogen status and the type of winemaking procedure have an impact on the chemical profile of the wine. Wines could be distinguished according to the type of winemaking procedure (industrial scale, small scale with MLF, small scale without MLF) and to the terroir (difference in vine nitrogen status). No effective impact of oxygen addition prior to bottling could be highlighted at this stage.
Analysis are currently underway to confirm this result with millesim 2015 and the wines will be analyzed all along the storage (5 to 8 years) to investigate the evolution of the volatile profile during ageing.

Carole Koestel

AGROSCOPE, Nyon, Switzerland carole.koestel@agroscope.admin.ch

Àgnes Dienes-Nagy, Danielle Nardone, Vivian Zufferey, Jean-Laurent Spring, Fabrice Lorenzini, Johannes Rösti

AGROSCOPE, Nyon, Switzerland

Wine Active Compounds and enological processes

EFFICACY OF SULPHUR DIOXIDE IN BARRELS SANITIZATION AND POSSIBLE ALTERNATIVES

Oak barrels form an integral part of wine production, especially that of high quality wines. However, wood's porosity complicates cleaning and sanitization, rendering barrels an ecological niche for microbial proliferation. Barrel ageing has indeed been identified as the most critical stage for Brettanomyces contamination1,2. This spoilage yeast produces several metabolites that adversely affect wine quality such 4-ethylphenol, 4-ethylguaiacol, volatile acidity and tetrahydropyridines3. It is thus clear that sound barrel sanitization methods are key to minimize the risk of in-barrel wine spoilage. Currently, sulphur dioxide (SO_2) produced by combustion of elemental sulphur is the most widely used biocide for barrel sanitization. Surprisingly, little research is available on the efficacy of SO_2 in eliminating spoilage microorganisms in oak barrels. Furthermore, in view of the fact that various B. bruxellensis strains display increased SO_2 tolerance, alternative sanitization methods ought to be explored. The aim of this study was to assess the efficacy of SO_2 treatments along with alternative treatments in eliminating B. bruxellensis from oak wood. Oak wood staves, contaminated with different B. bruxellensis strains, were subjected to several sanitization treatments, including, among others, ozone gas, steam, peracetic acid and sodium percarbonate. In a separate study, used oak barrels were contaminated with B. bruxellensis and treated with SO_2. Core samples were taken before and after treatment at different barrel sites over a period of four weeks. After their extraction from the oak wood, B. bruxellensis cells were subjected to live/dead staining and detected by means of flow cytometry. The treatments differed greatly in their ability to reduce B. bruxellensis cells. Furthermore, strains differed in terms of treatment sensitivity. SO_2 considerably diminished B. bruxellensis in oak barrels and was effective up to four weeks post treatment.

[1] Chatonnet et al., 1992. J. Sci. Food Agr. 60, 165-178.
[2] Renouf et al., 2006. J. Int. Sci. Vigne Vin 40, 101-106.
[3] Suárez et al. 2007. Food Chem. 102, 10-21.

Engela Kritzinger, Pascal Wegmann-Herr
Institute for Viticulture and Oenology
DLR Rheinpfalz Neustadt an der Weinstraße, Germany

Ulrich Fischer
Institute for Viticulture and Oenology
DLR Rheinpfalz Neustadt an der Weinstraße, Germany

Maren Scharfenberger-Schmeer
Institute for Viticulture and Oenology
DLR Rheinpfalz Neustadt an der Weinstraße, Germany
Hochschule Kaiserslautern
Dualer Studiengang Weinbau und Oenologie
Kaiserslautern, Germany

Wine Active Compounds and enological processes

ABOUT THE ROLE OF THE BOTTLENECK/CORK INTERFACE ON OXYGEN TRANSFER

Cork is a sustainable material which has been used for sealing wines from Antiquity, to close amphora, up to now, with two thirds of the wine bottles still being sealed with cork stoppers. During post bottling aging of wine, oxygen transfer occurs through the stopper, but also through the glass/stopper interface, and can lead to oxidation reaction. Studying diffusion of oxygen through the closure system is of a relevant interest considering the question of the shelf life. At the present time, the role of the bottleneck/cork interface still remains not properly defined despite its obvious importance.
The transfer of oxygen through a corked bottleneck was investigated using a manometric technique [1,2]. First, the effect of cork compression on oxygen transfer was evaluated without considering the glass/cork interface. The compression of cork (at 23 % strain, corresponding to the compression level of cork in a bottleneck for still wine) did not modify the effective diffusion coefficient of oxygen. The mean value of the effective diffusion coefficient is equal to 10−8 m2.s−1, with a statistical distribution ranging from 10−10 to 10−7 m2.s−1, which is of the same order of magnitude as for the non-compressed cork. Then, oxygen transfer through cork compressed in a glass bottleneck (cetie ring) was determined in order to assess the effect of the glass/cork interface. According to the experimental conditions used in this study (dry cork without surface treatment; 200 and ~ 0 hPa of oxygen on both sides of the sample), the mean effective diffusion coefficient is of 5 × 10−7 m2.s−1, thus revealing the role of the glass/stopper interface in the oxygen transfer [3].

