



Innovations in Technologies for Fermented Food and Beverage Industries

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Fermentation is a process that employs the metabolism of microorganisms. Its applications and outcomes are important not only to the food industry, but also for the consumers that associate fermented products with health benefits. Innovations and advances in the field of food and beverage fermentations are discussed within sixteen chapters that differ in focus and depth.

Starter cultures can be composed of selected single or multiple strains and aim to deliver desired characteristics to the final product. The strategies to improve starters are wide and include co-cultures or genetic engineering. The selection criteria consider factors, such as metabolic activity, characteristics of the microbe, the development of the culture and the final sensorial. A classification of fermented foods is offered based on the substrate. The fermentation processes are classified by alcoholic fermentation, where ethanol is obtained mainly by yeasts, and lactic acid fermentation by lactic acid bacteria (LAB). The book names the principal microorganisms normally involved within fermentations, which include bacteria from Lactobacilli, Acetobacter, and Bacillus, and yeasts from Saccharomyces family. Furthermore, the use of fermented food as functional food is also explained. Also, the associated health benefits are mentioned, such as the higher concentration of bioactive compounds present in fermented in comparison with the product before fermented. In addition, an overview of the current market of fermented foods and future projections are presented in the first chapter.

The use of LAB as a starter provides both advantages and functionalities, such as enzyme release. The role of starters to deliver safe fermented products with potential to

address protein needs or nutritional disease issues, especially in developing countries, is explained in chapter two. Other advances in the field of fermentation include the biologically active peptides with health purposes, including technological processes such as the use bacteriocins for food preservation (e.g. nisin in dairy products). A list of fermented food with the associated microorganism and health benefits are provided in chapter Three.

Chapter four discusses the selection criteria and characteristics of starter cultures. The chapter explains the advantages and the disadvantages of using thermal processes for extending shelf life. Moreover, it explains the mechanism of the non-thermal processes and its importance for fermented products for decontamination, providing examples of real uses. Some research on food metabolomics and potential techniques are briefly explained, such as encapsulation to deliver bioactive components. There are several advances in the field of alcoholic drinks which include innovations in craft distilling, development of beer concentrate for household equipment, and the creation of edible material to contain six-pack beers. These developments and the demand of low or non-alcoholic drinks/beer are linked with healthy trends as described in chapter five.

Understanding the Millennials as consumers is substantial. Chapter six depicts concrete examples of the importance of apps and social media as marketing strategies. The advantage of new technologies is that they act as a platform to gather consumer insights, and can be used to create dining experiences.

Chapters Seven and Eight cover a wide range of topics,



such as current and potential novel methods of food delivery, preservation, storage and industrial production for probiotics and functional food. The chapters also demonstrate the procedures of benchmark selection, food safety aspects and functional properties of probiotics from dairy sources. Moreover, the chapters demonstrate some ethical concerns, regulatory status, food markets and companies. On the other hand, chapter nine focuses on non-dairy probiotics. It categorizes these products and backgrounds by origin and trends.

Meat fermented products are a very important topic in the industry. Chapter ten discusses standardization of meat fermentation and compares it with the spontaneous fermentation. It explores the advantages, disadvantages, advances, and improvements with regards to hazards and contaminants from a microbiological origin and quality issues. The chapter gives examples on some microbial hazards that are naturally present in fermented meat, such as antimicrobial resistance or opportunistic behaviour. Other examples are Mycotoxins, moulds in homemade sausages, and biogenic amines.

Chapter eleven explores the fermenters' or bioreactors, materials, functionality and components that are introduced for wine and beer. It presents the important features that should be taken into consideration for the equipment which depend on the raw materials, budget, capabilities, and the desired outcome. In addition, it shows how nowadays the modern fermentations are linked to computers for data storage and analysis.

Chapter twelve analyzes the use of Genetically Modified (GM) Foods as one option for food-related problems, mentioning advantages such as a higher production worldwide in limited space, a way to address malnutrition, and the design of GM microorganisms to develop or inhibit the specific metabolites. Some examples for overcoming problems in the bakery, wine, and brewing industries and folate production are also mentioned. The chapter presents the main disadvantages (the main disadvantages of what?), such as the unknown consequences and environmental risks with regards to the resistance to antibiotics, herbicides or insects. Additionally, the risks for human health concerning toxins and allergens, and issues referring to traceability and regulations are also explained.

Chapter thirteen illustrates the topic of packaging, including some developments and improvements. For example, the importance to match the current sustainable trends, the advances that include RFID (radio frequency identification), the active packaging for absorbing undesirable substances, and the smart packaging for moni-

toring purposes.

Consumer demands and product acceptability shape the novel foods market. Therefore, market research and sensorial analysis are tools applied often in product development. Chapter fourteen explains the importance of innovation achieved by companies and consumers together towards the development of the desired product. Scepticism from the side of the consumer with regards to the processed foods leads to a growth on a minimally processed, natural and organic market and present conflicts with developments, such as nanotechnology or GMOs.

Intellectual Property (IP) is used by the food industry to keep the business profitable. Patents are widely used by companies to protect themselves from the formulation, new technologies, or even as a way for commercialization. The main categories that are protected under this instrument are fruits, vegetables, drinks and beverages. Chapter fifteen explains how the use of copyright is directed mainly for advertising or texts with marketing purposes, whereas industrial design refers to the physical attributes of the product with the objective to increase recognition by the consumer.

The normal percentage of residual sugars in wine fermentations are normally standardized less than 0,2-0,4%. The most common problems are hard to anticipate and include "stuck fermentation", in which a higher amount of residual sugars is produced, and "sluggish fermentation" in which a less efficient fermentation is produced. Both cases lead to economic and food losses. The last chapter of this book explains a computational intelligence approach based on multivariate statistical to anticipate these undesirable deviations in wine fermentations. Although the topics from this book can be seen as miscellaneous, it can be noted that the technologies for fermented food are in continuous improvement with the aim to deliver palatable and safety fermented products to consumers.

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