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# **Food Flavor and Chemistry**

## **Explorations into the 21st Century**

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## Preface

The Third George Charalambous Memorial Symposium was the 11th International Flavor Conference, held July 1-4, 2004 on Samos Island, Greece. The meeting was sponsored by the Agricultural and Food Chemistry Division of American Chemical Society and was attended from around the globe by professionals and scientific leaders belonging to academia, government laboratories and industry. Presentations were mainly in the flavor science and technology area, but advances in food science and nutrition were also highlighted.

This book represents primarily the proceedings of the presentations made at the conference. It covers articles of overview nature (Chapter 1), flavor of wine and dairy products (Chapters 2-9), composition of volatile aroma compounds of fruits, vegetables and meat (Chapters 10-16) as well as aroma generation (Chapters 17-21) and analytical issues in food flavors (Chapters 22-25). In addition, analysis of phenolic glycosides and migration of chemicals in food packaging is included (Chapters 26 and 27). A section is also devoted to discussions about antioxidants and specialty lipids with respect to their role in health promotion (Chapters 28-35). Finally, quality of food stuff as affected by processing is presented (Chapters 36-46).

The organizers acknowledge the generous contributions towards conference's expenses from International Flavors and Fragrances as well as Eastern Michigan University for setting up the website for the conference and production and printing of the abstracts of the conference. We, the editors, also thank all contributors for their excellent presentations and proceeding chapters.

The Editors  
April 2005

# Contents

## Overview

Halal Issues in Flavor Industry	3
<i>M. N. Riaz, M. M. Chaudry and M. Sadek</i>	

## Dairy and Wine Flavors

Real Time Release of Flavor Compounds and Flavor Perception: An Application to Cheese	13
<i>E. Pionnier, J.L. Le Quéré and C. Salles</i>	
Effects of Aroma Profiles of Piacentinu and Ricotta Cheese Using Different Tool Materials during Cheesemaking	23
<i>S. Mallia, S. Carpino, L. Corallo, L. Tuminello, R. Gelsomino and G. Licitra</i>	
Volatile Profiles of Piacentinu Ennese Cheese Produced with Raw and Pasteurized Milk	35
<i>S. Carpino, T. Rapisarda, J. Horne, A. i Falco and G. Licitra</i>	
Heat Stability of Ca-caseinate/Whey Emulsions. Effect of pH, Salts and Protein Ratios	42
<i>E. A. Theologou, P. G. Demertzis, M. Minor</i>	
Flavor of Wines Produced by Cells Immobilized on Various Supports	51
<i>Y. Kourkoutas, M. Kanellaki, A. Bekatorou, A.A. Koutinas and M. Iconomopoulou</i>	
Changes in the Profile of Major Volatile Compounds in Greek Wines Stored under Cellar Temperature Conditions	61
<i>Vasileios C. Siaravas, Panagiotis G. Demertzis and Konstantoula Akrida-Demertzi</i>	
Role of Anthocyanins in the Differentiation of Tempranillo Wines	72
<i>E. Revilla, M.J. González-Reig, P. Garcinuño and E. García-Beneytez</i>	
Organic Acid Composition of Ume Liqueur	82
<i>Rie Kuramitsu and Shoji Furukawa</i>	

## Composition

The Volatile Components of Indian Long Pepper, <i>Piper longum</i> Linn. <i>L. Trinnaman, N.C. Da Costa, M.L. Dewis, T.V. John</i>	93
Investigation on Aroma Volatiles from Fresh Flowers of Saffron ( <i>Crocus sativus</i> L.) <i>M. Bergoin, C. Raynaud, G. Vilarem and T. Talou</i>	104
GC/MS Analysis of the Volatile Compounds of <i>Tuber Melanosporum</i> from Tricastin and Alpes de Haute Province F (FRANCE) <i>Gaston Vernin, Cyril Párkányi and Hervé Casabianca</i>	115
Characterization of Off-odor of Local Duck Meat <i>Apriyantono, R. Hustiany, J. Hermanianto, P.S. Hardjosworo</i>	136
Glycosidically-bound Aroma Compounds Present in Green and Cured Vanilla Beans <i>D. Setyaningsih, A. Apriyantono, M. T. Suhartono</i>	145
Flavor Studies on Some Amazonian Fruits 1. Free and Bound Volatiles of Cocona ( <i>Solanum sessiliflorum</i> Dunal) Pulp Fruit <i>Alberto Fajardo, Alicia L. Morales and Carmenza Duque</i>	156
Flavor Studies on Some Amazonian Fruits. 2. Free and Bound Volatile of Cocona ( <i>Solanum sessiliflorum</i> Dunal) Pulp Fruit <i>Alberto Fajardo, Alicia L. Morales and Carmenza Duque</i>	164