[1] Lequin, S., Chassagne, D., Karbowiak, T., Simon, J. M., Paulin, C. and Bellat, J. P. 2012. Diffusion of oxygen in cork. Journal of Agricultural and Food Chemistry. 60(13), 3348-3356.
[2] Lagorce-Tachon, A., Karbowiak, T., Simon, J. M., Gougeon, R. and Bellat, J. P. 2014. Diffusion of Oxygen through Cork Stopper: Is It a Knudsen or a Fickian Mechanism? Journal of Agricultural and Food Chemistry. 62(37), 9180-9185.
[3] Lagorce-Tachon, A., Karbowiak, T., Paulin, C., Simon, J.-M., Gougeon, R. D. and Bellat, J.-P. 2016. About the Role of the Bottleneck/Cork Interface on Oxygen Transfer. Journal of Agricultural and Food Chemistry. 64, 6672−6675.

Aurélie Lagorce-Tachon
Université de Bourgogne Franche-Comté
AgroSup Dijon UMR PAM
Institut Universitaire de la Vigne et du Vin
Laboratoire Interdisciplinaire Carnot de Bourgogne
UMR 6303 CNRS,
Dijon, France

Thomas Karbowiak
Université de Bourgogne Franche-Comté
AgroSup Dijon UMR PAM, Dijon, France

Christian Paulin, Jean-Marc Simon, Jean-Pierre Bellat
Université de Bourgogne Franche-Comté
Laboratoire Interdisciplinaire Carnot de Bourgogne
UMR 6303 CNRS, Dijon, France

Wine Active Compounds and enological processes

ABOUT THE ROLE OF THE BOTTLENECK/CORK INTERFACE ON OXYGEN TRANSFER

Régis D. Gougeon

Université de Bourgogne Franche-Comté
AgroSup Dijon UMR PAM
Institut Universitaire de la Vigne et du Vin
Dijon, France

Wine Active Compounds and enological processes

OAK WOOD SEASONING : IMPACT ON OAK WOOD CHEMICAL COMPOSITION AND SENSORY QUALITY OF WINE

Oak wood selection and maturation are essential steps in the course of barrel fabrication. Given the existence of many factors involved in the choice of raw material and in natural seasoning of oak wood, it is very difficult to determine the real impact of seasoning and selection factors on oak wood composition.
A sampling was done to study the evolution of oak wood chemical composition during four seasoning steps: non matured, 12 months, 18 months and 24 months. For this sampling, three selection factors were taken into account: age, grain type and the Polyphenolic Index measured by Oakscan®.
Besides extractables (~10%), three polymers constitute the main part of oak wood: cellulose, hemicelluloses and lignins. These compounds may undergo hydrolysis or chemical reactions during cooperage processes, especially during heat treatment, which release some aromatic compounds or aromatic precursors having a genuine sensorial interest on wine aged in barrel or in contact with oak products. To date, no studies revealed a link between the proportions of these compounds in oak wood and the chemical and sensorial impact in wines ageing with oak wood.
Our study showed that the proportions of these compounds evolved significantly during oak wood seasoning and the results highlighted the impact of selection factors. Respectively, extractables, lignins, hemicelluloses and cellulose proportions were mostly for non matured, 12 months, 18 months and 24 seasoning months.
The development of a test plan with a Merlot wine from a second oak wood sampling, using similar modalities as the previous test plan allowed the evaluation of oak wood seasoning impact on the chemical composition of a wine ageing with oak wood pieces. Results showed a lowering of 8% in ellagitannins content of wine between 12 and 24 months modalities. An impact on volatile composition in wine has also been established.
Sensorial analysis on this Merlot wine led to significant differences demonstrated with triangular tests for some seasoning modalities.

Alexandra Le Floch

Université de Bordeaux, ISVV, EA 4577, Œnologie
INRA, ISVV, USC 1366, Villenave d'Ornon, France
R&D Tonnellerie Radoux-Pronektar, Jonzac, France

Michael Jourdes, Pierre-Louis Teissedre

Université de Bordeaux, ISVV, EA 4577, Œnologie
INRA, ISVV, USC 1366, Villenave d'Ornon, France

