FOOD MANUFACTURING PRACTICES AND SANITATION

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Summary

Human migration to urban areas and the consequent change of lifestyle led to increased consumption of industrially produced and prepared foods. This means that food manufacturing practice and sanitation are two of the most important factors in preventing foodborne diseases and in providing safe foods.

According to the generally accepted view of specialists, the system of control of raw materials and the manufacturing process in developed countries is at a level which assures production of safe food.

Lapses in food safety (e.g., the dioxin crisis in the EU) have global consequences, and raw materials (e.g., genetically modified organisms—GMO) and developments in food technology (e.g., reduced severity in heat treatment of foods) may be a source of newer safety problems, all of which means that continuous improvement in methods of safety control is needed.

At present, among systems aiming to assure maximal safety in food manufacturing, the GMP (Good Manufacturing Practice) and the HACCP (Hazard Analysis Critical Control Points) are the best known. Sanitation is also an important part of systems assuring food safety. Among future trends in manufacturing practice, the automation of quality control and use of sensors produced by recombinant DNA technology is mentioned.

1. Introduction

Industrially produced and prepared foods have increased in consumption with the large relocation of populations to urban areas. The traditional situation in which mothers bear the entire responsibility for the preparation of family meals has changed, and some traditional methods of food preparation that in the past ensured the safety of food have disappeared in the late twentieth century. This means that food manufacturing practice and sanitation are important factors in preventing foodborne disease and providing safe food.

Food industries should recognize the importance of food safety and seek means to ensure the safety of their products. As a result of the growing requirements of consumers concerning food safety and development of quality control methods, great progress was achieved in this field, primarily in the food industry of developed countries. A set of standards, commonly known as good manufacturing practices (GMPs), has been promulgated under the food laws to provide proper handling and processing of food products.

The modern food industry has its origins in prehistory, when the first food processing took place to preserve foods against famine, or to improve their eating quality. For example, grain was sundried to extend its storage life, and meat was roasted to improve its flavor. The first biochemical processing began in Egypt with the development of fermented products, including cheeses and wines. For a long period such preservation and preparation methods were only used on a domestic scale, to serve the needs of the family. However, as societies developed, specialization took place (for example, bakers and brewers), and trades developed. These were the forerunners of current food industries.

In countries with a temperate climate, processing techniques were developed over generations to allow food to be stored through the winter months and to increase the availability of foods out of season. The growth of towns and cities gave impetus to the development of preservation technologies, and an extended storage life allowed foods to be transported from rural areas to meet the needs of urban populations. During the nineteenth century, larger scales of production were achieved in factories, which were built to produce basic commodities, including starch, sugar, butter, and baked goods. These batch processes were based on tradition and experience, and no detailed knowledge existed of the composition of foods or of changes during processing. Toward the end of the nineteenth century, an increase in scientific understanding started the change from craft-based industry to science-based industry, which continues today.

The aims of the food industry today, as in the past, are fourfold:

1. to extend the period during which a food remains wholesome (the shelf life) by preservation techniques, which inhibit microbiological or biochemical changes and thus allow time for distribution and home storage
2. to increase variety in the diet by providing a range of attractive flavors, colors, aromas, and textures in food (collectively known as eating quality, sensory quality, or organoleptic quality); a related aim is to change the form of the food to allow further processing (for example, the milling of grains to flour)

3. to provide the nutrients required for health (termed nutritional quality of food)
4. to generate income for the manufacturing company

Each of these aims exists to a greater or lesser extent in all food production, but the processing of a given product may emphasize some more than others. For example, frozen vegetables are intended to have sensory and nutritional qualities that are as close as possible to the fresh product, but with a shelf life of several months instead of a few days or weeks. The main purpose of freezing is therefore to preserve the food. In contrast, sugar, confectionary, and snack foods are intended to provide variety in the diet. A large number of shapes, flavors, colors, and textures are produced from basic raw materials.

2. Trends in the Development of Food Technology and Their Effect on Food Safety

According to the generally accepted views of specialists in developed countries, the system of control of raw materials and food manufacture is at a level that assures the production of safe food products. Nevertheless, the processing technologies of food industries are in continuous development, novel raw materials are used, and new foods are developed. Consequently, new problems may arise, and with them the need for improvement of food control.

Lapses in food safety have global consequences. Developments in Europe, Japan, Australia, and the US involved several truly disastrous outbreaks leading to serious health risks and, in many cases, fatalities (e.g., mad cow disease, contamination of animal feed in Belgium and other European countries by dioxins, and Listeria outbreaks in a number of countries). These events produced not only deserved public concern about the lack of adequate protection, but also an atmosphere of near hysteria. This makes protection of the public more difficult because the media do not differentiate between dangerous problems and minor lapses (e.g., the occurrence of some charcoal particles derived from water filters in the processing of beverages). The factors pushing food manufacturers to further development are manifold. Some of them will be treated in the following sections.

2.1. New Needs and Preferences of Consumers

Throughout the world, particularly in urbanized areas, “health-promoting” aspects of diet are the subject of enormous and increasing public interest. A great variety of food components and food products have been promoted as being effective in health improvement, and are sold throughout a variety of marketing outlets, from health “boutiques” to major supermarkets. The overwhelming majority of claims of effectiveness are not supported by scientifically convincing and relevant evidence. While for the short run it may be feasible to generate profits by advertising unproved benefits, in the long run such a policy must backfire, to the great detriment of consumers (who may in the end lose reliable access to beneficial dietary components) and the food industry.

