

# THE CHEMISTRY OF WINE

86%

WATER

12%

ETHANOL

1%

GLYCEROL

0.4%

ORGANIC  
ACIDS

0.1%

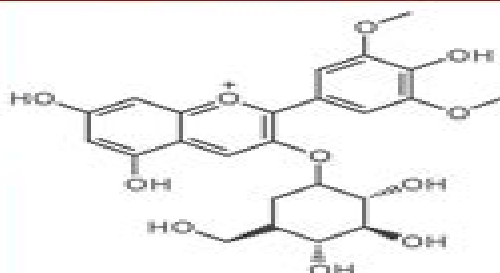
TANNINS &  
PHENOLICS

0.5%

OTHER  
COMPOUNDS

NOTE THAT THESE FIGURES ARE FOR AN AVERAGE COMPOSITION - EXACT PERCENTAGES WILL VARY DEPENDING ON THE PARTICULAR WINE

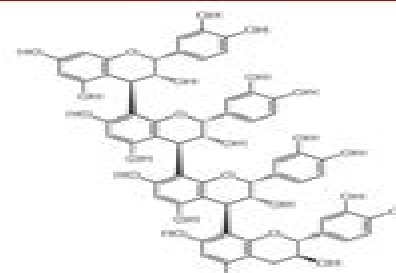
## ANTHOCYANINS



MALVIDIN-3-GLUCOSIDE

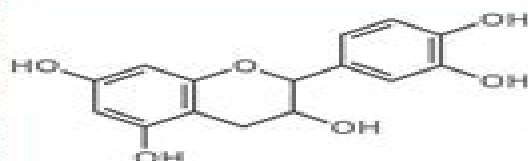
Anthocyanins are found in the skin of grapes. As soon as the grapes are crushed, they can react with other chemicals in wine to produce polymeric pigments. Anthocyanins on their own are also coloured, but the colour varies depending on pH.

## TANNINS



Tannins are polymers of other chemicals within wine. Condensed tannins are polymers of flavan-3-ols, and give red wine its astringency, causing a dry feeling in the mouth after drinking. Changes in tannin structure over time are an important factor in wine aging.

## FLAVAN-3-OLS



CATECHIN

Flavan-3-ols originate in the seeds of grapes, and are known for their bitterness. In red wine, the amount present can reach up to 800 milligrams per litre. 20 milligrams per litre is the amount required in order for a bitter taste to be imparted.



OVER  
**1000**  
DIFFERENT  
COMPOUNDS

## FLAVONOLS



QUERCETIN

Flavonols can help enhance the colour of red wine, via a process called 'co-pigmentation'. These compounds have potential anti-oxidant and anti-carcinogenic effects; however, their concentration in red wine is likely too low to confer any significant health benefits.



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# Wine Flavour Chemistry

**Rob Arnold**



## **Wine Flavour Chemistry:**

*Wine* Ronald J. Clarke, Jokie Bakker, 2008-04-15 The commercial importance of wine continues to increase across the globe with the availability of many new wines encompassing a remarkable and exciting range of flavours Wine Flavour Chemistry focuses on aspects of wine making procedures that are important in the development of flavour describing some of the grapes used and their resulting wines In depth descriptions of flavour reaction pathways are given together with cutting edge scientific information concerning flavour release its associated chemistry and physics and the sensory perception of volatile flavours Wine Flavour Chemistry contains a vast wealth of information describing components of wine their underlying chemistry and their possible role in the taste and smell characteristics of wines fortified wines sherry and port Many extremely useful tables are included linking information on grapes wines composition and resulting perceived flavours Wine Flavour Chemistry is essential reading for all those involved in commercial wine making be it in production trade or research The book will be of great use and interest to all enologists and to food and beverage scientists and technologists in commercial companies and within the academic sector Upper level students and teachers on enology courses will need to read this book All libraries in universities and research establishments where food and beverage science and technology and chemistry are studied and taught should have multiple copies of this important book The Science of Wine Jamie