## Formation of Flavors

Generation of Potentially New Flavoring Structures from Thiamine by a New Combinatorial Chemistry Program <i>René M. Barone, Michel C. Chanon, Gaston A. Vernin and Cyril Párkányi</i>	175
Generation of Aldehydes from Maillard Reaction of Glucose and Amino Acids <i>Jiangang Li and Chi-Tang Ho</i>	213
The Biosynthesis of Furanones in Strawberry: Are the Plant Cells All Alone? <i>Kyriacou and I. Zabetakis</i>	219
Evolution of Volatile Compounds and Sensory Rancidity in Purified Olive Oil during Storage under Normal and Accelerated Conditions (25-75 °C) <i>M.D. Salvador, S. Gómez-Alonso, V. Mancebo-Campos and G. Fregapane</i>	224
Dewatering-impregnation-Soaking in Nonconventional Solutions as Source of Natural Flavorants of Colombian Azúcar Varieties of Mango ( <i>Mangifera indica</i> ) and Perolera Pineapple ( <i>Ananas comosus</i> ) <i>L. Morales, M. P. Castaño, D. C. Sinuco, G. Camacho and C. Duque</i>	231

## Analysis

Application of GCxGC (Comprehensive 2DGC) in Flavor Analyses <i>Hajime Komura and Mineko Kawamura</i>	243
Aroma Active Norisoprenoids in Orange and Grapefruit Juices <i>Kanjana Mahattanatawee, Russell Rouseff, Kevin Goodner and Michael Naim</i>	252
Black Truffle Flavor: Investigation into the Impact of High-Boiling-Point Volatiles by GC-Olfactometry <i>Jensen, T. Talou, C. Raynaud and A. Graset</i>	260
Evidence of the Presence of ( <i>S</i> )-Linalool and of ( <i>S</i> )-Linalool Synthase Activity in <i>Vitis vinifera</i> L., cv. Muscat de Frontignan <i>G. M. de Billerbeck, F. Cozzolino and C. Ambid</i>	271
Isolation and Identification of Phenolic Glycosides from Quinoa Seeds ( <i>Chenopodium quinoa</i> Willd) <i>Nanqun Zhu, Shengmin Sang, Robert T. Rosen and Chi-Tang Ho</i>	278
Potential Migration of Organic Pollutants from Recycled Paperboard Packaging Materials into Dry Food <i>V.I. Triantafyllou, K. Akrida-Demertzi and P.G. Demertzis</i>	283

## Antioxidants and Health

Antioxidant Capacity of Phenolic Extract from Wild Blueberry Leaves and Fruits <i>Marian Naczek, Ryszard Amarowicz, Ryszard Zadernowski, Ron Pegg, and Fereidoon Shahidi</i>	293
Antioxidative Activity of Cruciferous Vegetables and the Effect of Broccoli on Edible Oil Oxidation <i>Ryoyasu Saijo, Rong Wang, Keiko Saito, Reiko Nakata, Satoko Ofuji, Tomoko Inoue, Yuko Mori, Miwa Motoki and Yoko Tabata</i>	304
Biological Studies and Antioxidative Activity for White Truffle Fungus ( <i>Tuber borchii</i> ) <i>Emad S. Shaker</i>	312
Structured Lipids Containing Long-Chain Omega-3 Polyunsaturated Fatty Acids <i>S.P.J.N. Senanayake and F. Shahidi</i>	323
Hepatic Acute-Phase Response to 3-Alkyl-2-phenyl-2-hydroxymorpholinium Cations <i>F.M. Fouad, O. A. Mamer, F. Sauriol, A. Lesmple, F. Shahidi and G. Ruthenstroth-Bauer</i>	335



