Investigation of mercury residual in dried Anchovy from Buru Island

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Abstract. Dried anchovy is a prominent fishery product from Buru Island, produced by the community in villages Saliong and Siahoni at the coastal of Kayeli bay. The artisanal gold mine activity at mount Botak few years ago was resulted mercury contamination into the waters of Kayeli bay and it is appropriate to investigate the mercury contaminants in dried anchovy. This study was carried out to determine the amount of mercury residual in dried anchovy from Saliong-Batuboi and Siahoni. Further more dried anchovy as a good income for the community can be ensure its food safety for the consumers. The result showed that the average of mercury residual was 0.3135 mg/kg in 2017, 0.2498 mg/kg in 2018 and the value decline into 0.135 mg/kg in 2019. Refer to Indonesia Standard SNI 7387-2009 and CODEX STAN 193-1995 (Amended 2009), mercury residual in dried anchovy from Buru Island under 0.5 mg/kg and safe to be consumed.

Key words : dried anchovy, Buru island, mercury levels

1. Introduction

Dried anchovy produced by the community in villages Saliong-Batuboi and Siahoni at the coastal of Kayeli bay is a prominent fishery product from Buru Island and have a good feasibility business1. Artisanal gold mine activity few years ago at mount Botak was resulted mercury contamination into the Kayeli bay2,3. There was mining gold activity lead people worry and afraid to consume marine products from Kayeli bay furthermore people warn to each other to not eat dried anchovy and other marine products from Kayely bay. This situation could be bad influence to the dried anchovy production as a good income for the community.

Consumers need to be sure about the food safety of the dried anchovy which is a good imply to the product as a good income for the community. Investigate the mercury level is appropriate to confirm the residual mercury contamination. Refer to National Indonesian Standard and Codex Alimentarious Standard, maximal limit of Mercury (methylmercury) in dried achovy may not more than 0.5 mg/kg. Based on that description, sampling product and laboratory analysis was carried out to determine mercury levels in dried anchovy produced by the community in villages Saliong-Batuboi and Siahoni at the coastal of Kayeli bay. The determined value of mercury levels will be useful for convincing consumers that dried anchovy from Kayeli Bay is safe to be consume.

2. Methodology

2.1. Sampling dried anchovy

Sampling dried anchovy carried out in 2017, 2018 and 2019 on July-August. Dried anchovy got from the community in villages Saliong-Batuboi and Siahony at the coastal of Kayeli bay Buru island and brought to the laboratory of environment, ecotoxicology and microbiology IPB Bogor and Makasar Health Laboratory Center, Ministry of Helath Republic of Indonesia.
2.2. **Mercury Analysis**

Mercury analysis was performed at the laboratory of environment, ecotoxicology and microbiology IPB Bogor and Public Health Laboratory Makasar, Indonesian Ministry of Health. Mercury analyzed by using Atomic Absorbance Spectrophotometer, unflame cold vapor method at the wavelength 253.7 nm (refer to Indonesia National Standard SNI 01-2896-1998, point 6).

- **Sample preparation**
  - Destruction using closed system microwave digestor: a) 1 gram sample weighed in the destruction tube, added with 2 ml HNO₃ and H₂O then covered tightly and putted in the microwave oven. b) blanks using reagents worked as well as the sample did. c) a standard series prepared. d) 20 ml reducing solution added into the standard series solution, decomposition solution and blank solution then rad by using a flame-free atomic absorpsion spectrophotometer at a wavelength 253.7 nm. e) a calibration curve with the Y axis as absorbance and the X axis created as concentration (in ppm) and calculate the Hg content in the sample.