Goode, 2005 The Science of Wine does an outstanding job of integrating hard science about wine with the emotional aspects that make wine appealing Patrick J Mahaney former senior Vice President for wine quality at Robert Mondavi Winery Jamie Goode is a rarity in the wine world a trained scientist who can explain complicated subjects without dumbing them down or coming over like a pointy head It also helps that he is a terrific writer with a real passion for his subject Tim Atkin MW The Observer *Wine Chemistry and Biochemistry* M. Victoria Moreno-Arribas, Carmen Polo, 2008-11-06 The aim of this book is to describe chemical and biochemical aspects of winemaking that are currently being researched The authors have selected the very best experts for each of the areas The first part of the book summarizes the most important aspects of winemaking technology and microbiology The second most extensive part deals with the different groups of compounds how these are modified during the various steps of the production process and how they affect the wine quality sensorial aspects and physiological activity etc The third section describes undesirable alterations of wines including those affecting quality and food safety Finally the treatment of data will be considered an aspect which has not yet been tackled in any other book on enology In this chapter the authors not only explain the tools available for analytical data processing but also indicate the most appropriate treatment to apply depending on the information required illustrating with examples throughout the chapter from enological literature *Understanding Wine Chemistry* Andrew L. Waterhouse, Gavin L. Sacks, David W.

Jeffery, 2024-05-16 Understanding Wine Chemistry Understand the reactions behind the world's most alluring beverages The immense variety of wines on the market is the product of multiple chemical processes whether acting on components arising

in the vineyard during fermentation or throughout storage Winemaking decisions alter the chemistry of finished wines affecting the flavor color stability and other aspects of the final product Knowledge of these chemical and biochemical processes is integral to the art and science of winemaking Understanding Wine Chemistry has served as the definitive introduction to the chemical components of wine their properties and their reaction mechanisms It equips the knowledgeable reader to interpret and predict the outcomes of physicochemical reactions involved with winemaking processes Now updated to reflect recent research findings most notably in relation to wine redox chemistry along with new Special Topics chapters on emerging areas it continues to set the standard in the subject Readers of the second edition of Understanding Wine Chemistry will also find Case studies throughout showing chemistry at work in creating different wine styles and avoiding common adverse chemical and sensory outcomes Detailed treatment of novel subjects like non alcoholic wines non glass alternatives to wine packaging synthetic wines and more An authorial team with decades of combined experience in wine chemistry research and education Understanding Wine Chemistry is ideal for college and university students winemakers at any stage in their practice professionals in related fields such as suppliers or sommeliers and chemists with an interest in wine

**Flavor Chemistry** Roy Teranishi, Emily L. Wick, Irwin Hornstein, 2012-12-06 Celebrating the founding of the Flavor Subdivision of the Agriculture and Food Chemistry Division of the American Chemical Society this book provides an overview of progress made during the past 30 40 years in various aspects of flavor chemistry as seen by internationally renowned scientists in the forefront of their respective fields In addition it presents up to date findings in the areas of flavor chemistry analytical methods thermally produced flavors and precursors enzymatically produced flavors and precursors and sensory methods and results

**Chemistry of Wine Flavor** Andrew Leo Waterhouse, Susan E. Ebeler, 1998 Wine flavour chemistry is a complex and diverse field that ranges from the potently aromatic pyrazines to the complex polymeric tannins Modern chemistry is now opening some doors to the mysteries of wine flavour and this unique monograph is dedicated to current research developments The book starts with the Riesling terpenes which are responsible for floral aroma when new and the kerosene like aroma that appears in old age and with the chemically related norisprenoids found in Cabernet Sauvignon and Merlot It includes three reports on flavours of microbial origin particularly the effects of different yeast strains and it looks at important factors in ageing including acetaldehyde the contribution of oak and problems with cork taint It also explores in detail the relationship between winemaking techniques and the chemistry and taste attributes of phenolic compounds

