Chapter

Introductory Chapter: A General Overview on Latest Trends in Food Engineering

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1. Introduction

Foods represent a complex mixture of hundreds of components, which contribute to their characteristic flavor. Nowadays, assuring the food's flavor stability represents an issue of food industry involved actors, becoming one of the main technological challenges. An educated consumer has increasing demands related to food quality perception over the last years. As a consequence, the food flavor instability is a critical quality issue of food industry. Achieving food's quality in respect to its flavor and stability is a complex process, especially by considering the large variety of flavor compounds and diversity of food accepted by consumers. The knowledge of all mechanisms involved in food flavor changes during processing and storage period is compulsory. Ideally, food should have the same flavor from the moment of packaging to the moment it gets to the consumer. Unfortunately, food is exposed to chemical reactions starting with the moment it is taken out from the plant. Given the actual trend of big food industry producers to accede to the global food market, this involves longer durations on which the product passes until it arrives to the consumers, contributing in increasing risk of its quality damage. New innovative cost-effective technologies are in discussion, capable of satisfying the actual consumer's quality demands.

Foods were thermally treated for cooking purposes since many centuries ago, firstly to modify and preserve their organoleptic and nutritional characteristics. Anthropologists agree that thermal cooking of food had a great impact on phenotypical properties, intellectual development of mankind, and later to the society, depending on economy, culture, and geography. The transfer from home cooking to industrialized processes began in the late nineteenth century, firstly aiming food preservation and later, after the Second World War, focusing food safety and quality issues [1]. Food engineering as a study discipline was first introduced in West European countries willing to offer a curriculum for actors in the food industry, including chemical engineering aspects, food microbiology, and biology. Nowadays, there is a difference between food technology and food engineering. The first treats the application of methods of food preservation and food processing, while food engineering is a more complex area focusing on a combination between food and applied sciences such as microbiology, physical sciences, chemistry, and engineering.

Thermal food processing is one of the most efficient methods of preservation. Beneficial effects include inactivation of food pathogens, natural toxins, and other unwanted changes, prolonging the shelf-life, adjusting the food digestibility, increasing the bioavailability of nutrients, and improving the functional properties. Still, thermal processing usually comes with unwanted changes in food composition

such as decrease in nutrients, formation of toxic compounds, or other influencing the organoleptic properties. Continuously, heat treatment has to be improved according to the latest trends in food research, focusing on the increasing beneficial effects and counteracting the undesired effects.

Active packaging concept gains more interest due to its effectiveness in antimicrobial protection insurance, especially to pathogenic microorganisms. Still open for discussion, the subject refers to the influence of food-packaging polymers on food products after the incorporation of protective microorganisms. Actually, this is one of the biggest challenges when considering transposing these biomaterials to industrial scale use [2].

The past decade offered a great opportunity in valorizing the results in active biofilms characterized by antimicrobial and antifungal activities in order to extend the food shelf-life and to reduce the addition of food additives. As so, biologically active polysaccharides such as kefiran [3–5] or chitosan [6] proved an incredible potential to food industry by their high antimicrobial activity against pathogenic and spoilage microorganisms. The positive impact relates also to better environmental practices by avoiding the conventional packaging materials such as plastics and reducing the food waste [7, 8].

Advanced processing methods tend to preserve the characteristic properties of food including their organoleptic and nutritional qualities better when compared to the conventional food processing methods and, in some cases, are even more cost-effective. There is a clear rise in the populations suffering from food allergies, especially infants and children. Though this fact is widely attributed to the changing livelihood of population in both developed and developing nations and to the introduction of new food habits with advent of novel foods and new processing techniques, their complete role is still uncertain. As so, the return to ancient natural food recipes [9] could be an alternative for reinterpretation of food in a more safety and healthier way.

For example, cereals are traditionally processed into foods and beverages through fermentation worldwide. With lactic acid fermentation, as the most known ancient preserving method, studies found that valuable compounds are formed during the process [10]. Additionally, lactic acid fermentation enhances food safety by reducing the toxic compounds and producing antimicrobial factors, which facilitate the inhibition and elimination of food pathogens. Many health-enhancing attributes are related to the consumption of lactic acid fermented products.

