The Effect of Alkaline and Acid Washings on The Quality Attributes of Tilapia Muscle

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Introduction

Tilapia occupies an important place in freshwater fish trade in Malaysia. However, one of the major problems associated with marketing of tilapia, in particular black tilapia, is their poor acceptability due to the presence of earthy odour and flavour. Geosmin and 2-methylisoborneol are the principle compounds responsible for the earthy odour and flavour in fish. Their presence in the black tilapia muscle cultured in the ex-mining pool in Malaysia was also confirmed by a GCMS study of the volatile flavour and off-flavour components of the tilapia muscle carried out in our laboratory. Washing can reduce the earthy odour and flavour in fish. Washing of freshwater fish with tamarind pulp, lemon juice, vinegar or a mixture of them to remove the earthy odour and flovour is a common practice in Malaysia and its effectiveness has been proven in breaded tilapia. The Indian continent practices washing with alkali solutions for the removal of such properties. Since those juices contain organic acids as one of their main constituents, therefore, for industrial purposes these practices can be translated into washing with dilute organic acids. No report on the removal of the earthy odour and flavour by acid washing such as acetic, citric and tartaric acid is found. Hence, the effects on these treatments on the physico-chemical and the sensory properties of the fish muscle need to be looked into. Therefore, studies were conducted to determine effect of selected organic acids and alkali washings on the muddy characteristic removal and their effects on the physico-chemical properties of the tilapia muscle.

Materials and Methods

Black tilapia (Oroechromis mossambicus), weighing 150 to 300g, 15 to 20cm long was obtained from local farm. Live fish was killed by a blow. They were then dressed and filleted. The fillets were then rinsed with chilled water (3-5°C) to remove blood, slime and other unwanted materials. The fillets were drained to remove excess water before been washed in the respective acids or alkaline solutions. The ratio of alkaline/acid solutions to fillet was 4:1. Several quality indices were determined. They were pH of muscle, color (sensory and instrumental), rancidity, protein stability, thermal properties of muscle (DSC) to name a few. Two separate trials were carried out to determine seasonal variations.

Results and Discussion

Sodium and potassium hydroxide solutions were the alkali used for washings. KOH was found to have more significant effect in majority of the quality indicators determined. Both the alkali showed slightly different trends on their influence on the quality attributes of the fish muscle. This is perhaps due to their different diffusibility rates. KOH treatments resulted in a significant reduction in the muddy odour of the muscle.

The effectiveness of the acid washing treatments in the removal of the muddy component varies with the acid used. The acids also had the ability to camouflage the muddy characteristics as commented by the panelists. Unlike the alkali washing treatment, the reduction of the muddy odour and flavour works through a different mechanism whereby the apparent absence of geosmin (since through GCMS analysis) can be due to the conversion of the geosmin into an odourless compound i.e. argosmin beside the possibility that it is leached into the washed water. Increasing the concentration of all acids above 0.125M seems to result in negative effects to the fish muscle characteristics. Texture of the fish muscle becomes fibrous and increase in opacity unlike in alkali washings where the muscle turned into gel-like translucent substance. Increase in the yellowness of the samples were also observed. All quality indicators monitored tend to indicate that acid washings may be superior to alkali washings, however, the main drawback is the depth of penetration of the acid into the muscle. The outer muscle layers were found to denature and thus formed a distinct outer zone preventing futher penetration of the acids from the washed solution into the interior layer. Hence decreasing the effectiveness of the treatment since the denatured layer will also prevent the leaching of the geosmin and 2-methylisoborneol (MIB). Electron microscopy also showed that the muscle had different pattern of denaturing upon exposure to different acids.

Conclusions

The acid washings of the fish muscle are effective in reducing the muddy flavour and odour of the fish muscle. It also has the ability to camouflage the muddy character. The effectiveness of the acid washings varies. Washings should not be carried out with acid concentration above 0.125 M when the contact time is for 10 min. The noticeable textural degradation is different from that observed in alkali washings. Both acid and alkali washings can produce positive quality attributes, but they were to be used at different contact time and concentrations.

Benefits from the study

Development of procedures for the reduction of muddy flavor and odor in freshwater fish, which is applicable for industrial application. This will increase the value of the fish either as minimally processed products or an raw materials for processed products.

Patent(s), if applicable:

Not applicable for time being

Stage of Commercialization, if applicable:

Have potential, but requires the interest of the private sector.

Project Publications in Refereed Journals

1. Nurul Izzah, A., Ahmad, F.B.H., Jamilah, B. and Yusoff, S. 2000. Volatile flavour and off-flavour components in black tilapia (O.mossambica) cultured in ex-tin mines. Research Journal of Chemistry and Environment. 4(3): 67-72.

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13. Abu Bakar, F., Jamilah, B., Hassan, Z. and Ali, A.R. 2000. Effect of acid washings on the microbiological characteristics of red tilapia (Mossambicus nilotica) fillets during storage. Proc. of the 23th Microbiology Symposium., Aseania Resort, Langkawi, 19-21 Nov., 2000. p 241-244.

Graduate Research

Name of Graduate	Research Topic	Field of Expertise	Degree Awarded	Graduation Year
Nurul Izzah Ahmad	Extraction, characterization and removal of muddy characteristics in tilapia fillets	Food Processing and chemistry	MSc	completed
Anida Yusoff	Effect of alkaline washings on the rancidity development in tilapia fillets	Food processing and preservation	MSc	Completed
Azelina Shaari	Development of fish chips with treated tilapia fillets	Food processing and preservations	MSc	Draft thesis submitted

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