**Wine Science** Ronald S. Jackson, 2014-05-31 Wine Science Fourth Edition covers the three pillars of wine science grape culture wine production and sensory evaluation It discusses grape anatomy physiology and evolution wine geography wine and health and the scientific basis of food and wine combinations It also covers topics not found in other enology or viticulture texts including details on cork and oak specialized wine making procedures and historical origins of procedures New to this edition are expanded coverage on micro oxidation and the cool prefermentative maceration of red grapes the

nature of the weak fixation of aromatic compounds in wine and the significance of their release upon bottle opening new insights into flavor modification post bottle the shelf life of wine as part of wine aging and winery wastewater management Updated topics include precision viticulture including GPS potentialities organic matter in soil grapevine pests and disease and the history of wine production technology This book is a valuable resource for grape growers fermentation technologists students of enology and viticulture enologists and viticulturalists New to this edition Expanded coverage of micro oxidation and the cool prefermentative maceration of red grapes The nature of the weak fixation of aromatic compounds in wine and the significance of their release upon bottle opening New insights into flavor modification post bottle Shelf life of wine as part of wine aging Winery wastewater management Updated topics including Precision viticulture including GPS potentialities Organic matter in soil Grapevine pests and disease History of wine production technology

**Hyphenated Techniques in Grape and Wine Chemistry** Riccardo Flamini, 2008-04-30 This book presents the modern applications of hyphenated techniques in the analysis and study of the chemistry of grape wine and grape derivative products It explains the different applications and techniques used in the laboratory such as liquid and gas phase chromatography mass spectrometry and capillary electrophoresis and describes the methods developed using instrumentation with high performance and reliability Additionally the book covers the principal applications of modern sample preparation methods such as solid phase extraction and solid phase microextraction

Wine Jokie Bakker, Ronald J. Clarke, 2011-11-30 Wine Flavour Chemistry brings together a vast wealth of information describing components of wine their underlying chemistry and their possible role in the taste smell and overall perception It includes both table wines and fortified wines such as Sherry Port and the newly added Madeira as well as other special wines This fully revised and updated edition includes new information also on retsina wines ros s organic and reduced alcohol wines and has been expanded with coverage of the latest research Both EU and non EU countries are referred to making this book a truly global reference for academics and enologists worldwide Wine Flavour Chemistry is essential reading for all those involved in commercial wine making whether in production trade or research The book is of great use and interest to all enologists and to food and beverage scientists and technologists working in commerce and academia Upper level students and teachers on enology courses will need to read this book wherever food and beverage science technology and chemistry are taught libraries should have multiple copies of this important book

Einfluss von glykosidischen Aromavorstufen auf das Aroma in Sekt Jens Witte, 2009-01-14

The Terroir of Whiskey Rob Arnold, 2020-12-22 Look at the back label of a bottle of wine and you may well see a reference to its terroir the total local environment of the vineyard that grew the grapes from its soil to the climate Winemakers universally accept that where a grape is grown influences its chemistry which in turn changes the flavor of the wine A detailed system has codified the idea that place matters to wine So why don t we feel the same way about whiskey In this book the master distiller Rob Arnold reveals how innovative whiskey producers are recapturing a sense of place to create distinctive nuanced flavors He takes

readers on a world tour of whiskey and the science of flavor stopping along the way at distilleries in Kentucky New York Texas Ireland and Scotland Arnold puts the spotlight on a new generation of distillers plant breeders and local farmers who are bringing back long forgotten grain flavors and creating new ones in pursuit of terroir In the twentieth century we inadvertently bred distinctive tastes out of grains in favor of high yields but today s artisans have teamed up to remove themselves from the commodity grain system resurrect heirloom cereals bring new varieties to life and recapture the flavors of specific local ingredients The Terroir of Whiskey makes the scientific and cultural cases that terroir is as important in whiskey as it is in wine