Thomas Giordanengo, Nicolas Mourey

R&D Tonnellerie Radoux-Pronektar
Jonzac, France

Wine Active Compounds and enological processes

POPULATION EFFECT OF *B. BRUXELLENSIS* IN RED WINE ON RESPONSE TO DIFFERENT ACTIVE SULFITE LEVELS

Brettanomyces bruxellensis is considered as spoilage yeast encountered mainly in red wine. This yeast is able to reduce vinylphenols to volatile phenols from phenolic acids and other molecules which are responsible for organoleptic deviations («Brett character» and «mousiness taint"). SO_2 is used by winemaker to prevent *B. bruxellensis* growth. However, nowadays, winemakers wish to diminish sulfite addition in wines. Usually, molecular SO_2 (active SO_2) is used about 0.3 to 0.8 mg/L. But these levels take into account neither difference of strains resistance to sulfites nor the level of population. Moreover, SO_2 is known as a chemical stressor inducing viable but non-culturable (VBNC) state of *B. bruxellensis*. These cells not detectable by plate counting can lead to a new contamination when sulfite amount decreases over time. In this context we first assessed in red wine the effect of the SO_2 levels on two strains phenotypically different for their sulfite resistance. We then tested the relationship between SO_2 amount (0, 0.5, 0.9 and 1.1 mg/L active SO_2) and population levels (103, 104 and 105 cells/mL) in red wine. Over time, yeasts were enumerated by both plate counting and flow cytometer using vitality and viability dyes. This latter method allows the potential culture dependent shortcoming such as the VBNC state of wine microorganisms to be circumvented. Our results showed different SO_2 resistance according to the strain used. A correlation between yeast population level and SO_2 resistance was demonstrated: the higher the yeast concentration, the greater the SO_2 resistance. Under certain conditions, VBNC state of *B. bruxellensis* was highlighted for the first time in red wine. Moreover, cells become culturable again over time. So, it seems important to take into account the level of populations to better adjust the amount of active SO_2.

Cédric Longin

Université de Bourgogne Franche-Comté
AgroSup Dijon, PAM UMR A 02.102
Institut Universitaire de la Vigne et du VIn
Equipe VALMIS
Dijon, France

Claudine Degueurce, Frédérique Julliat, Michèle Guilloux-Benatier, Sandrine Rousseaux, Hervé Alexandre

Université de Bourgogne Franche-Comté
AgroSup Dijon, PAM UMR A 02.102
Institut Universitaire de la Vigne et du VIn
Equipe VALMIS
Dijon, France

Wine Active Compounds and enological processes

UTILISATION DES EXTRAITS DE PROTEINES DE LEVURE POUR LE COLLAGE DES VINS BLANCS

Des produits de collage renfermant des protéines d'origine exclusivement levurienne, appelés Extraits de Protéines de Levure (EPL) sont recommandés par l'OIV depuis 2012. Nous avons réalisé des collages sur trois campagnes (2013 à 2015) avec des protéines levuriennes, animales et végétales. Les résultats que nous présentons dans cette étude (vin de base champenois, assemblage de Pinots) traduisent le comportement moyen observé. L'EPL utilisé (FYNEO) présente des protéines allant essentiellement de 12 à 50 kDa, 86% des protéines ayant un PM >15kDa, répondant aux spécifications de l'OIV. Les meilleures clarifications sont obtenues avec l'EPL + tanins de châtaignier (7-9 NTU, Témoin à 59 NTU). L'EPL utilisé seul montre une clarification marquée (13,8-15,3 NTU, pour des doses de 4 à 9g/hl). Ces valeurs sont supérieures à celles observées pour le collage EPL + Tanins. La couleur des vins est mesurée par la méthode CIE–L*a*b*. L* est la luminosité, a* la composante rouge/rose et b* la composante jaune des vins. Le collage avec la colle de poisson et les 3 collages avec l'EPL seul améliorent la luminosité des vins. A l'inverse, les collages avec tanins diminuent tous la luminosité L* du vin en raison de la présence de tanins œnologiques résiduels. Concernant les composantes a* et b*, les vins collés avec l'EPL seul montrent des couleurs rose et jaune moins prononcées en raison de l'élimination de composés responsables de ces caractéristiques chromatiques. Pour le collage avec l'EPL seul, le volume de lies augmente logiquement avec l'augmentation de la dose de colle, même si les faibles doses donnent des volumes proportionnellement légèrement supérieurs. Les lies générées avec les collages EPL 6g/hL et l'association Gélatine/ Tanins sont égales (% v/v). Enfin, pour les collages EPL + Tanins, les volumes de lies sont supérieures aux volumes notés sans tanins. Tous ces paramètres montrent la réelle efficacité des EPL pour le collage des vins blancs.

Richard Marchal

University of Reims Champagne-Ardenne
URVVC EA 4707
Reims, France
richard.marchal@univ-reims.fr

Thomas Salmon

University of Reims Champagne-Ardenne
URVVC EA 4707
Reims, France

Olivier Pillet, Bertrand Robillard

Institut d'Œnologie de Champagne
Epernay, France

Wine Active Compounds and enological processes

PESTICIDE REMOVAL IN WINE WITH A PHYSICAL TREATMENT BY MOLECULAR SIEVING

Among the exogenous contaminants of the wines, pesticides are the molecules on which the public is the most conversant about. Even if there is no proven toxicological risk associated with the presence of pesticide residues in the wines, this issue is a major concern for consumers and producers. Recently several articles were published in France and indicated a widespread contamination of wines from conventional or organic wines. These articles also highlight the lack of official Maximum Residue Limit for wine. It is also reported that, among the residues detected, many molecules are possible or probable carcinogens, toxic for the development or the reproduction, endocrine disruptors or neurotoxic.
Few physical processes are currently available to remove pesticide residues from wine. Based on that observation, the objective of this study was to evaluate the ability of a new physical treatment of wine by molecular sieving with Zeolites to remove pesticide residues. Zeolites are already widely used in water or air treatment applications. One of the main characteristics of these aluminosilicates is the development of regular pore size in the microporous domain. According to their preparation, they have physicochemical properties such as cation exchange, molecular sieving, catalysis, and adsorption.
This article describes the selection of a Zeolite exhibiting high removal ability for a great variety of pesticides. Trials were done on a red wine contaminated with 21 pesticides frequently detected in wines are also presented. All the molecules are removed with an elimination yield higher than 90%. Their removal is influenced by the Zeolite concentration and the contact time. The influence of such a treatment on red wine key physico-chemical parameters and aromas was also investigated. The article also presents the influence of zeolite treatment on the perception of winetasters for trials done on red wine, white wine and wine with residual sugars.

