

**M.S.58. CHINNAMMA GEORGE—Biochemical changes associated with processing of shellfishes and flavour constituents of body meat and claw meat of crab—1985—
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Industrial processing of crabs, mussels and clams although taken widely in India has not shown rapid strides as expected in terms of quantity inspite of heavy demands from overseas markets. This is largely due to the lack of precise information on the resources and absence of technical data on the amenability to processing of the different varieties available. The high labour costs involved in harvesting and separating the muscle from the shell and the subsequent removal of sand from the meat (clam) also hinder their industrial processing economically. This investigation is carried out with a view to understanding of many of such aspects with direct application to the seafood industry.

From the size-weight measurements of crab (*Scylla serrata*) the whole weight and meat weight can be computed if length alone is known. Crab body meat and claw meat differ markedly in organoleptic qualities. The difference is established in terms of bio-chemical characteristics. The seasonal influence on bio-chemical parameters of crab muscle is another piece of study.

From the results it is concluded that season has profound influence on chemical composition and it is known to affect the qualitative and quantitative nature of the microflora associated with fish and fishery products. Changes in quality of crab muscle stored at different temperatures viz. 37°C, 25-28°C, 6.5-7.5°C and 0°C are studied. High temperatures enhance rapid spoilage. In live crabs the flesh is held to the shell by a membrane making it difficult to remove the meat.

If it is stored in ice for 18-24 hours, the membrane breaks down and the flesh can be easily taken out as flakes. The high rate of spoilage in shellfishes may be attributed to the high percentage of free amino acids (in crab muscle about 50% of the non-protein nitrogen fraction is amino nitrogen). There is a slow but gradual decrease in the sarcoplasmic protein fraction in crab muscle frozen and stored at -23°C , but the extractability of myofibrillar protein diminished at a faster rate compared to other protein fractions. The adenosine triphosphatase activity of actomyosin dropped from 24.3 to 0.098 $\mu\text{g}/\text{Pi}/\text{mg}$ protein/minute during a period of 48 weeks. The development of tough texture during frozen storage of fishery products can be correlated to the protein denaturation leading to the loss of water holding capacity of the muscle. The drip loss increased with frozen storage life and the frozen storage quality is found to have a direct bearing on the pre-freezing ice storage life.

The use of harmless chemical glazes in retarding the deleterious changes due to freezing and storage is studied and found that a mixture of ascorbic-citric acids (1% solution in the ratio 1:4) is distinctly advantageous in prolonging the shelf-life of frozen crab muscle. The optimum cooking time for crabs in boiling water or steam without pressure is 15 minutes. Four series of studies were conducted under varying conditions of raw materials to compare the frozen storage characteristics. The details of the study is given below:

1. cooked and iced vs iced and cooked
2. raw vs cooked shellon
3. raw vs cooked meat alone and
4. raw vs cooked claw with shellon

Canning conditions are standardised to prepare good quality canned product. The nutrients lost in brine is also estimated.

The relation between height and length and height and meat weight are studied for wild and cultured variety of mussels (*Perna viridis*). Proximate chemical composition, protein fractions and free amino acid patterns are reported. The relation between age and chemical constituents are also studied. The results prove the existence of highly significant correlation between height and alpha amino nitrogen, glycogen and ribose. Biochemical, bacteriological and organoleptic changes in mussels stored in ice proved that in 10 days time the material reached the stage of Fair to Poor (score 4 on hedonic scale) with slight loss of characteristic flavour and yellowish discolouration.

Under frozen storage the changes observed in mussel meat are:

- (1) colour changed from white to dull white and to brown as spoilage increased.
- (2) the firmness and elasticity of the material is replaced by sponginess accompanied by fluid loss.
- (3) loss of characteristic sweet flavour.

Standard plate count during ice storage showed steady increase. But during freezing and storage after 44 weeks at -23°C , the viable count came down by 99%. Reduction in pathogenic organisms like *E. coli* and *F. streptococci* is observed. *E. coli* is completely destroyed towards the end. Studies on cooked frozen mussel meat revealed that precooked and iced lot had more shelf-life (38 weeks) than pre-iced and cooked samples (16 weeks). Discolouration and hardening of texture increased with progressive pre-process-ice storage.

Canning procedure was standardised for mussel meat and nutrients lost in

brine was worked out.

The length-height relationship was worked out for clams (*Villorita* sp.). The correlation coefficient was highly significant. The studies on proximate composition of clam meat revealed wide variation during different seasons of the year especially in protein, amino acids, glycogen, ribose and fat contents. Retention of sand in the muscle was occurred even if care was taken to remove the gut portion. Regarding food value, clam meat is slightly inferior to crab or mussel meat. Protein fractions isolated from clam muscle revealed more percentage of sarcoplasmic proteins and lesser quantity of myofibrillar protein than crab and mussel.

The free amino acid pattern of clam muscle is also reported. Live clams stored in ice had a self-life of 9 days. A good correlation was obtained between quality determined organoleptically and the amounts of water soluble nitrogen, free amino nitrogen, glycogen and inorganic phosphorous retained in the muscle. During frozen storage the soluble protein was dropped from 63.0 to 55.0% in uniced samples and from 59.4 to 47.3% in samples iced for 8 days. The loss in solubility of muscle protein was related to the change in texture, water holding capacity of the muscle and the loss of juiciness. The uniced samples had a shelf-life of 35 weeks and that of 8 days iced sample had only 4 weeks.

The total plate count decreased during frozen storage. The pathogenic organisms like *E. coli* and *F. streptococci* also showed the same trend.

The analytical date of the canned products prepared from clams stored under ice up to 13 days is presented. Due to high concentration of glycogen in mussel and clam black precipitate was formed during colour development for ribose estimation according to standard Mejbaum's method. Remedial steps were worked out to prevent precipitation with $95 \pm 5\%$ accuracy.

The results of the investigations prove that a number of parameters as reported in this work have to be considered and evaluated both at harvesting and subsequent post-harvesting and processing of these valuable food commodity if it is to be an economically viable proposition industrially.