

COOKING INNOVATIONS

USING HYDROCOLLOIDS FOR THICKENING,
GELLING, AND EMULSIFICATION



AMOS NUSSINOVITCH • MADOKA HIRASHIMA

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*To our mothers, Rebekah Nussinovitch and Nariko Hirashima, who gave us life,
taught us how to cook, and spiced our existence with knowledge, tradition, and love.*

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Preface

Hydrocolloids are among the most commonly used ingredients in the food industry. They function as thickeners, gelling agents, texturizers, stabilizers, and emulsifiers; in addition, they have applications in the areas of edible coatings and flavor release. Manufactured foods that are reformulated for reduced fat rely primarily on hydrocolloids to provide suitable sensory quality. Furthermore, hydrocolloids are currently finding increasing applications in the health arena: they provide low-calorie dietary fiber, among many other uses.

Many books have been devoted to a description of the different water-soluble polymers (hydrocolloids) and their uses. In 1969, a monograph by M. Glicksman, *Gum Technology in the Food Industry* (Academic Press), presented a technical compilation of information in the area of hydrocolloid technology as it pertains to the food industry. The need for such a book was apparent to most food technologists and scientists, particularly those engaged in the development of convenience foods. This book was followed by three more volumes by Glicksman (1982 to 1984) entitled *Food Hydrocolloids*, volumes I, II, and III (CRC Press). The first volume was composed of two parts, the first dealing with comparative properties of hydrocolloids and the second with biosynthetic gums. The second volume dealt with natural food exudates and seaweed extracts, and the third volume described cellulose gums, plant seed gums, and plant extracts. Those books were much more comprehensive than Glicksman's first monograph and were very useful for both food technologists and academics.

In 1980, an excellent book entitled *Handbook of Water-Soluble Gums and Resins* (McGraw Hill Company) was edited by R. L. Davidson. The book comprised 23 chapters written by advisors and contributors from universities and the industry. It contained information on where water-soluble gums and resins come from, how they are used, how they work, and their individual uses to obtain specific properties and performance. It gave an encyclopedic description of the major commercial varieties of both natural and synthetic gums and resins, each listing beginning with a concise overview, followed by full details on the chemistry, properties, handling uses, and other pertinent factors.

In 1997, a monograph by one of us (A. Nussinovitch) entitled *Hydrocolloid Applications: Gum Technology in the Food and Other Industries* (Blackie Academic & Professional) was published, composed of two parts. The first dealt briefly with a description of the known hydrocolloids. The second was devoted to information which is more difficult to locate, namely uses of hydrocolloids in ceramics, cosmetics, and explosives, for glues, for immobilization and encapsulation, in inks and paper, and for the creation of spongy matrices, textiles, and different texturized products. Another monograph by A. Nussinovitch entitled *Water-Soluble Polymer Application in Foods* (Blackwell Science) from 2003 was devoted to the uses of hydrocolloids in foods and in biotechnology, and discussed topics such hydrocolloid adhesives, hydrocolloid coatings, dry macro- and liquid-core capsules, multilayered products, flavor

encapsulation, texturization, cellular solids, and hydrocolloids in the production of special textures. Yet another monograph by A. Nussinovitch from 2010, *Plant Gum Exudates of the World: Sources, Distribution, Properties, and Applications* (CRC), provided a description of the most extensive collection of plant gum exudates in print. The book included a chapter specifically devoted to food uses of plant exudates, including confectionery, salad dressings and sauces, frozen products, spray-dried products, wine, adhesives, baked products, and beverages, among many other industrial products and animal foods.

In 2009, the 2nd edition of *Handbook of Hydrocolloids*, edited by G. O. Phillips and P. A. Williams, was published. This excellent manuscript reviewed over 25 hydrocolloids, covering their structure and properties, processing, functionality, applications, and regulatory status. In addition to the traditional hydrocolloids, the book emphasized protein hydrocolloids and protein–polysaccharide complexes, expanded the coverage of microbial polysaccharides, and also discussed the role of hydrocolloids in emulsification and as dietary fibers.

These are just a few examples of the wealth of material existing in this field of science. Note that the inclusion of a book in this short list does not imply that it is any better than other published books on hydrocolloids or their widespread applications.

Although some food recipes can be located in a few of these many books, there are no scientific books fully devoted to the fascinating topic of hydrocolloids and their unique applications in the kitchen. A kitchen can be regarded as an experimental laboratory, with food preparation and cookery involving processes that are well described by the chemical or physical sciences. Finally, it is well established that an understanding of the chemistry and physics of cooking and the involvement of different ingredients (such as hydrocolloids) in these processes will lead to improved performance and increased innovation in this realm. Since the use of hydrocolloids is on the rise in many fields, the writing of a book that covers both past and future uses of hydrocolloids in the kitchen is both timely and of great interest.

General Approach and Aims

Each chapter in this book addresses a particular hydrocolloid, protein hydrocolloid, or protein–polysaccharide complex, in alphabetical order. The chapter starts with a brief description of the chemical and physical nature of the hydrocolloid, its manufacture, and its biological/toxicological properties. It is important to note that this book is not intended as a replacement for the already published books on hydrocolloid properties (some of which are mentioned above); our aim is not to compete with or repeat any of the information found in those books. In the present book, the emphasis is on practical information for the professional chef and amateur cook alike. Furthermore, such a volume may serve to inspire cooking students, and to introduce food technologists to the myriad uses of hydrocolloids, how they are used and for what specific purposes. Each chapter includes a few recipes demonstrating that particular hydrocolloid's unique abilities in cooking and those abilities are elaborated upon. Several formulations were chosen specifically for the food technologist, who will be able to manipulate them for large-scale use or as a starting point for novel industrial formulations. In summary, the volume is written such that chefs, food engineers, food science

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