

**M.S.102. DAMODARAN NAMBOODIRI, D.—Enzyme Reactions as Index of Freshness of Fish and Shellfish—1988—  
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This thesis reports the findings of a study on the potentiality of certain endogenous enzyme systems as tools of quality control of fish and shellfish. A citivity determinations of the four enzymes viz.  $\text{Ca}^{2+}$  ATPase, lipoamide reductase, lactate dehydrogenase and 5' AMP deaminase were carried out in the species mrigal, mullet, pearlspot, milkfish, tilapia and *Penaeus indicus* during the period of iced and frozen storage.

Significant loss of activity was observed in the cytoplasmic enzymes lactate dehydrogenase and 5' AMP deaminase in fish and shellfish subjected to ice storage. Highly significant correlations were observed between activities of the enzymes LDH and 5' AMP deaminase in ice stored fish and shellfish and freshness indices such as total volatile nitrogen,  $\alpha$ -amino nitrogen, free fatty acid and overall acceptability score. Critical values of enzyme activities below which the samples are considered unacceptable were computed based on the above results. Critical values of LDH specific activities in most of the species studied ranged from 312.1 to 545.0 (NADH  $\mu$  mole/min/mg protein). Limiting values of 5' AMP deaminase specific activity (expressed as units/mg protein) ranged from 1.38–2.92. Although loss in activities of the enzymes  $\text{Ca}^{2+}$  ATPase and lipoamide reductase were observed in a few species subjected to storage in ice, this trend

was not consistent and significant in the remaining species.

Studies on the effect of freezing and thawing on enzyme activity in press juice of fish muscles have shown that the substantial increase in the activity of lipamide reductase can be employed in distinguishing fresh fish from that which has been frozen and thawed.

Prolonged cold storage ( $-20^{\circ}\text{C}$ ) of fish and shellfish resulted in a steady decrease in the activities of the enzymes  $\text{Ca}^{2+}$  ATPase and lactate dehydrogenase. Significant correlations were observed between fall in enzyme activity and other biochemical and sensory tests for freshness. Based on these results critical values of enzyme activities were determined. In the case of fish muscle  $\text{Ca}^{2+}$  ATPase, limiting value was in the range of  $0.011\text{--}0.088 \mu$  mole  $\text{Pi}/\text{min}/\text{mg}$  protein and that of LDH activity ranged from 174.1 to 204.3 NADH  $\mu$  mole/ $\text{min}/\text{mg}$  protein. These results indicate that activities of the above two enzymes can be used as indices of freshness of fish and shellfish subjected to frozen storage ( $-20^{\circ}\text{C}$ ).

A study was conducted on cold shock reactions in several species of freshwater, brackish water and marine species of fish. When compared to storage at room temperature, chilling resulted in rapid onset of stiffening in the various species studied. A comparative study on the bio-chemical characteristics of cold shock reactions at  $0^{\circ}\text{C}$  and rigor mortis at room temperature was carried out to find out the subtle differences between the two phenomena. A definite lowering in muscle PH was found associated with stiffening at  $0^{\circ}\text{C}$ . Muscle glycogen content also decreased similarly. ATPase activity in fish muscle was determined to find out the extent of denaturation of myofibrillar proteins. Although ATPase activity at the time of onset of stiffening at  $0^{\circ}\text{C}$  was higher than activity at the time of death, it was found lower than in fish muscle undergoing rigor at room temperature. Studies on the effect of exposure to different temperatures on the onset of stiffening in tropical fishes have shown an intense thermal shock in fishes exposed to  $37^{\circ}\text{C}$ .