Extension of shelf life of marinated Tilapia (*Oreochromis mossambicus*) fillets during chilled storage: Effect of high pressure and vacuum packaging

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Demand for fresh, additive-free and safe seafood products have stimulated efforts to discover novel processing methods to extend the shelf life of fresh products with minimum quality loss. The quality and safety of food products are the two factors that influence the choices of today's increasingly demanding consumers. Often, marination of fresh fish is employed to improve flavour and tenderness of the product. Conventional food sterilization and preservation methods often result in a number of undesired changes in foods, such as loss of smell, colour, flavour, texture, and nutritional value of the final product. High pressure (HP) processing, or High hydrostatic pressure (HHP) processing, or Ultra high pressure (UHP) processing is a relatively non-thermal food processing method that subjects liquid or solid foods, to a pressure between 100 to1000 MPa (Hogan *et al.*, 2005). Extensive investigations have revealed the potential benefits of high pressure processing as an alternative to heat treatment. These benefits are apparent in various areas of fish processing, such as the inactivation of microorganisms and enzymes, denaturation and alteration of the functionality of proteins and structural changes to the materials. Tilapia is currently one of the most popular cultivated fresh- water fish in the world, to such an extent that it has been called the fish of the future (www.delishably.com). In the present study, high pressure processing was investigated for its effects on quality and shelf life of fresh tilapia fillets in combination with vacuum packaging, which is a popular method of extending the shelf life of food products.

Fresh farmed tilapia each weighing 100 g were divided into six batches. One batch was kept as control air packed without marination. The other five bathes were marinated with spice condiments and kept for 30 min. One batch of marinated sample was air packed, the 2nd was vacuum packed and the 3rd was subjected to vacuum marination for 10 min. To compare the effect of vacuum impregnation of condiments into the fillets. All the above four lots were packed in polyeter/polythene laminated films. The remaining two marinated samples were subjected to pressure processing in High pressure equipment (Model No: FPG7100:9/2C, Stansted Fluid Power Ltd., Essex, UK) at pressure levels of 200 MPa and 400MPa with a ramp rate of 600 MPa and a holding time of 5 min. (Figs. 1-3).

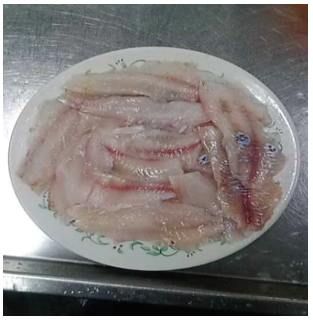

Fig. 1. Raw tilapia fillets

Fig. 2. Marinated tilapia fillets

Hardness of tilapia fillets (25 mm x 25 mm x 10 mm) measured using a Universal Texture Testing machine (Lloyd Model LRX, Fareham Hand, UK) were found to be decreasing in all the samples during chilled storage. The decreasing trend was less pronounced in pressure treated samples, with a least reduction in 400 MPa treated samples. Chemical analysis did not show significant difference in pH values between pressure treated samples at 200 MPa and 400 MPa, but the treatments showed an increasing trend during storage.

An increase in Total Volatile Base Nitrogen (TVB-N) values was found in all the samples, during storage with higher values in non-marinated AP control (25.12 mg N_2/100 gm) than marinated samples. The pressure treatment at 200 MPa and 400 MPa showed highest impact in reducing the TVB-N values, perhaps due to partial inhibition of bacterial growth. The oxidation indices values also increased during storage in all the treatments, but the effect of high pressure had a strong influence in reducing the PV, FFA and TBA values. Even though a marginal increase in oxidation rate

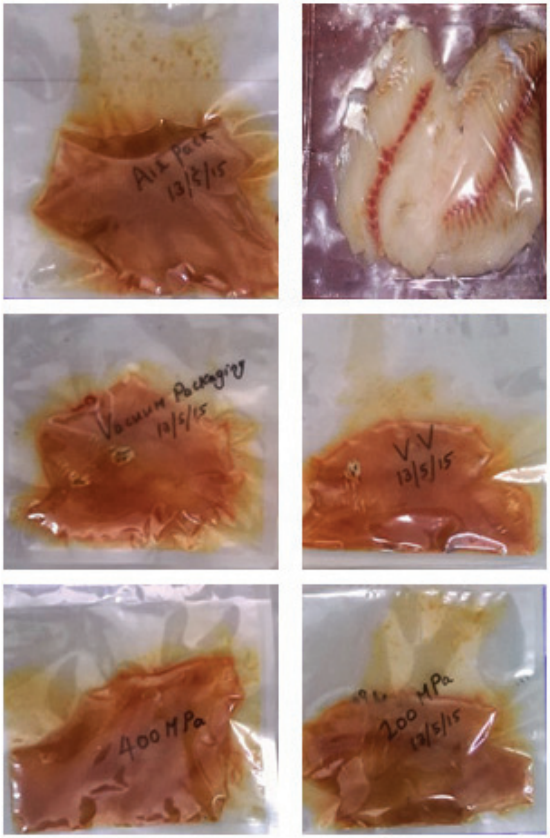

Fig. 3. Tilapia fillets with different treatments (A - Marinated air packed, B - Non-marinated, C - Vacuum packed, D - Double vacuum packed, E - 400 MPa treated, F - 200 MPa treated)

of high pressure processed samples in the initial phase was observed, pressure level of 400 MPa was optimal in controlling proteolysis, and TVB-N formation.

The average aerobic mesophilic count indicated that vacuum marinated-pressure processed (200 and 400 MPa) samples had a shelf life of more than 27 days, whereasmarinated air and vacuum packed samples were rejected before 27 days. The control samples without marination had only 11 days of shelf life. Maximum shelf life was indicated by marinated tilapia processed under 400 MPa pressure, with more than 30 days of storage. The inactivation of vegetative microorganisms during pressure treatment may be due to changes in the permeability of the cell membrane resulting in improper transport mechanism, finally leading to lack of nutrients and cell death.

Application of high pressure improved the shelf life of marinated tilapia compared to conventional method of packing. The pressure level of 400 MPa was found to be optimal and most effective in prolonging the storage period to more than 30 days in chilled condition. The results of present study suggests that HPP as a commercially feasible processing solution over traditional processing methods for production of shelf-stable high value fisheries products.

References

Hogan, E., Kelly, A.L. and Sun, D. (2005) - High Pressure Processing of Foods: An Overview (Eds.) R. Paul Sing and Dennis R. Heldman, Introduction to Food Engineering, Elsevier Publishers, Page 3.

http://delishably.com/food-industry/Why Tilapia is the fish of the future