Nowadays, demands for nondairy substitutes with high acceptance and functionality, given by pleasant flavor and nutrient content (vitamins, minerals, antioxidants, prebiotics, and probiotics), respectively, are increasing. Cereal-based beverages have a great potential to fulfill this demand [11, 12]. As part of the worldwide traditional cuisine and culture, these products are often transposed to industrial re-interpretation [13] as novel food products with various beneficial microorganisms (especially in the case of lactic acid fermented products) and functional properties designed for a balanced nutrition and life quality improvement. As so, through intensive research, focusing on this field and industrial production, these novel foods are taken beyond their national reputation. By applying novel trend technology, food products are designed for a balanced nutrition, easy and safe to store, prepare, and consume, and able to supply all the needed vitamins and nutrients.

The evolution of food industry offered many opportunities of using low-cost food additives and ingredients. Beverage industry is the most exposed to using caloric sweeteners [14], sucrose, high-fructose corn syrup, fruit juice concentrates, etc., which in latest studies proved their harmful health effects. Products such as soft drinks, carbonated soft drinks, fruit ades, fruit drinks, sports drinks, energy and vitamin water drinks, sweetened iced tea, cordial, squashes, and lemonade are attributed as the major sugar contributors in the USA for their consumption after each meal, as

a supplementary source of calories. This intake severely contributes to obesity and obesity-related diseases in children and adults. As a result of novel food regulation, past years' research focused on the reduction of sugar in food and beverages along with avoiding the addition of other artificial sweeteners. Some prospects were made and proved the positive effects of a predicted reduction of sweeteners in food [15].

Wild edible plants as part of the cultural and genetic heritage are harvested and processed into value-added products especially in the Eastern Europe. They represent important sources of nutrients and health-promoting compounds, being consumed as remedies especially in rural and suburban areas. However, these products lack recognition as important contributors to human diet in developed areas [16]. Current research promotes the using of wild edible plants in human diet, while several strategies present their importance for social, economic, and agro-ecological development. Given the growing interest for a natural alternative of products obtained by chemical synthesis, bioactive compounds found increasing application in food industry, cosmetics, pharmaceutical industry, and even in agriculture.

Sea-buckthorn (*Hippophaë rhamnoides*), hawthorn (*Crataegus monogyna*), wild grown European blackberry (*Rubus fruticosus* L.), cornelian cherry (*Cornus mas*), blackthorn (*Prunus spinosa*), dog rose (*Rosa canina*), and bird cherry or hackberry (*Prunus padus*) are only few of the wild fruits with great potential for food industry as a valuable source of bioactive compounds, mainly phenolic compounds [17].

Novel bioactive compounds obtained by lab-scale extraction techniques such as high-pressure processing [18], pulsed electric field on berry fruits [19], grape pomace and food industry byproduct extraction [20–22], microwave-assisted extraction, ultrasonically assisted diffusion processes, supercritical fluid extraction, pressurized hot water extraction, gas-assisted extraction, and enzyme-assisted extraction were transposed to industrial application such as juice industry [18] and oilseed processing industry. Extraction-dependent factors—temperature, infusion duration, tea, and water ratio—were also tested in tea brewing in order to deliver important product information to consumers [23].

Modeling of processes through mathematics is widely used in food industry. Recently, an experimentally validated multiscale modeling for coffee extraction was developed [24].

Food loss is a major concern to all economic, environmental, and social aspects. In recent years, several modeling of waste treatments depending on food characteristics were proposed [25]. In order to assess the stability of a food product during storage period, degradation kinetics modeling was elaborated using different indicators such as the ascorbic acid content and color intensity loss [26].

Given the fast-growing engineering fields, namely the food industry with novel food processes technologies, novel ingredients, advanced enzyme production and applications, and other complementary technologies, this book will disclose the state of the latest trends in food engineering.

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Conflict of interest

Author declares there is no conflict of interest.

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