Arnaud Massot

Cellule de transfert Amarante Process, ADERA arnaud.massot@u-bordeaux.fr
Villenave d'Ornon, France

Fabrice Meunier

Cellule de transfert Amarante Process, ADERA
Villenave d'Ornon, France

Céline Franc, Laurent Riquier, Gilles de Revel, Martine Mietton-Peuchot

Université de Bordeaux, ISVV, EA 4577
Unité de Recherche Œnologie
INRA, ISVV, USC 1219 ŒNOLOGIE
Villenave d'Ornon, France

Wine Active Compounds and enological processes

TRAITEMENT DES MOÛTS BLANCS ISSUS DE RAISINS ALTÉRÉS EVALUATION DES PRODUITS ALTERNATIFS A LA CASÉINE

Les produits oenologiques de collage ont beaucoup évolué au cours des dernières années. Le manque de références objectives sur l'efficacité de ces produits pour le traitement des moûts issus de raisins altérés a conduit à la mise en place de cette étude au cours des millésimes 2011 à 2013.
Le dispositif expérimental consiste à comparer une vingtaine de nouveaux produits de collage du commerce, la caséine et la PVPP seule ainsi que des témoins non traités débourbés avec différents niveaux de turbidité (en général 50, 100 et 200 NTU). Les collages sont réalisés au cours du débourbage sur 15 moûts différents issus de raisins altérés par l'oïdium ou par Botrytis cinerea. La qualité des vins est évaluée par des dégustations descriptives des moûts et des vins pendant trois ans au cours de leur conservation en bouteilles.
Cette étude montre l'importance d'une bonne clarification du moût. La qualité des vins témoin non traité est d'autant plus grande que le moût est plus limpide. Dans la majorité des essais un débourbage aux alentours de 50 NTU est suffisant, sans collage, pour éliminer ou atténuer un défaut olfactif. L'utilisation d'enzymes pectolytiques peut s'avérer nécessaire pour atteindre ce niveau de turbidité.
Les nouveaux produits de collage sont au moins aussi efficaces que les produits de référence (caséine, PVPP). Leur pouvoir désodorisant dépend davantage de la nature du produit que de la spécialité commerciale. Les produits composites sont plus efficaces que les protéines végétales seules mais moins que les charbons. Néanmoins, l'amélioration de la qualité olfactive s'accompagne généralement d'une perte de structure et d'équilibre en bouche. Par conséquent, il convient d'éviter tout traitement inutile, en particulier aux charbons, qui pourrait s'avérer préjudiciable à la qualité globale du vin. Cette étude fournit des éléments objectifs pour limiter l'usage des intrants en oenologie.

Eric Meistermann

Institut Français de la Vigne et du Vin
Colmar, France
eric.meistermann@vignevin.com

Michel Pinsun

Chambre d'Agriculture d'Alsace
Colmar, France

Wine Active Compounds and enological processes

YEAST PHYSIOLOGY MONITORING IN FERMENTATIVE CONDITIONS

Alcoholic fermentation is the main step for winemaking from grape must. It is mainly performed by the yeast *Saccharomyces cerevisiae*, even if other yeasts called non-*Saccharomyces* may be involved in the alcoholic fermentation and bring some aroma searched by winemakers in their final products. Some commercial mixed starters of non-*Saccharomyces* and *S. cerevisiae* strain are currently available, but there is a lack of knowledge about what happens in these yeast mixed cultures. Indeed, two of the recurrent problems with the use of these non-*Saccharomyces* yeasts are their early death at the beginning of the alcoholic fermentation or the loss of the aromatic molecules they produced. In this context, the yeast physiology monitoring is studied during alcoholic fermentation in grape juice using flow cytometry. This powerful technique allows a rapid and specific monitoring of different physiological parameters like the accumulation of Reactive Oxygen Species (ROS) or lipids inside cells, early apoptosis, intracellular pH and viability thanks to specific fluorochromes. The aim of these analyses is to better understand what happens between S. cerevisiae and different non-*Saccharomyces* strains during alcoholic fermentation by comparing pure cultures of each strain and the co-cultures with *S. cerevisiae*, with the hypothesis that the differences observed reflects yeast-yeast interactions.

