Quality and safety concerns of formaldehyde treated Indian mackerel

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Seafoods forms an important part of a healthy diet, but chemical contamination of seafood may lead to serious food-borne diseases. Marketing of formaldehyde contaminated fish in our country is posing a dangerous threat to fish consumers. Seafood vendors tend to use intentionally and carelessly formaldehyde to prevent fish from spoiling and to increase the storage time with reduced usage of ice. Food Safety and Standard Authority of India (FSSAI) have issued many newspaper reports on the marketing of formalin added fish coming from other states to markets of Kerala. Formaldehyde is a very reactive chemical which is being used as disinfectant and for preserving dead bodies. Apart from that, it is used widely in many industries like textile, paper, plastics and paint, etc. It is often added to food for pleasing the consumers, but this chemical poses serious threat to human health mainly due to its carcinogenic nature. Formaldehyde can also be developed during post-mortem in marine fish and crustaceans, from the enzymatic reduction of Trimethylamine-Oxide (TMAO) to equimolar amounts of formaldehyde and Dimethylamine (DMA). The commercially available form of formaldehyde is 30-50% aqueous solution. It is classified as a Group 1 carcinogen by the International Agency for Research on Cancer (IARC). Because of its adverse effects to human health it is prohibited under the Food Regulation Act-1985. According to the United States Environmental Protection Agency (USEPA), maximum daily reference dose (RfD) for formaldehyde is 0.2 mg/ kg body weight per day.

Since seafood is one of the most important food protein sources in India, intake of formaldehyde from contaminated fish is of great concern for human health. There is no information available on the formaldehyde residual level in formaldehyde treated fishes during ice storage and the associated biochemical, microbial and sensory changes. A detailed study was conducted at ICAR-CIFT to establish chemical safety of the formaldehyde contaminated or treated fish using the method of Castell and Smith (1973). The formaldehyde is formed naturally in the fish, the base level concentration was found to be 1.24 ± 0.02 mg/ kg in the untreated fish in minute quantities. The levels in control and treated samples were significantly different ($p<0.05$). The formaldehyde, which is taken into the fish gets washed out during the chilling process as indicated in Fig. 1.

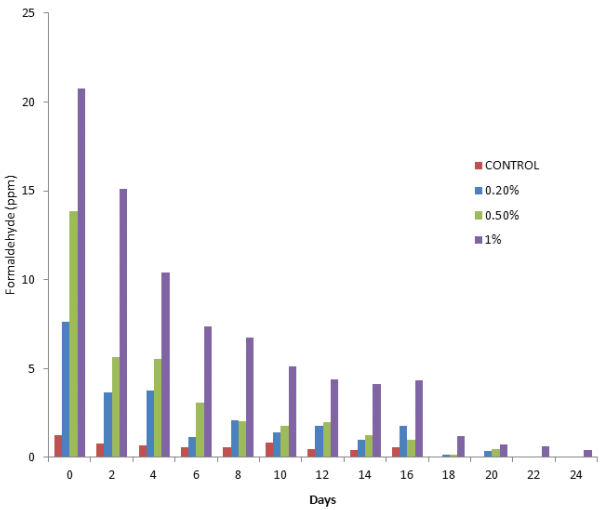

Fig. 1. Changes in residual level of formaldehyde in control and treated samples during ice storage

There was a statistically significant ($p<0.05$) decrease of formaldehyde content of treated samples during iced storage. A gradual increase of pH value was observed in both control and treated samples during iced storage. The pH of control sample on the 0th day was 6.49 ± 0 which increased to 6.76 ± 0.3. TVBN showed an initial increase just after treatment of the samples. The initial TVBN level of 13.2 ± 2.9 for the control sample increased by 16, 18 and 20 mg% with 0.2, 0.5 and 1% treated samples for unknown reasons. The final TVBN values of treated samples were much less than that of control on the day of rejection supporting the bactericidal action of formaldehyde. But the loss of formaldehyde could be facilitating the increasing of TVBN during the latter stages of storage. Initial aerobic plate count in untreated fresh mackerel was 4 log cfu/g, whereas the mackerel treated with 0.2%, 0.5% and 1% was 2.43 log cfu/g, 2.04 log cfu/g and 1.5 log cfu/g respectively indicating the bactericidal action of formaldehyde. The aerobic plate counts were the lowest in 1% formaldehyde treated samples, but aerobic counts of 0.2% and 0.5% treated samples were not showing much difference. Aerobic plate count of fish was typically 10^6 -10^8 at the point of sensory rejection. The shelf life of chilled fish increased gradually from 12 days to 20, 20 and 24 days, respectively for control, 0.2, 0.5 and 1% formaldehyde treated samples and this can mislead the fish consumers while purchasing and ultimately threaten the health of fish consumers.

Reference

Castell, C.H. and Smith, B. (1973) - Measurement of formaldehyde in fish muscle using TCA extraction and the Nash reagent. *J. Fisheries Res. Bd. Canada*, **30:** 91-98.