Post Mortem Changes in Fish

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To
My Wife
SASMITA
Acknowledgement

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B. K. Khuntia
Foreword

The demand for fish is increasing day-by-day due to the rapid growth of population and steep rise in the consumers' demand for healthy foods. At present, fish is not only treated as a cheap and easily available source of animal protein, it has also acquired an esteemed position as a rich source of $\omega-3$ fatty acids, the panacea for cardiovascular diseases. It has surpassed many food items to become one of the most popular healthy foods all over the world. At the same time the consumer is becoming more and more conscious about the quality of fish and fishery products available in the market. On the other hand, the production of fish has reached an almost stagnation in recent years. This invites for the effective utilisation of the produce without allowing a bit of it to be wasted. As fish is a highly perishable food commodity, it needs greater care than most of the other food materials.

Several changes occur in the fish body after death. These post mortem changes gradually lead to the loss of quality ultimately resulting in its spoilage. A thorough understanding of these post mortem changes is required to meticulously manipulate them so as to retain its quality over a prolonged period of time. This will not only help in providing the consumer with good quality fish and fishery products, it will also reduce the wastage of fish resulting from its spoilage. This book entitled “Post Mortem Changes in Fish” authored by Dr. B. K. Khuntia, Associate Professor, College of Fisheries, Orissa University of Agriculture and Technology, contains an in-depth description of these post mortem changes such as hyperaemia, rigor mortis, autolysis, microbial putrefaction, lipid autoxidation and discoloration. The intricate mechanisms of these changes have been described in a lucid manner with several illustrations.

I congratulate Dr. Khuntia for his untiring efforts in preparing such an exhaustive and illustrated book. I am sure this book will be an invaluable asset for the students, teachers, researchers, professionals, traders, fish processing technologists and all those involved in fish processing.

Dr. S. Ayyappan
Deputy Director General (Fisheries)
Indian Council of Agricultural Research
New Delhi
Preface

Fish, as a food commodity, has been associated with man since time immemorial. It is a nutritionally rich, cheap source of animal protein. At present, it is gaining additional importance among the affluent people due to their increasing awareness about its unique nutritional properties not found in any other food commodity. Although advancement in technology of fishing and aquaculture has resulted in increasing the production of fish, its effective utilisation has not yet met with the expected success, particularly in the tropical developing countries. A large portion of the total world fish catch is either discarded or sold at a low price due to the fast deterioration of its quality. The problem is more precarious in the tropical countries where the high ambient temperature further enhances the rate of quality deterioration.

Fish is a highly perishable food commodity as its quality starts deteriorating immediately after death. The lion’s share of the total world fish catch is consumed fresh in which the post mortem changes have tremendous influence on quality. Moreover, the quality of processed fishery products depends largely on the quality of the raw material which in turn depends on the post mortem changes. As no processing method can improve the quality of fish, it is imperative to take utmost care to minimise the post mortem deteriorative processes occurring in the fish body. This necessitates a thorough understanding of the processes, which occur in the fish body after death so that the factors influencing these processes can be manipulated to minimise the deteriorative processes. The book has been written to provide some basic knowledge about the post mortem changes which occur in fish and the ways they can be controlled desirably.

The book elaborates various aspects of the post mortem changes in fish through a number of illustrations. There are seven Chapters in the book, each followed by a summary. In addition, there are nine Text Boxes, which provide further information related to the post mortem changes. The book may be introduced as a textbook at postgraduate level for students specialising in fish processing. For undergraduate students of fisheries, the summary at the end of each chapter is quite adequate to brief them the fundamentals of changes in fish body after death. This will open the window for further understanding of other subjects in fish processing. The book shall be useful to students, teachers, researchers, extension personnel and all associated with fish processing. The author cordially invites critical comments and suggestions for further improvement in the quality of the book in future.

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I. What are Post Mortem Changes?

Fish has been a lucrative food item since ancient times. Besides its use as food, it has gained additional importance in recent years because of its agricultural, industrial, medicinal and ornamental uses. In most cases, its ultimate utilisation needs its ‘carcass’ or the dead body. For its utilisation, fish is harvested from its aquatic habitat, which leads to its death. After death several changes take place in its body. These changes are collectively called ‘post mortem changes’ (post: after; mortem: death). They can be grouped into the following six steps mentioned in the order of their occurrence after death.

1. Hyperaemia
   In this step, the skin of fish releases large quantity of mucus to the body surface.

2. Rigor Mortis
   During rigor mortis (rigor: stiffening; mortis: death) the body of fish stiffens for a certain length of time after death.

3. Autolysis
   In autolysis (auto: self; lysis: break down) the complex tissue components of fish body such as proteins, fats (lipids) and nucleic acids are hydrolysed or broken down into their simple building blocks by the enzymes present in the fish body (endogenous enzymes). Proteins are hydrolysed to amino acids; fats to fatty acids and glycerol and nucleic acids to nucleotides as given below. Due to hydrolysis of proteins, which are the important structural component of fish tissue, autolysis results in the softening of fish tissue. The end products of hydrolysis become a nutrient-rich medium for the growth of microbes.

   Proteins $\rightarrow$ Amino acids
   Fats $\rightarrow$ Fatty acids + glycerol
   Nucleic acids (RNA & DNA) $\rightarrow$ Nucleotides

4. Microbial Putrefaction or Decomposition
   In this step, the tissue components of fish, intact or hydrolysed through autolysis, are decomposed by microorganisms into off-odour, off-flavour substances accumulation of which distracts the consumers and thereby results in the spoilage of fish.