The only rational way to bring order and sanity to the chaotic universe of health claims and promotional campaigns is to provide a scientific basis for assessing, evaluating, and assuring the efficacy of food components. This is a major task for nutrition, toxicology, and food professionals.

Both from theoretical and practical points of view, it is a difficult task to understand the human response to organoleptic properties because of the difficulty of correlating organoleptic properties with chemical composition and physical structure, and of quantifying customer response, given its susceptibility to factors beyond organoleptic properties (e.g., exposure to advertising, cultural factors, and the heterogeneity of responses relating to age, sex, and ethnic differences).

However, brain science is among the most rapidly advancing disciplines, and advances in this field will have a profound impact on food science, in particular on understanding the role of dietary components in the control of appetite and satiety; the impact of dietary components on physiological states (i.e. the role of "mood foods"); and the role of the human nervous system, including the brain, in converting signals from the sensory apparatus to provide sensations of taste, flavor, and texture.

Food science and technology is essential for producing food products with a desired functionality. I refer to functionality in the broadest sense, not just to the health-related properties usually considered in the current usage of the term "functional foods." Food functionality here refers to the control of food properties to provide a desired set of organoleptic properties, wholesomeness (including nutrition, safety, and, indeed, all health-related functions), and properties related to processing and engineering, particularly ease of processing, storage stability, and minimal environmental impact.

One of the great challenges to food technology will be to put the development of "health-promoting foods" on a rational basis. Advances in biology and medicine have identified a number of diet-related factors contributing to human health and well-being. There is increasing pressure, therefore, to build into the food supply a much broader, proactive version of "wholesomeness." That will involve continued and much more extensive efforts to avoid diseases and negative conditions from food ingestion, but it will increasingly concern itself with the production of foods actively promoting health and well-being—not only through macronutrients and micronutrients, but also through ingredients with more specific physiological functions, including the so-called area of medical foods or nutraceuticals.

In the industrialized countries, at least, the societal burden because of health problems has shifted from infections (AIDS represents a significant exception) and undernourishment to chronic diseases. Cardiovascular diseases, cancer, and mental illness are likely to be the key scourges of humanity in the twenty-first century. Food technology has a role to play in combating these chronic diseases. It will require new and advanced techniques and concepts, because the focus will increasingly be on trace compounds rather than on macronutrients. In addition, traditional measures of food wholesomeness based on such aspects as freedom from pathogens, caloric content, protein value, and vitamin content will have to be supplemented with more sophisticated measures of health-maintaining functionality.

Of course, food technology has always been concerned with preventing unwholesome effects of food ingestion. Food microbiology and food processing have been devoted to prevention of the occurrence of pathogens and microbial toxins in food. Food chemistry and toxicology have been devoted to the elimination of the dangers of environmental or process-induced contaminants. These efforts will continue, and new advances will promote consumer and/or societal demands.

2.2. Reducing the Severity of Processing

Reducing the severity of processing, and consequently decreasing the losses of some nutrients, is one of the trends in modern food technology. However, a less intensive heat treatment may increase the risk of microbial contamination. The risks arising from less severe processing may be reduced by deeper knowledge of the impact of processing on food components and on microorganisms. Research in the application of new technologies to processing, such as high-pressure processing, novel applications of electromagnetic techniques, and so on, are in urgent need of being anchored in a knowledge base providing an understanding of their mechanisms of action.

The aims of modifying the composition of foods may be different. Fat replacers may reduce the energy content of foods. However, this modification needs a study of the functionality of replacers, for example, to help replace additives or naturally occurring components that may be deleterious to consumers. Enrichment with nutrients (vitamins, minerals) or with non-nutrient biologically active components is also possible. The area of food allergens will be of particular interest, as will the area of food/drug interactions. As we understand these areas, a better demand will be created for new nonallergenic food products, and for food products safe for consumers who must remain on long-term medication.

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Biographical Sketch

Anna Halász, D.Sc. is visiting consulting professor at the Department of Food Science of the Central Research Institute of Food Industry, and associate professor at Budapest University, Technology and Economics.

She received her M.Sc. Degree from Budapest University of Technology and Economics (faculty of Chemical Engineering) in 1961, and her D.Sc. degree in 1968 from The Hungarian Academy of Sciences.

Dr. Halász is Chairman of the section of Food and Agriculture of the Hungarian Biochemical Society, a member of the Working group on Microbiology of The Hungarian Scientific Society for Food Industry, and a member of the Yeast Working Group of The International Association for Cereal Science and Technology.

She has been the recipient of the Distinguished Researchers Award of The Ministry of Agriculture, and she was awarded the Bronze Medal of the Hungarian Republic. She is also a recipient of the Swiss Federal Foundation Fellowship in science (1970, 1971).

Dr. Halász has presented more than 100 invited lectures at international and national scientific meetings, universities, and other institutions. She has published more than 100 research papers. Her present major interest is food microbiology and food safety.