Stimulation of Hepatic Acute-Phase Response by Stress, Sucrose Polyester and Zocor in Animal Model	341
<i>F.M. Fouad, O. Mamer, F. Sauriol, A. Lesimple, F. Shahidi, M. Khayyal, M. Hasseeb and G. Ruthenstroth-Bauer</i>	

The Functionality of Buckwheat Sour Juice	350
<i>Kozo Nakamura, Chiho Nakamura, Shigeyoshi Maejima, Masataka Maejima, Michiaki Watanabe, Mayumi Shiro, and Hiroshi Kayahara</i>	

Functionality Enhancement in Germinated Brown Rice	356
<i>Kozo Nakamura, Su Tian, and Hiroshi Kayahara</i>	

### Quality

Comparison of the Influence of Hydrodynamic Pressure (HDP)-treatment and Aging on Beef Striploin Protein	375
<i>A.M. Spanier, T.M. Fahrenholz, E.W. Paoczay and R. Schmukler</i>	

Hydrodynamic Pressure (HDP)-treatment: Influence on Beef Striploin Proteins	391
<i>A.M. Spanier and T.M. Fahrenholz</i>	

Use of Capillary Electrophoresis (CE) to Assess the Influence of Hydrodynamic Pressure (HDP)-treatment and Aging of Beef Striploin Proteins. A Method for Assessment of Meat Tenderness	405
<i>A.M. Spanier and T.M. Fahrenholz</i>	

Changes in Protein Distribution in Beef <i>Semitendinosus</i> Muscle (ST) in Samples Showing Varying Response to Hydrodynamic Pressure (HDP)-treatment	418
<i>A.M. Spanier and T.M. Fahrenholz</i>	

Multiquality Enhancement of Muscle Food: A Hypothesis Explaining How Hydrodynamic Pressure (HDP)-Treatment Leads to Meat Tenderness	431
<i>A.M. Spanier and R.D. Romanowski</i>	

Flavor and Quality Characteristics of Bakery Products from Frozen Dough with Various Added Ingredients	447
<i>V. Giannou and C. Tzia</i>	

Shelf-life Prediction and Management of Frozen Strawberries with Time Temperature Integrators (TTI)	459
<i>E.D. Dermesonlouoglou, M.C. Giannakourou and P.S. Taoukis</i>	

Stability of methanolic extract activity for leaves, peels and Citrus seeds under UV Irradiation	472
<i>Emad S. Shaker</i>	

Effect of Different Initial and Supplementary Brining Treatments on the Fermentation of cv. Conservolea Green Olives	484
<i>E.Z. Panagou, C.C. Tassou, and K.Z. Katsaboukakis</i>	

<i>Contents</i>	xi
Shelf-life Determination of Untreated Green Olive cv. Conservolea Packed in Polyethylene Pouches under Different Modified Atmospheres <i>E.Z. Panagou, and C.C. Tassou</i>	492
Microbiological, Physicochemical and Sensorial Changes of Marinated Fish Products <i>J. S. Arkoudelos, C.C. Tassou, P. Galiatsatou, and F.J. Samaras</i>	500
Subject Index	507

## Overview



## HALAL ISSUES IN THE FLAVOR INDUSTRY

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## 1. ABSTRACT

Halal is a term that describes the foods permitted for consumption by Muslim, who makes up more than 20 percent of the world population. Food products imported by Muslim countries must meet health and Halal requirements. With the advancement of ingredient technology, flavor industry has become quite complex. Use of alcohol and animal derived ingredients in the development of flavors presents challenges for the producers of Halal Foods. Guidelines and requirements for Halal food productions are discussed in this article, to assist those interested in dealing with Muslim and Muslim markets.

