

Increase in the Shelf Life Anchovy (*Engraulis ringens*) from Flaying then Bleeding in a Sodium Citrate Solution

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Abstract : The objective of this study was to investigate the effect of flaying then bleeding anchovy (*Engraulis ringens*) immersed within a sodium citrate solution. Anchovy is a pelagic fish that readily deteriorates due to its high content of polyunsaturated fatty acids. As such, within the Peruvian food industry, the shelf life of frozen anchovy is explicitly 6 months, this short duration imparts a barrier to use for direct consumption human. Thus, almost all capture of anchovy by the fishing industry is eventually used in the production of fishmeal. We offer this an alternative to its typical production process in order to increase shelf life. In the present study, 100 kg of anchovies were captured and immediately mixed with ice on ship, maintaining a high quality sensory metric (e.g., with color blue in back) while still arriving for processing less than 2 h after capture. Anchovies with fat content of 3% were immediately flayed (i.e., reducing subcutaneous fat), beheaded, gutted and bled (i.e., removing hemoglobin) by immersion in water (Control) or in a solution of 2.5% sodium citrate (treatment), then subsequently frozen at -30 °C for 8 h in 2 kg batches. Subsequent glazing and storage at -25 °C for 14 months completed the experiments parameters. The peroxide value (PV), acidity (A), fatty acid profile (FAP), thiobarbituric acid reactive substances (TBARS), heme iron (HI), pH and sensory attributes of the samples were evaluated monthly. The results of the PV, TBARS, A, pH and sensory analyses displayed significant differences ($p < 0.05$) between treatment and control sample; where the sodium citrate treated samples showed increased preservation features. Specifically, at the beginning of the study, flayed, beheaded, gutted and bled anchovies displayed low content of fat (1.5%) with moderate amount of PV, A and TBARS, and were not rejected by sensory analysis. HI values and FAP displayed varying behavior, however, results of HI did not reveal a decreasing trend. This result is indicative of the fact that levels of iron were maintained as HI and did not convert into no heme iron, which is known to be the primary catalyst of lipid oxidation in fish. According to the FAP results, the major quantity of fatty acid was of polyunsaturated fatty acid (PFA) followed by saturated fatty acid (SFA) and then monounsaturated fatty acid (MFA). According to sensory analysis, the shelf life of flayed, beheaded and gutted anchovy (control and treatment) was 14 months. This shelf life was reached at laboratory level because high quality anchovies were used and immediately flayed, beheaded, gutted, bled and frozen. Therefore, it is possible to maintain the shelf life of anchovies for a long time. Overall, this method displayed a large increase in shelf life relative to that commonly seen for anchovies in this industry. However, these results should be extrapolated at industrial scales to propose better processing conditions and improve the quality of anchovy for direct human consumption.

Keywords : citrate sodium solution, heme iron, polyunsaturated fatty acids, shelf life of frozen anchovy

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