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Research Paper

Fish Analysis Containing Biogenic Amines Using Gas Chromatography Flame Ionization Detector

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Abstract
Biogenic amines generally can be found in fish due to amines in fish undergoing a degradation process. According to the United States Food and Drug Administration (FDA), biogenic amines in fish and fish products can cause harm to consumers if consumed more than 50 µg/mL. Thus, it is important to analyze them. Five biogenic amines such as heptylamine, histamine, tyramine, cadaverine and spermidine were extracted using soaking method with methanol 50% (v/v), afterward they were detected in fish and fish products using gas chromatography – flame ionisation detector (GC-FID) and the biogenic amines structures were confirmed using mass spectrometry (MS). The detection limits (DLs) were range at 1.20 – 2.90 µg/mL. Histamine was detected in fish and fish products such as sardine (Sardinella gibosa) and mackerel (Scomberomorus guttatus) at concentration of 5.96 and 2.69 µg/mL, respectively, whereas cadaverine was found in sardine (Sardinella gibosa) at concentration of 4.96 µg/mL. Histamine concentrations in this study were detected below 50 µg/mL which is below the permissible threshold associated with scombroid poisoing.

Keywords
Biogenic amines, gas chromatography, fish, detection limit

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1. INTRODUCTION

Biogenic amines are compounds that contain nitrogenous and having low molecular weight and based on chemical structures can be categorized such as aliphatic, aromatic and heterocyclic. They can also be classified based on the number of amine groups such as monoamines are tyramine and phenylethylamine, diamines are putrescine and cadaverine and polyamines for spermidine and spermine (Liu et al., 2020). Biogenic amines generally can be found in food that containing protein such as meat, fish, milk, vegetables, yoghurt and their products. The presence of biogenic amines in protein foods can be shaped through amino acids decarboxylation with the presence of a particular bacterial straion, or by amination and transamination of ketones and aldehydes (Gama and Rocha, 2020) .

Several factors considered as main factors that increase biogenic amines accumulation in food such manufacturing processes, water activity, acidulant and sweetening reagents food physico-chemical parameters (pH, NaCl and ripening temperature) and presence of decarboxylase-posotive microorganisms and free amino acids. All of these factors influence the bacteria population in fish (Hidalgo et al., 2016). Histamine is a special issue compared to other biogenic amines. Studies have reported that histamine is a chemical compound that naturally found in human body but when ingested in high quantity from food, it can cause histamine poisoning. The FDA also stated that histamine concentration safely consumed at below 50 µg/mL (Food et al., 2011). Histamine poisoning or called Scombroid poisoning is the most common food borne diseases related to fish consumption and related to Scombroidae family such as mackerel, sardine, tuna, blue fish and mahi-mahi (Qiao et al., 2020). Several approaches have been applied in order to determine biogenic amines, such as thin layer chromatography (TLC), high performance liquid chromatography (HPLC) and gas chromatography (GC) (Aflaki et al., 2015). Biogenic amines detection are imperative and there are some reasons to analyse biogenic amines in food such as to modify the current methods, to determine the biogenic amines concentration form other countries using valid techniques and to indicate food quality and potential toxicity.

The detector in chromatography instruments has an important role to convert the analyte analysed into a signal that can be measured where the signal related to concentration of the analyte. However, biogenic amines have disadvantages when analysed using chromatography approaches such as low volatil-