## 2. INTRODUCTION

Food consumed by Muslims which meets the Islamic dietary code is called Halal food. Muslims use two major terms to describe food: Halal and Haram. Halal means permitted or lawful and Haram means forbidden or unlawful. Other terminologies used are makrooh, mashbooh and dhabiha. Makrooh is an Arabic word meaning religiously 'discouraged' or 'disliked'. It covers any foods and liquids which are disguised or harmful to the body. Mash-Booh is also an Arabic word and means 'suspected'; it covers the gray area between the Halal and Haram. Dhabiha means 'slaughtered' it implies that the animal has been slaughtered by a Muslim, according to the Islamic method of slaughter.

The food industry, like any other industry, responds to the needs and desires of the consumer. People all over the world are now more conscious about foods, health and nutrition. They are interested in eating healthy foods that are low in calories, cholesterol, fat, and sodium among others. Many people are interested in foods that are organically produced without the use of synthetic pesticides and other non-natural chemicals. The ethnic and religious diversity in America and Europe has encouraged the food industry to prepare products which are suitable to different groups, Chinese, Japanese, Italian, Indian, Mexican, Seventh Day Adventist, Vegetarian, Jewish, Muslim, etc.

## 2.1 What are Halal Foods?

By definition, Halal foods are those that are free from any component that Muslims are prohibited from consuming. According to the Quran (the Muslim scripture), all good and clean foods are Halal. Consequently, almost all food of plant and animal origin are considered Halal except those that have been specifically prohibited according to the Quran and the Sunnah (Tradition of Muhammad).

Accordingly, all foods pure and clean, are permitted for consumption by the Muslims except the following categories, including any products derived from them or contaminated with them:

- Carrion or dead animals.
- Flowing or congealed blood.
- Swine, including all by-products.
- Animals slaughtered without pronouncing the name of God on them.
- Animals killed in a manner that prevents their blood from being fully drained from their bodies.
- Animals slaughtered while pronouncing a name other than God.
- Intoxicants of all types, including alcohol and drugs.
- Carnivorous animals with fangs, such as lions, dogs, wolves, tigers, etc.
- Birds with sharp claws (birds of prey), such as falcons, eagles, owls, vultures, etc.
- Land animals such as frogs, snakes, etc.

## 2.2 How does one translate major prohibitions into practice in today's industrial environment? Let us look at how the laws are translated into practice:

**2.2.1 Carrion and Dead Animals.** It is generally recognized that eating carrion is offensive to human dignity and probably nobody voluntarily consumes carrion in the modern civilized society. However, there is a chance of an animal dying from the shock of stunning before it is properly slaughtered. This is more common in Europe than in North America. The meat of such dead animals would not be proper for Muslim consumption.<sup>1</sup>

**2.2.2 Proper Slaughtering.** There are strict requirements for the slaughtering of animals: the animal must be of a Halal species, i.e., cattle, lamb, etc.; the animal must be slaughtered by a Muslim of proper age; the name of God must be pronounced at the time of slaughter; and the slaughter must be done by cutting the throat of the animal in a manner that induces rapid, complete bleeding and results in the quickest death.

Certain other conditions should also be observed. These include considerate treatment of the animal, giving it water to prevent thirst, using a sharp knife, etc. These conditions ensure the humane treatment of animals before and during slaughter. Any by-products or derived ingredients must also be from duly slaughtered animals to be good for Muslim consumption.

**2.2.3 Swine.** Pork, lard, and their by-products or derived ingredients are categorically prohibited for Muslim consumption. All chances of cross-contamination from pork into Halal products must be thoroughly prevented. In fact, in Islam, the prohibition extends beyond eating. For example, a Muslim must not buy, sell, raise, transport, slaughter, or in any way directly derive benefit from swine or other Haram media.

**2.2.4 Blood.** Blood that pours forth (liquid blood) is generally not offered in the marketplace or consumed, but products made from blood and ingredients derived from it are available. There is general agreement among religious scholars that anything made from blood is unlawful for Muslims.

**2.2.5 Alcohol and Other Intoxicants.** Alcoholic beverages such as wine, beer, and hard liquors are strictly prohibited. Foods containing added amounts of alcoholic beverages are also prohibited because such foods, by definition, become impure. Non- medical drugs and other intoxicants that affect a person's mind, health, and overall performance are prohibited, too. Consuming these directly or incorporated into foods is not permitted.