Clément Petitgonnet

Université de Bourgogne Franche-Comté clement.petitgonnet@u-bourgogne.fr
AgroSup Dijon, PAM UMR A 02.102, Dijon, France
Institut Universitaire de la Vigne et du Vin
Equipe Valmis, Dijon, France

Géraldine Klein, Hervé Alexandre

Université de Bourgogne Franche-Comté
AgroSup Dijon, PAM UMR A 02.102, Dijon, France
Institut Universitaire de la Vigne et du Vin
Equipe Valmis, Dijon, France

Wine Active Compounds and enological processes

REVISITING THE DPPH ASSAY FOR MEASURING THE ANTIOXYDANT POTENTIAL OF WHITE WINE ACTIVE COMPOUNDS

The aging of premium wines and in particular dry white wines has become an important scientific issue over the last decades where the phenomenon called «premature aging» has appeared worldwide. In a context of sustainability, new processes based on the reduction of inputs both at the vineyard and in the cellar (for instance sulfites) are sometimes considered as threats towards expected organoleptic optimums. Therefore, a better understanding of the physico-chemical mechanisms of oxidation is required to predict and control the appearance of premature aging. This is based in particular on the development of innovative predictive tools for determining wines oxidative stability. Different strategies can be implemented.
In this project, the antioxidant capacity of model solutions after controlled levels of oxygenation has been determined using modified DPPH analyses. This method has permitted to obtain a hierarchy of antioxidant capacities for a range of pertinent white wine metabolites (phenolics, N-containing compounds, S-containing compounds...), and to identify potential synergic effects. Moreover, correlations between DPPH results and oxygenated radicals spin trapping measurements by electron spin resonance (ESR) could be used to identify antiradical processes involved.

Rémy Romanet

Université de Bourgogne Franche-Comté
AgroSup Dijon PAM UMR A 02.102
Institut Universitaire de la Vigne et du VIn
Equipe PAPC
Dijon, France

Maria Nikolantonaki, Christian Coelho, Régis Gougeon

Université de Bourgogne Franche-Comté
AgroSup Dijon PAM UMR A 02.102
Institut Universitaire de la Vigne et du VIn
Equipe PAPC
Dijon, France

Wine Active Compounds and enological processes

INFLUENCE OF CORK QUALITY, BOTTLE POSITION, SPARKLING WINE GAS CONTENT AND TIME UPON CORK STOPPER RESILIENCY

After Champagne popping, the second consumer's observation is the shape of the cork stopper. For high quality sparkling wine closure, pretty exclusively made from natural cork, we expect the so-called "mushroom shape". Nevertheless, we sometimes observe a "barrel" shape due to inappropriate cork's elastic properties after only 1-2 years, whatever the origin of the wine. The aim of this study was to follow the loss of cork stopper resiliency with time, bottle position and cork quality. Cork stoppers made with planks from two geographical origins (corks A and B) were compared. For each origin, 2 qualities (High, Medium obtained by artificial vision selection) were studied. A total of 720 bottles of Champagne were closed and stored vertically (Vb) or horizontally (Hb) at 11°C and open after 1 to 3 years to follow cork characteristics (diameter, wine penetration). Degassed Champagne bottles sealed with crown caps and stored in the same conditions were used as a control to estimate the effect of CO2. One year after corking, significant differences were observed between corks from Vb and Hb whatever the cork origin and its quality, and these differences increased with time. The heterogeneity was also strongly higher among Hb than for Vb, proving the importance of the bottle storage position after corking. Concerning Hb, a highly significant difference was observed between cork A and cork B whatever the quality. But inside each origin, there was no difference between the High and the Medium quality in spite of the classification in two groups by optical control. The penetration of liquid is twice higher in corks in contact with the wine but this measure can not explain the differences of resiliency previously described. Finally, the cork stoppers from degassed Champagne showed a very low resiliency (3-8%) when compared with cork stoppers from normal (gaseous) Champagne (10-71%) proving the importance of CO2 in the evolution of cork elasticity with time.

Thomas Salmon, Richard Marchal

University of Reims Champagne-Ardenne
URVVC EA 4707
Reims, France

Alexandre Marcoult, Pauline Bouche Thewys

Oller & Cie - SIBEL
Reims, France

Francese Pastò

Francisco OLLER
Cassà de la Selva, Girona, Spain

Wine Active Compounds and enological processes

IMPACT OF WINEMAKING PROCESS ON THE AMOUNT OF POLYPHENOLS, NUTRACEUTICALS, ANTIOXYDATIVE ACTIVITY AND SENSORY ANALYSIS IN SOUTH-KOREAN WINES PRODUCED FROM VITIS LABRUSCA