Wine Tasting Ronald S. Jackson,2009-05-15 Wine Tasting A Professional Handbook is an essential guide for any professional or serious connoisseur seeking to understand both the theory and practice of wine tasting From techniques for assessing wine properties and quality including physiological psychological and physicochemical sensory evaluation to the latest information on types of wine the author guides the reader to a clear and applicable understanding of the wine tasting process Including illustrative data and testing technique descriptions Wine Tasting is for professional tasters those who train tasters and those involved in designing wine tastings as well as the connoisseur seeking to maximize their perception and appreciation of wine Revised and updated coverage notably the physiology and neurology taste and odor perception Expanded coverage of the statistical aspect of wine tasting specific examples to show the process qualitative wine tasting examples for winery staff tasting their own wines more examples for consumer groups and restaurants tripling of the material on wine styles and types wine language the origins of wine quality and food and wine combination Flow chart of wine tasting steps Flow chart of wine production procedures Practical details on wine storage and problems during and following bottle opening Examples of tasting sheets Details of errors to be avoided Procedures for training and testing sensory skill

**Nose Dive** Harold McGee,2020-10-15 A TIMES BOOK OF THE YEAR 2020 BEST BOOKS OF 2020 SCIENCE FINANCIAL TIMES SHORTLISTED FOR THE ANDRE SIMON AWARD The long awaited new book from Harold McGee winner of the Andr Simon Food Book of the Year the James Beard Award What is smell How does it work And why is it so important HAROLD McGEE leading expert on the science of food and cooking has spent a decade exploring our most overlooked sense Nose Dive is the amazing result it takes us on an adventure across four billion years and the whole globe from the sulphurous early Earth to the fruit filled Tian Shan mountain range north of the Himalayas and back to the keyboard of your laptop where trace notes of phenol and formaldehyde are escaping between the keys A work of astounding scholarship and originality Nose Dive distils the science behind smells and translates it into an accessible and entertaining sensory and olfactory guide We ll sniff the ordinary wet pavement and cut grass and extraordinary ambergris and truffles the delightful roses and vanilla and the challenging swamplands and durians We ll smell each other We ll smell ourselves Here is a story of the world of all of the smells under our noses DIVE IN

*Managing Wine Quality* Andrew G. Reynolds,2021-11-19 Managing Wine Quality Volume 1 Viticulture and Wine Quality Second Edition reviews our current understanding of wine aroma color

taste and mouthfeel In addition it focuses on the measurement of grape and wine properties the instrumental analysis of sensory evaluation and wine authenticity and traceability The effects of viticulture technologies on grape composition and wine quality attributes are also included with sections on viticultural and vineyard management practices fungal contaminants grape processing equipment and grape harvesting methods for both red and white wines In addition there is coverage on the potential impacts of global warming on wine quality With a focus on recent studies advanced methods and a look to future technologies this fully updated edition is an essential reference for anyone involved in viticulture and oenology who wants to explore new methods understand different approaches and refine existing practices Reviews our current understanding of wine aroma color taste and mouthfeel Details the measurement of grape and wine properties through instrumental analysis must and wine and sensory evaluation Examines viticulture and vineyard management practices fungal contaminants and processing equipment

*Wine Faults and Flaws* Keith Grainger, 2021-05-19 2022 Winner of the OIV Award in the Oenology category An essential guide to the faults and flaws that can affect wine Written by the award winning wine expert Keith Grainger this book provides a detailed examination and explanation of the causes and impact of the faults flaws and taints that may affect wine Each fault is discussed using the following criteria what it is how it can be detected by sensory or laboratory analysis what the cause is how it might be prevented whether an affected wine is treatable and if so how and the science applicable to the fault The incidences of faulty wines reaching the consumer are greater than would be regarded as acceptable in most other industries It is claimed that occurrences are less common today than in recent recorded history and it is true that the frequency of some faults and taints being encountered in bottle has declined in the last decade or two However incidences of certain faults and taints have increased and issues that were once unheard of now affect many wines offered for sale These include reduced aromas premature oxidation atypical ageing and very much on the rise smoke taint This book will prove invaluable to winemakers wine technologists and quality control professionals Wine critics writers educators and sommeliers will also find the topics highly relevant The wine loving consumer including wine collectors will also find the book a great resource and the basis for discussion at tastings with like minded associates Reviews I read this book avidly from cover to cover I ll dip into it for future reference as required which is how many will employ it Meanwhile I learned a great deal and it now influences how I think about wine evaluation I commend this excellent new book to you Consider it an investment Paul Howard Wine Alchemy