### **2.3 Foods are broadly categorized into four groups for the ease of establishing their Halal status and formulating guidelines for the industry.**

**2.3.1 The meat and poultry** group contains four out of five Haram (prohibited) categories. Hence higher restrictions are observed here. Animals must be Halal. One cannot slaughter a pig the Islamic way and call it Halal. Animals must be slaughtered by a sane Muslim, while pronouncing the name of God. A sharp knife must be used to sever the jugular veins, carotid arteries, trachea, and esophagus, and blood must be drained out completely. Islam places great emphasis on humane treatment of animals, so dismemberment must not take place before the animal is completely dead, as described earlier.

**2.3.2 Fish and Seafood.** To determine the acceptability of fish and seafood, one has to understand the rules of different schools of Islamic jurisprudence, as well as the cultural practices of Muslims living in different regions. All Muslims accept fish with scales; however, some groups do not accept fish without scales such as catfish. There are even greater differences among Muslims about seafood, such as molluscs, and crustaceans. One must understand the requirements in various regions of the world. For example for exporting products containing seafood flavors.

**2.3.3 Milk and Eggs** from Halal animals are also Halal. The predominant source of milk in the West is from cow, and the predominant source of eggs is the chicken. All other sources are required to be labeled accordingly. There are a variety of products made from milk and eggs. Milk is used for making cheese, butter, and cream. Most of the cheeses are made with various enzymes, which could be Halal if made with microorganisms or Halal slaughtered animals. The enzymes could be Haram if extracted from porcine sources or questionable when obtained from non-Halal slaughtered animals. Similarly, emulsifiers, mold inhibitors and other functional ingredients from non-specified sources may make milk and egg products doubtful to consume.

**2.3.4 Plant and Vegetable** materials are generally Halal except alcoholic drinks or other intoxicants. However, in the modern day processing plants, vegetables and meats may be processed in the same plant and on the same equipment, increasing the chance of cross-contamination. Certain functional ingredients from animal sources may also be used in the processing of vegetables, which make the products doubtful. Hence processing aids and production methods have to be carefully monitored to maintain the Halal status of foods of plant origin.

From the above discussion on the laws and regulations it is clear that there are several

factors determining the Halal/Haram status of a particular foodstuff. It depends on its nature, how it is processed and how it is obtained. As an example, any product from pig would be considered as Haram because the material itself is Haram. Similarly, beef from an animal that has not been slaughtered according to Islamic rites would still be considered unacceptable. Food and drink that are poisonous or intoxicating are obviously Haram even in small quantities because they are harmful to health.

Producing Halal food is similar to producing regular foods, except for certain basic requirements. Halal foods can be processed by using the same equipment and utensils as regular food, with few changes.

## 2.4 Halal and Kosher:

Many of the Muslim rules are similar to Kosher laws in terms of slaughtering rituals of animals and the complete avoidance of pork and all pork derivatives. So, often times consumers tend to assume Kosher is similar to Halal. Whereas Kosher and Halal are two different entities carrying a different meaning and spirit. Kosher certification is not compatible with complex Muslims' dietary laws. *There is a philosophical difference between Halal and Kosher certification and Halal may never overlap with Kosher.*<sup>3</sup> Alcohol is prohibited for the Muslims, whereas all the wines are Kosher and are part of the meal. Several gelatins are being marketed as Kosher regardless of the origin, and there are some Kosher gelatins whose origin is pork.<sup>2</sup> Similarly, enzymes' source is not a big issue in Kosher but the source of enzymes in cheese is a big issue for Muslims.

## 2.5 Flavor Issues in Halal Food Production:

The major uses of alcohol today are for alcoholic beverages and as a solvent in the food, cosmetics and pharmaceutical industries. Alcoholic beverages legally can contain between 0.5% and 80% ethyl alcohol by volume. Pure industrial alcohol may be 95% alcohol. Alcoholic beverages can be consumed directly or added to foods, either as an ingredient during formulation or during cooking. When alcohol is an added ingredient, the ingredient label of the food product must list the specific alcoholic beverage that has been added, if the final amount of alcohol is greater than 0.5%. Examples of this would be liqueur-flavored chocolates, cakes and meals containing wine, such as beef stroganoff in wine sauce.