Korean wines are almost produced by the grape vitis labrusca “Campbell Early”. These grapes have less color pigments and polyphenols contents than vitis vinifera. It has two major consequences, a rapid oxidation of wines with a short storability, and the absence of the protective effects of polyphenols on human health, ie the “french paradox. To promote these two parameters we focused on the improvement of several winemaking processes.
First, various methods of maceration, hot or cold, before or after alcoholic fermentation, using enzymes or not were carried on. Secondly, we studied the effect of some enological tannins on the wine during aging process. For each step of this work the impact of the winemaking processes on the amount of polyphenols, antioxydative activity and the presence of nutraceuticals such as resveratrol, quercetin and caffeic acid were investigated. PCA analysis were established to find correlation between all these parameters. In addition, at each stage of the study sensory analysis were performed to ensure that the optimal parameters gave to the wines a good organoleptic quality.
Wines obtained with hot maceration before fermentation showed the best antioxidant activities, with or without enzymes. The activity of hot macerated wines appeared to be carried by total polyphenols and flavonoids. Hot macerated wines presented the best colored, aromatic, tannic and overall wines.
Condensed or mixed tannins, added at the end of the alcohol fermentation, caused the best antioxidant activity. Condensed tannins enhanced the amount of resveratrol, hydrolysable one increased the amount of quercetine, both without enzyme. The addition of different tannins increased to varying degrees sensory properties of wines
In agreement with all the results of the study, the best compromise could be hot maceration before fermentation and mixed tannins both without enzymes.

Jean-Pierre Souchard

Laboratoire des Interactions Moléculaires et Réactivité Chimique et Photochimique
UMR CNRS 5623
Université de Toulouse, Toulouse, France
souchard@chimie.ups-tlse.fr

Haewook Choi

Department of Wine and Food Fermentation Technology
Young-Dong University, Chungbuk, Korea

Wine Active Compounds and enological processes

IMPACT OF GLUTATHIONE ON YEAST VITALITY DURING FERMENTATION OF BOTRYTIS-INFECTED MUSTS

Yeasts are confronted to several stress factors during fermentation which can lead to differences in yeasts' metabolic activity. This can result in a prolonged alcoholic fermentation period and alongside the formation of off-flavors. The infection of grapes with Botrytis cinerea exposes wine industry to a significant disease problem. Processing of infected grapes lowers the organoleptic wine quality as it leads to color deterioration or undesired aroma components [1]. Glutathione (GSH) is described as an important stress response factor in yeast cells [2] and can also occur in must and wine where it acts as a substantial antioxidant [3]. The aim of this study was to examine the impact of GSH on yeast fermentation efficiency in musts prepared from botrytisized grapes. Dif-ferent degrees of fungal infestation were introduced by mixing musts from grapes visually classified as 100 % infected and sound grapes. The selection of an appropriate yeast starter culture is of great importance. Thus, the application of two yeast strains is compared to show the influence of GSH addition on their ability to resist adverse growth conditions. Yeast vitality is analyzed by flow cytometry with the cell permeable ester-ase-substrate fluorescein diacetate. Other fermentation parameters (sugar concentration, alcohol degree, acetaldehyde concentration) were monitored to give information about fermentation progress. The results show that vitality between controls, 25 % and 75 % Botrytis-infected musts differs especially in the main fermentation phase while the addi-tion of GSH slightly shortens fermentation period of botrytisized musts. Since yeasts have to cope with many different stress factors during fermentation, the contribution of GSH to a successful fermentation in combination with an appropriate yeast strain needs to be elaborated.

[1] Cilindre, C., Castro, A. J., Clément, C., Jeandet, P., Marchal, R. 2007. Influence of Botrytis cinerea infection on champagne wine proteins (characterized by two-dimensional electrophore-sis/immunodetection) and wine foaming properties. Food Chemistry, 103, 139-149.
[2] Penninckx, M. J., Elskens, M. T. 1993. Metabolism and functions of glutathione in micro-organisms. Advances in Microbial Physiology, 34, 239-301.
[3] Kritzinger, E. C., Bauer, F. F., du Toit, W. J. 2013. Role of glutathione in winemaking: A review. Journal of Agricultural and Food Chemistry, 61, 269–277.

Sabrina Zimdars

Institute of Nutritional and Food Sciences
Molecular Food Technology
University of Bonn, Bonn, Germany

Andreas Schieber, Fabien Weber

Institute of Nutritional and Food Sciences
Molecular Food Technology
University of Bonn, Bonn, Germany