*Yeast* Antonio Morata, Iris Loira, 2017-11-08 Yeast Industrial Applications is a book that covers applications and utilities of yeasts in food chemical energy and environmental industries collected in 12 chapters The use of yeasts in the production of metabolites enzymatic applications fermented foods microorganism controls bioethanol production and bioremediation of contaminated environments is covered showing results methodologies and processes and describing the specific role of yeasts in them The traditional yeast *Saccharomyces cerevisiae* is complemented in many applications with the use of less known non *Saccharomyces* yeasts that now are being

used extensively in industry This book compiles the experience and know how of researchers and professors from international universities and research centers *Food Flavors* Henryk Jelen, 2011-10-25 Food flavor appearance and texture are the sensory properties that influence food acceptance and among these flavor is usually the decisive factor for the choice of a particular product *Food Flavors Chemical Sensory and Technological Properties* explores the main aspects of food flavors and provides a starting point for further study in focused areas Topics discussed include The nature of food odorants and tastants and the way they are perceived by the human olfactory system Basic anatomy and physiology of sensory systems involved in flavor sensation olfactory pathways and interactions between olfactory and gustatory stimuli The fundamentals of flavor compounds formation based on their main precursors lipids amino acids and carbohydrates Technological issues related to flavor compounds Physicochemical characteristics of aroma compounds and the main factors that influence aroma binding and release in foods Safety and regulatory aspects of flavorings used in foods Flavors of essential oils and spices cheeses red meat wine and bread and bakery products Food taints and off flavors Analytical approaches to characterize food flavors The book also explores the latest technology in artificial olfaction systems with a chapter on the main physical and chemical features of these sensors Bringing together the combined experience of a host of international experts the book provides insight into the fundamentals of food flavors and explores the latest advances in flavor analysis **Gas**

**Chromatography in Plant Science, Wine Technology, Toxicology and Some Specific Applications** Bekir Salih, Ömür Çelikbıçak, 2012-02-29 The aim of this book is to describe the fundamental aspects and details of certain gas chromatography applications in Plant Science Wine technology Toxicology and the other specific disciplines that are currently being researched The very best gas chromatography experts have been chosen as authors in each area The individual chapter has been written to be self contained so that readers may peruse particular topics but can pursue the other chapters in the each section to gain more insight about different gas chromatography applications in the same research field This book will surely be useful to gas chromatography users who are desirous of perfecting themselves in one of the important branch of analytical chemistry **A Complete Guide to Quality in Small-Scale Wine Making** John Anthony Considine, Elizabeth

Frankish, 2023-08-17 *A Complete Guide to Quality in Small Scale Wine Making* Second Edition is the first and only book to focus specifically on the challenges relevant to non industrial scale production of optimal wine with a scientifically rigorous approach Fully revised and updated with new insights on the importance of all aspects of the production of consistent quality wine this book includes sections on organic wine production coverage of the selection and culturing of yeast and the production of sparkling methode champenois and fortified wines The new edition includes insights into the latest developments in flavor chemistry production protocols NIR and FTIR for multipurpose analysis and microplate and PCR procedures and IR methods for essential analysis among others Written by an expert team with real world experience and with a multi cultural approach this text will provide a complete guide to all the stages of the winemaking process and

evaluation and clearly explains the chemistry that underpins it all Fully revised and updated each chapter includes new insights and latest information Presents fully referenced tested and proven methods Elaborates on the chemistry to enable understanding of the processes and the impact of variation      **Flavor chemistry of food: mechanism, interaction, new advances** ,2023-07-24

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down. I admire your incredible attitude and sense of humor, and I really value our ...