Foods are cooked in alcohol to enhance the flavor or to impart a distinctive flavor. Wine is the most common form of alcohol used in cooking. While it may seem that all of the added alcohol evaporates or burns off during cooking, it does not. Rena Cultrufelli of the USDA has prepared a table listing the amount of retained alcohol in foods cooked in alcohol. The retained alcohol varies depending upon the cooking method. The following gives some of the retained alcohol content of foods prepared by different cooking methods.<sup>4</sup>

• Added to boiling liquid and removed from the heat	85%
• Cooked over a flame	75%
• Added without heat and stored overnight	70%
• Baked for 25 minutes without stirring	45%
• Stirred into a mixture and baked or simmered for 15 minutes	40%
• Stirred into a mixture and baked or simmered for 30 minutes	35%
• Stirred into a mixture and baked or simmered for 1 hour	25%
• Stirred into a mixture and baked or simmered for 2 hours	10%



- Stirred into a mixture and baked or simmered for 2½ hours 5%

Two of the major uses of pure alcohol are as a solvent and raw material. As a solvent, it is used to extract flavoring chemicals from plant materials such as vanilla beans. Dilute ethyl alcohol is almost universally used for the extraction of vanilla beans. After the extraction, vanilla flavor, called natural vanilla flavoring, is standardized with alcohol. By the Food and Drug Administration's FDA's standard of identity, natural vanilla flavoring must contain at least 35% alcohol by volume, otherwise it may not be called natural vanilla flavoring.<sup>5</sup>

One important function of alcohol is to facilitate the mixing of oil-based ingredients into water-based products or water-based ingredients into oil-based products. This is an important use in the production of flavors. Most flavors are oils. For example, orange flavor is oil derived from orange skins. Orange flavor would not dissolve in water but will dissolve in alcohol. The mixture of alcohol and orange flavor will then dissolve in water. So to produce an orange flavored carbonated drink, alcohol is used to make sure the orange flavor is fully mixed and dissolved in the carbonated water and remains dissolved over the expected shelf life of the product.<sup>6</sup>

Alcoholic beverages of any type are prohibited for Muslims. The use of alcoholic beverages in preparing or producing food items or drinks is also prohibited. Hence eating or drinking products made with alcoholic beverages, such as spiked punch, or cakes containing brandy are not permitted. Grain alcohol or synthetic alcohol may be used in the production of food ingredients, as long as it is evaporated to a final level of less than 0.5% in food ingredients and 0.1% in consumer products. These guidelines are practiced by some of the Halal certification organizations, while others follow a somewhat stricter guidelines.

The following points may be helpful for the use of alcohol in Halal food production.

1. Natural products containing a small amount of intrinsic alcohol do not present a Halal issue.
2. Alcohol contained in a natural product may be concentrated into its essence, thereby concentrating the amount of alcohol. Most Halal certifying bodies would accept a small amount of such inherent alcohol, generally less than 0.1%, and sometimes up to 0.5%.
3. Use of alcohol in any concentration in an industrial process is acceptable due to technical reasons, where other viable alternatives are not available. The final alcohol content in the product of such industrial application must be reduced to less than 0.5% by evaporation or conversion to acetic acid. This means flavors that will be used in food production must not contain more than 0.5% alcohol to qualify as Halal. Some countries, however, do accept amounts higher than 0.5%, while others have an even lower cut-off.
4. Addition of any amount of fermented alcoholic drinks such as beer, wine, liquor, etc., to any food product or drink renders the product Haram. However, if the essence is extracted from these products and alcohol is reduced to negligible amount, most Halal certifying agencies and importing countries accept the use of such essences in food products. Consultation with proper authorities or end users can clarify this issue.
5. Consumer products with added ingredients that contain alcohol must have less than 0.1% alcohol including both added and any natural alcohol to qualify as Halal. At this level one cannot taste the alcohol, smell the alcohol, or see the alcohol, a criterion generally applied for the impurities. This reasoning has been established by the Islamic Food and Nutrition Council of America. Other groups may accept more lenient or stricter guidelines than these. The food industry should consult their customer companies or Halal approval agencies for