W A C 2 0 1 7

List of Participants - Liste des participants

Name	First Name	Affiliation, Country, Town	e-mail
Abdo	Hany	Université de Bourgogne, Dijon, France	hany_abdo201192@hotmail.fr
Achaintre	Vanille Charlotte	Sofralab	
Aires	Virginie	Université de Bourgogne, Dijon, France	virginie.aire02@u-bourgogne.fr
Antalick	Guillaume	Charles Sturt University, Wagga Wagga, Australia	gantalick@csu.edu.au
Arcicasa	Alain	Université de Boirgogne, Dijon, France	arcicasa.alain@wanadoo.fr
Bahut	Florian	Université de Bourgogne, Dijon, France	bahut.floriant@gmail.com
Bechtloff	Pia	TU Braunschweig, Braunschweig, Germany	p.bechtloff@tu-bs.de
Beuchet	Christophe	La Compagnie des Indes	
Bogoeva	Adelina	Université des Technologies Alimentaires, Plovdiv, Bulgaria	adelina..bogoeva@abv.bg
Bonnafoux	Hugo	Institut Français de la Vigne et du Vin, Gruissan, France	nathalie.imbern@vignevin.com
Breniaux	Marion	Lallemand, Blagnac, France	
Buerhle	Franziska	University of Bonn, Bonn, Germany	f.buerhle@uni-bonn.de
Buica	Astrid	Stellenbosch University, Stellenbosch, South Africa	abuica@sun.ac.za
Campbell-Sills	Hugo	Lallemand, Blagnac, France	
Canon	Francis	Université de Bourgogne, Dijon, France	
Capozzi	Vittorio	University of Foggia, Figgia, Italy	vittorio.capozzi@unifg.it
Carroquino Onate	Javier	University of Zaragoza, Zaragoza, Spain	javier.carroquino@unizar.es
Chalons	Pauline	Université de Bourgogne, Dijon, France	
Chatelet	Bertrand	Institut Français de la Vigne et du Vin, Villefranche sur Saône, France	bertrand.chatelet@vignevin.com
Cholet	Céline	ISVV, Université de Bordeaux, Villenave d'Ornon, France	
Colangelo	Donato	Università Cattolica del Sacro Cuore, Milano, Italy	donato.colangelo@unicatt.it
Cottet	Anabelle	Oenobrands, Montpellier, France	
Courtaut	Flavie	Université de Bourgogne, Dijon, France	
Cretin	Blandine	ISVV, Université de Bordeaux, Villenave d'Ornon, France	
Crivallero Guerra	Celito	EMBRAPA Uva e Vinho, Bento Gonçalves, Brazil	celito.guerra@embrapa.br
Dani	Caroline	Centro Universitàrio Metodista IPA, Porto Alegre, Brazil	carolinedani@yahoo.com.br
Del Pozo Bayon	Maria Angeles	CIAL (CSIC-UAM), Madrid, Spain	m.delpozo@csic.es
Deleris	Magali	Lallemand, Blagnac, France	mbou@lallemand.com
Domizio	Paola	Università degli Studi di Firenze, Firenze, Italy	paola.domizio@unifi.it
Ducati	Jorge	Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil	ducati@if.ufrgs.br
Ducruet	Julien	Agroscope Changins, Nyon, Switzerland	julien.ducruet@changins.ch
Escudero	Ana	Universidad de Zaragoza, Zaragoza, Spain	escudero@unizar.es
Feng	Hui	E. & J. Gallo Winery, Modesto, USA	hui.feng@ejgallo.com
Ferrari	Gérald	BNIC Station Viticole, Cognac, France	gferrari@bnic.fr
Franco-Luesma	Ernesto	Université de Bourgogne, Dijon, France	efrancoluesma@gmail.com
Gabaston	Julien	ISVV, Université de Bordeaux, Villenave d'Ornon, France	julien.gabaston@u-bordeaux.fr

WAC 2017

Name	First Name	Affiliation, Country, Town	e-mail
Garcia Casarejos	Nieves	Universidad de Zaragoza, Zaragoza, Spain	ngarcia@unizar.es
Gargallo Valero	Pilar	Universidad de Zaragoza, Zaragoza, Spain	pigarga@unizar.es
Geffroy	Olivier	Ecole d'Ingénieurs de PURPAN, Toulouse, France	olivier.geffroy@purpan.fr
Gilmore	Adam	Horiba, Flemington, USA	adam.gilmore@horiba.com
Gobert	Antoine	Université de Bourgogne, Dijon, France	antoine.gobert1@gmail.com
Gök	Recept	TU Braunschweig, Braunschweig, Germany	r.goek@tu-braunschweig.de
Gonzàlez-Làzaro	Miriam	Fundaciòn Universidad de La Rioja, Logrono, Spain	otri@unirioja.es
Gougeon	Louis	ISVV, Université de Bordeaux, Villenave d'Ornon, France	louis.gougeon@u-bordeaux.fr
Grammacurta	Marine	ISVV, Université de Bordeaux, Villenave d'Ornon, France	
Grangeteau	Cédric	Université de Bourgogne, Dijon, France	
Guzzon	Raffaëlle	Fondazione Edmund Mach, Trento, Italy	raffaele.guzzon@fmach.it
Hayes	Keith	Wine Australia Industry House, Adelaide, Australia	keith.hayes@wineaustralia.com
Izard	Jean-Claude	ACTICHEM, Montauban, France	izard@actichem.fr
Jegou	Sandrine	Université de Reims Champagne-Ardenne, Reims, France	
Junqua	Remy	Université de Bordeaux, Bordeaux, France	
Koestel	Carole	Agroscope Changins, Nyon, Switzerland	carole.koestel@agroscope.admin.ch
Lacampagne	Soizic	Université de Bordeaux, Bordeaux, France	
Laguna Cruañes	Laura	Instituto de Investigaciòn en Ciencias de la Alimentaciòn, Madrid, Spain	laura.laguna@csic.es
Le Floch	Alexandra	ISVV, Université de Bordeaux, Villenave d'Ornon, France	
Liger-Belair	Gérard	Université de Reims Champagne-Ardenne, Reims, France	gerard.liger-belair@univ-reims.fr
Liu	Youzhong	Université de Bourgogne, Dijon, France	
Lytra	Georgia	ISVV, Université de Bordeaux, Bordeaux France	geolytra@yahoo.gr
Ma	Wen	ISVV, Université de Bordeaux, Villenave d'Ornon, France	wenmawine@gmail.com
Mansfield	Anna Katharine	Cornell University, Geneva, NY, USA	akm87@cornell.edu
Marchal	Richard	Université de Reims Champagne-Ardenne, Reims, France	sophie.waligorski@sattnord.fr
Marchal	Axel	ISVV, Université de Bordeaux, Villenave d'Ornon, France	
Massot	Arnaud	ISVV, Université de Bordeaux, Villenave d'Ornon, France	arnaud.massot@u-bordeaux.fr
Mechelmans	Jos	Université de Bourgogne, Dijon, France	oenotri@msn.com
Meistermann	Eric	Institut Français de la Vigne et du Vin, Colmar, France	claudia.renel@vignenvin.com
Mekoue	Julie	Lallemand SAS	
Meunier	Fabrice	ISVV, Université de Bordeaux, Villenave d'Ornon, France	
Morcillo Parra	Angeles	Universitat Rovira i Virgili, Tarragona, Spain	maangeles.morcillo@urv.cat
Moriaux	Anne-Laure	Université de Reims Champagne-Ardenne, Reims, France	anne-laure.moriaux@etudiant.univ-reims.fr
Philipp	Christian	HBLA für Wein und Obstau, Klosterneuburg, Austria	christian.philipp@weinobst.at
Picchi	Monica	GESAAF Università di Firenze, Montespertoli, Italy	monica.picchi@unifi.it
Pichery	Marie-Claude	Université de Bourgogne, Dijon, France	marie-claude.pichery@u-bourgogne.fr
Poupault	Pascal	Institut Français de la Vigne et du Vin, Amboise, France	pascal.poupault@vignevin.com
Rabot	Amélie	ISVV, Université de Bordeaux, Villenave d'Ornon, France	celine.cholet@u-bordeaux.fr

