SHELF LIFE STUDIES OF FOODS & BEVERAGES

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DEVELOPMENTS IN FOOD SCIENCE 33

SHELF LIFE STUDIES OF FOODS AND BEVERAGES

Chemical, Biological, Physical and Nutritional Aspects

Edited by

GEORGE CHARALAMBOUS

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PREFACE

Shelf life - the catchall term encompassing the chemical, biochemical, microbiological, sensorial and nutritional stability of foods and beverages - will certainly remain of paramount importance to the grower, the processor, the manufacturer, the marketer and the consumer. This importance derives from many reasons, all of them pragmatic.

The prevention of spoilage and waste in the face of dwindling resources in the food supply, as well as environmental reasons, form the cornerstones of the importance of shelf life. However, distribution over great distances, pandering to specific requirements, meeting increasingly sophisticated consumer expectations, economics - are but a few of the several other reasons which have led to a synergism between scientists, producers and manufacturers: very many disciplines are called upon to achieve improved shelf life of foods and beverages.

The present work, coming seven years after a predecessor of a similar title from the same Editor and Publisher, offers not only a much needed update but also current results and views on such topics as the effects of shelf life of extrusion, irradiation, packaging of foods and beverages. Experts from academia, industry and research centers provide latest information along with very up to date bibliographies. A feature of this work is that some topics have been treated by experts from different countries, offering their own findings and insights: chocolate/cocoa is discussed in separate chapters by Dutch, French and United States scientists, wine by German, Spanish, French and United States colleagues, and so on.

I wish to thank the authors for their considerable efforts and the Publishers for their unfailing advice and assistance. I am also grateful to Dr Henryk Daun, Professor of Food Science at Rutgers University for contributing his own insights in the Introduction.

The Editor

INTRODUCTION

Modern society demands foods that are safe, nutritious, aesthetically appealing, readily available, convenient to use, and reasonably priced. Considerable progress in food science and technology and in many related areas over the past decades has made it possible to meet these challenges. New approaches such as food biotechnology or automated, computerized production lines, provide a basis for optimistic views on future food supplies.

Long distances between manufacturing centers and their retail sales destinations require preservation of quality over considerable periods of time. Shelf life, defined as the maximal period of time during which the predetermined quality attributes of food are retained, becomes a critical factor in the consumer acceptability and the economic feasibility of a product. Shelf life extension, using means acceptable to the consumer as well as regulatory requirements, remains a paramount aim of scientists working in diversified areas of raw materials, processing, packaging, transportation, wholesale and retail distribution, and preparation of foods.

The main mechanisms involved in the loss of food quality include chemical, physical and biological phenomena. Considerable effort is being made to determine the causes of quality deterioration and to develop preventive steps. The ultimate objective of these approaches is to determine the molecular basis of undesirable changes, and to modify food systems in order to achieve longer shelf life. The most common experimental solutions include model systems subjected to a set of preselected conditions. This method usually allows determination of scientifically correct relationships. The problem arises when an attempt is made to relate the results of these experiments to real food systems, which are most frequently extremely complex. The most common mistake is not to take into consideration several levels of structural organization of foods. In this respect, chemists are frequently further from reality than physico-chemists, who include parameters defining states of the matter. Structural characteristics of real food systems that are usually the controlling factors of many chemical, physical and biological processes have to be part of any interpretation of the data.

Another aspect of the complexity of real food systems is the multidirectional and multistage character of the processes involved. Although theoretically possible, it is not realistic to describe all geometrical attributes of appearance and to determine all chemical components and all physico-chemical and biological processes of the real food system. The number of chemicals involved is extremely large. An analysis that is aimed solely at the maximum number of identified compounds does not provide useful information. The selection of compounds that can be related to the sensory properties is most important. The mechanisms of these substances' retention and release and their proportions, may significantly influence quality attributes of foods.

Prediction of shelf life is a very important subject. The majority of current attempts are based on an assumption that quality changes follow zero order reactions, and that the rate of change at constant temperature is constant. This approach is useful and, in selected instances, allows correct approximation of shelf life. However, due to the complexity of the changes occurring, it is far from accurate. Some of the complications include multistage reactions that have different rates. Another aspect that I would like to call "cryptic changes" involves chemical or physical processes that are slow and not detectable externally for a long time. After a given period of storage these changes suddenly manifest themselves due to the accumulation of undesirable characteristics.

Similar effects can be observed when precursors of off-flavor are formed during storage (for example, in the frozen state) which do not appear before cooking but, immediately after heat processing undesirable flavor notes are determined. The cryptic quality changes that also include physical-chemical processes, related to texture for example, are not easy to predict but cannot be ignored.

Comprehensive approach to the determination of shelf life requires consideration of weight factors defining the importance of major attributes of food quality, such as safety, nutritional value and sensory properties. Since deterioration rates may be different for various attributes, the determination of the critical path of changes is required.

New achievements in basic sciences, better and more sophisticated analytical methods, as well as computerized acquisition and interpretations of data have created new possibilities for progress in the development of scientific principles of shelf life determination. The large number and high quality of publications related to shelf life, exemplified also by this book, demonstrate the continuing importance of this field.

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