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CHEMICAL CHANGES IN FOOD DURING PROCESSING

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Preface

This volume results from the Eighth Basic Symposium held by the Institute of Food Technologists in Anaheim, California on June 8–9, 1984. The theme of the symposium was "Chemical Changes in Food during Processing."

The speakers included a mix of individuals from academic institutions, governmental agencies, and the food industry. Twenty speakers discussed topics ranging from the basic chemistry relating to food constituents to the more applied aspects of chemical changes in food components during food processing.

It was the intent of the organizers to bring together a group of speakers who could address the chemistry of changes in food components during processing from a mechanistic point of view. As a consequence, the proceedings of this symposium emphasize the basic chemistry of changes in food constituents from a generic perspective which is intended to provide the reader with a background to address more specific problems that may arise.

The book is introduced with an overview of the major chemical changes in food during processing to orient the reader as to its scope and to give a general feel for the areas covered. A major part of the initial section of the volume focuses on the chemistry and biochemistry of oxygen and oxidative reactions as influenced by environmental factors, metals, enzymes, and ionizing radiation. These pervasive reactions are major causes for changes observed in foods during processing and storage. Recent emphasis given to the so-called "active-oxygen species" in initiating oxidative alterations in biological materials dictates a treatment of their relevance to changes in foods. Although we are accustomed to thinking of metals primarily in terms of redox reactions, a variety of ionic reactions catalyzed by these agents and their chelates is discussed from a mechanistic point of view.

There is a natural progression to free radical chemistry and alterations induced in lipids from autoxidation, from thermally induced

changes, from ionizing radiation, and from enzymatic modifications. Enzymatic oxygenation of lipids in plants may play a key role in their physiology analogous to the lipid oxidation cascade systems in animals. A major concern of the food scientist is to minimize damage from oxidative reactions in foods, and a basis is given for a better understanding of antioxygenesis at the molecular level.

Two groups of enzymes that are of principal importance to the food scientist are discussed in some detail. The oxidoreductases provide a basis for establishing blanching limits for fruits and vegetables. On the other hand, they can serve as focal points for undesirable changes in foods, as in enzymatic browning. The mechanistic discussions of selected oxidoreductases will give the reader a fundamental grasp of the diversity in how these enzymes effect change. The hydrolases are ubiquitous enzymes designed to use water for breaking down substrates in foods. However, an understanding of the mechanisms of hydrolases can provide the food scientist with opportunities for controlling or even diverting the course of their reactions.

Changes in biopolymers during processing can alter their physical and nutritional properties. The reader is treated to a comprehensive discussion of textural alterations in foods as affected by chemical, physical, and enzymatic changes in pectins, starches, and cellulose. Proteins possess a large number of side-chain functional groups subject to chemical alterations. A discussion of the reactivities of amino acid residues in proteins paves the way for a comprehensive discussion on the effects of environmental elements, such as heat, light, pH, and oxygen, on the amino acid residues of proteins. An important reaction affecting not only the nutritive quality of proteins but also the color and flavor of foods is nonenzymatic browning. Some new aspects relating to the polymeric products of the Maillard reaction are discussed.

Throughout this volume it is shown that the effects of environmental factors are constantly impacting on the quality of food constituents. This is especially true in the destruction of vitamins during food processing. A thorough discussion relates many environmental factors to rates of vitamin destruction. In addition to the kinetics of vitamin destruction under defined conditions, the organic reaction pathways involved in vitamin loss are detailed.

The organoleptic properties of foods cannot be underestimated. The aromas, taste, and colors of foods serve as a basis for the selection and palatability of foods which, in turn, contributes to consumer nutrition. The origins and changes in food flavors are complex, but are treated in this volume in a very thorough fashion from a sound chemical viewpoint. Likewise food colorants are represented by substances

as diverse as the lipophilic carotenoids to the water-soluble anthocyanins. The chapter on origins of colors as well as their alterations during food processing brings the reader abreast of current knowledge on chemical changes in the major natural food pigments.

As noted previously, the major environmental factors that impact on the quality of foods are well known. However, quantitative treatments of the complex interactions between food constituents and their environment are difficult and often require simplifying assumptions for adequate modeling.

The final chapter in the book includes a discussion of the effects of water activity, light intensity, oxygen concentration, and temperature on lipid oxidation, nonenzymatic browning, enzymatic reactions, and protein–lipid interactions. General models of environmental effects on food deterioration are illustrated by a case of optimization of dehydration to maximize nutrient retention in a dehydrated food.

This volume represents a broad treatment of chemical changes in food processing. The major components of foods are discussed without a commodity orientation but within the context of functional group chemistry of the functional constituents. It is hoped that thoughtful readers will find it of value in some aspect of their professional activities.

The success of the Eighth Basic Symposium was the result of the expert assistance of the members of the 1984 Basic Symposium Committee: Dr. Bernard J. Liska, 1984 President of IFT; Calvert L. Willey, Executive Director of IFT; John B. Klis, Director of Publications; and the IFT staff who provided support, publicity, and coordinated physical planning and details that make such a two-day symposium a success.

For the eighth time, John Klis coordinated all details of interface with the publisher, and Anna May Schenck, JFS Assistant Scientific Editor, served as copy editor for the proceedings. Their capabilities, professionalism, and patience in the face of pending deadlines have brought these proceedings to fruition.

However, it is to the authors of the chapters of this book that we owe our deepest gratitude. Without their expertise, persistence, and cooperation, this symposium and book would not have been possible.

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