WAC 2017

Name	First Name	Affiliation, Country, Town	e-mail
Ramirez	Manuel	Universidad de Extremadura, Badajoz, Spain	mramirez@unex.es
Rebenaque	Pierrick	Agroscope Changins, Nyon, Switzerland	pierrick.rebenaque@changins.ch
Roullier-Gall	Chloé	Technical University of Munich, Freising, Germany	c.roullier.gall@gmail.com
Sadoudi	Mohand	Inter Rhône, Orange, France	msadoudi@inter-rhone.com
Saenz-Navajas	Maria-Pilar	Universidad de Zaragoza, Zaragoza, Spain	maria@saenz.info
Salmon	Thomas	Université de Reims Champagne-Ardenne, Reims, France	thomas.salmon@univ-reims.fr
Shay	Neil	Oregon University, Oregon, USA	Neil.shay@oregonstate.edu
Sparow	Céline	Sofralab	
Souchard	Jean-Pierre	INPT-ENSAT Toulouse, Toulouse, France	souchard@chimie.ups-tlse.fr
Symoneaux	Ronan	ESA Angers, Angers, France	r.symoneaux@groupe-esa.com
Taillandier	Patricia	INPT-ENSAT Toulouse, Toulouse, France	patricia.taillandier@ensiacat.fr
Torchio	Fabrizio	Università Cattolica del Sacro Cuore, Piacenza, Italy	fabrizio.torchio@unicatt.it
Vanden Heuvel	Justine	Cornell University, Geneva, NY, USA	jjv1@cornell.edu
Vignault	Adeline	ISVV, Université de Bordeaux, Villenave d'Ornon, France	adeline.vignault@gmail.com
Weber	Fabian	University of Bonn, Bonn, Germany	fabian.weber@uni-bonn.de
Wegmann-Herr	Pascal	DLR Rheinpfalz Institute for Viticulture and Enology, Neustadt, Germany	pascal.wegmann-herr@dlr.rlp.de
Winstel	Delphine	ISVV, Université de Bordeaux, Villenave d'Ornon, France	
Yammine	Sami	Université de Bordeaux, Bordeaux, France	
Zerbib	Marie	Montpellier, France	marie.zerbib@umontpellier.fr
Ziegler	Michael	DLR Rheinpfalz, Neustadt ad Weinstrasse, Germany	michael.ziegler@dlr.rlp.de
Zimdars	Sabrina	University of Bonn, Bonn, Germany	s.zimdars@uni-bonn.de

Official Sponsors

SOFRALAB
The Oenological Company

OENOBRANDS
ADVANCED WINEMAKING SOLUTIONS

LALLEMAND

PAM

UB
UNIVERSITÉ DE BOURGOGNE

The UNESCO Chair is supported by

Dijon

Ville de Beaune

BOURGOGNES
Bureau Interprofessionnel des Vins de Bourgogne

RÉGION BOURGOGNE FRANCHE COMTE

BOISSET
La Famille des Grands Vins

SOCIÉTÉ CIVILE
DU
DOMAINE DE LA ROMANÉE-CONTI
SEULE PROPRIÉTAIRE
DE LA
ROMANÉE-CONTI ET DE LA TACHE