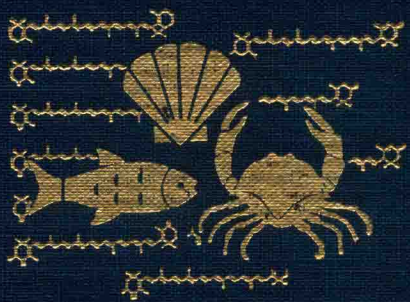

CHEMISTRY & BIOCHEMISTRY OF MARINE FOOD PRODUCTS

Chemistry & Biochemistry of Marine Food Products

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Preface

Although the food of aquatic and marine origin is this country's earliest food supply and the base for its oldest commercial industry, over the past many decades we, as a nation, have given up this heritage to a land-based protein economy.

With the congressional passage of the "Fishery Conservation and Management Act of 1976", today known as the 200-mile bill, this nation is being given a renewed opportunity to use and manage more than 20% of the world's seafood resources that happen to live within this 200-mile zone.

Twenty years ago, our food resources seemed inexhaustible. With today's technology, we know they are not. The demand for food protein will continue to grow as population expands. Food from the sea will provide an alternate source of this nourishment.

This volume represents the first attempt to draw together in one forum what we presently know about the chemistry and biochemistry of marine food products. The book is an expansion of a symposium held in 1979 during the American Chemical Society's Washington meeting.

This book is an attempt to emphasize the importance of chemistry and biochemistry to the complexities of fisheries technology and to provide a deeper understanding of those changes occurring in this resource. Fisheries are unique in our domestic food system because we have potentially some 250 species to work with, each with its own set of characteristics. When we expand our subject to include species from other parts of the world, we increase our matrix to more than 1000 kinds of fish and shellfish.

It is understandable, then, that we should attempt to bring together that basic body of knowledge upon which others can continue to expand.

This book also includes data and references translated from foreign sources that have not appeared elsewhere in U.S. scientific literature.

The scope of the book will give to the fisheries scientist and food technologist an immense appreciation for the complexities called fish as food and their by-products.

Acknowledgment

The authors are indebted to National Fisheries Institute, Inc., and the Sea Grant Program at Virginia Polytechnic Institute and State University for providing funds for making the publication possible.

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1

Lipid Oxidation in Fish Muscle Microsomes

H.O. Hultin, R.E. McDonald, and S.D. Kelleher

INTRODUCTION

Lipid oxidation is a major cause of spoilage in fish muscle. This is due to the highly unsaturated nature of the fatty acids in fish tissue. Fatty-type fish, such as mackerel and herring, can undergo lipid oxidation rapidly at refrigerator temperatures. It is generally not as significant a problem with nonfatty fish stored in the round or as fillets, since mircobial spoilage usually develops more rapidly than lipid oxidation. This occurs even though tissue enzymes are considered to be the principal problem in stored fish until approximately 6 days after storage, after which microbial deterioration becomes dominant. Lipid oxidation may become a problem in nonfatty fish which are minced, because of the incorporation of oxygen into the tissue or the disruption and intermixing of tissue components.

Although the general importance of lipid oxidation in fish tissue has been recognized, the mechanisms of the oxidative processes are not well understood. It is known that metals such as iron (Fe) catalyze lipid oxidation in fish (Castell 1971). The involvement of an enzyme system in lipid oxidation has not been confirmed.

It was first observed in 1963 that the microsomal fraction from liver was capable of catalyzing the oxidation of the microsomal lipids in the presence of reduced nicotinamide adenine dinucleotide phosphate (NADPH), O_2, and Fe (Hochstein and Ernster 1963). The oxidation was enhanced in the presence of adenosine diphosphate (ADP) or other pyrophosphates and appeared to be coupled to the NADPH oxidase system of the microsomes. Wills (1969) demonstrated that liver microsomes formed lipid peroxides when incubated with ascorbate or NADPH but not with NADH. Pfeifer and McCay (1971) reported the generation of free radicals during the oxidation of NADPH by

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