- **Making the Calibration Curve**
  - Preparation of solution: standard CRM mix with a concentration of 100 mg/L Hg solution
  - Preparation of Calibration Curves for Shimadzu AA-6300 instruments: a standard solution with the concentration 0; 2; 4; 6; 8; and 10 ppb created and added with 5.5 ml of concentrated H₂SO₄ then adjusted by using ion free water.
  - Making a Calibration Curve for the Agilent 240FS instrument: a standard solution with the concentration range 0; 2; 4; 6; 8; and 10 ppb created, diluted and adjusted by using a mixture solution of 5% HNO₃ : 5% HCl (1:1).
  - Measurement of absorption value of standard solutions and samples (AAS Shimadzu AA-6300): the mercury cathode lamp in the AAS device instaled. Absorption cell on the AAS burner head placed and optimized according to the tool manual. Waste solution prepared. U pipe filled with MgClO₃. MVU in circular-closed mode setted.
Power switch OFF positioned. Blank solution in the reaction container with magnetic rod prepared. Power switch ON setted. 5 ml SnCl₂ added and wait for the absorbance stabilize then read and record. Reapeted for the other sampels.

- Measurement of absorption value of standard solutions and samples (AAS Agilent 240FS): mercury cathode lamp in the AAS device instaled. Hydride Vapor Generation (VGA-77) connected to the AAS device. Absorption cell placed on the AAS burner head and optimatization performed. 0.6% NaBH₄ solution in 0.5% as reductand and ion free water as acid prepared. The capillary tube for the sampel dipped into the standar solution and sampel then waited in ± 1 minute. The value of each standard solution and sampel read and recorded.

- Calculation
The mercury content in the sample is calculated using the following formula:
Mercury content (µg / g) = [(µg metal / ml of the calibration curve) x V]/m
V = volume of dissolution, in ml
m = sample weight, in grams
Calculate the mercury levels in sample using a calibration curve or straight line equation and note the following: the maximum allowable difference between the two duplicate measurements is 2%, averaging the results. If the measurement results of the absorption value of the sample are greater than the absorption value of the standard solution with the highest concentration that is still in the linear limit, repeat the test by diluting the test sample.

3. Results and Discussion
The mercury levels in dried anchovy from Kayeli bay Buru Island should be made clear to the general public to ensure the food safety of the product. Mercury levels of dried anchovy produced by the community in villages Saliong-Batuboi and Siahoni at the coastal of Kayeli bay was determined as shown on Figure 1. The average value of mercury levels was 0.3135 mg/kg in 2017, decline into 0.2498 mg/kg in 2018 and 0.135 mg/kg in 2019. Refer to Indonesia Standard SNI 7387-2009 and CODEX STAN 193-1995 (Amended 2009), mercury residual in dried anchovy from Buru Island under 0.5 mg/kg and safe to be consume. Based on this data, can be claim that dried anchovy from Kayeli bay is not a mercury food poisoning potentially to people. Methylmercury is very toxix, persistent and readily bioaccumulated, especially in aquatic food chain. Mercury is a heavy metal that present in the earth and its methylated by bacteria in acquatic environment to methyl mercury in anaerobic condition. It is then concentrated by the food chain so predatory fish and other seafood animals have the highes levels moreover consuming fish and other seafood lead to human mercury exposure.

The major source of human exposure to methylmercury is eating contaminated fish. Methylmercury an organic compound is the most toxic form of mercury to which human normaly exposed. Methylmercury bioaccumulated with larger fish which eat smaller one, containing much higher levels than non-predatory fish. The smaller fish are excellent sources of protein and provide omega 3 fatty acids that are important to cardiac function and good healths. Anchovy is non-predatory small fish with a short life span so that methylmercury bioaccumulated reatively small and much lower than the safety standard furthermore safe to be consume.
4. Conclusion

Average value mercury levels in dried anchovy from Kayeli bay Buru Island was 0.233 mg/kg, lower than the highest threshold specified by Indonesia National Standard and Codex Alimentarius Standard 0.5 mg/kg and safe to be consume.

Acknowledgment

Authors would like to thank to Ministry of Research and Technology and Higher Education of the Republic of Indonesia, funding this study.

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