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PROCESSING GREEN SHELLS AT TAMBAK LOROK USING ECOENZYMES AS AN ALTERNATIVE METHOD TO REDUCE METAL LEVELS PB AND FE

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ABSTRACT :

Green mussels are one of the popular marine products in Tambak Lorok, which also reported to contain high amounts of heavy metals, especially Pb and Fe. Therefore, people using tamarind for green mussels treatment. However, this method causes a decrease in organoleptic properties, so this research is carried out regarding the application of eco-enzymes in reducing heavy metal content in green mussels. The research was carried out through several stages, i.e. observation, literature study, trials, laboratory tests, final product manufacture and organoleptic tests. The results of laboratory tests showed that the use of eco-enzyme with a certain concentration was able to reduce the levels of Pb and Fe about 41.18% and 10.90%, respectively. In addition, based on the results of organoleptic tests, the average level of preference in terms of color, aroma, taste and texture is 4.67, 4.33, 4.78 and 4.33, respectively. In conclusion, eco-enzymes can be used to reduce heavy metal levels of Pb and Fe on green mussels in Tambak Lorok without reducing their organoleptic properties, which is increase consumer interest and improve the economy value of the local people, in addition to maintaining the health of the local people when consuming it.

Keywords: Eco-Enzyme, Ferric, Green Mussel, Heavy Metal, Plumbum

1. Introduction :

Green mussels are one of the most popular seafood products. In fact, some green mussels are harvested at the age of 3-4 months due to high consumer demand (Putri et al., 2018). In fact, green mussels are generally harvested at the age of 5-6 months in tropical regions (Noor et al., 2016). This demonstrates the high consumer demand for green mussels. As a fishing village, Tambak Lorok also harvests green mussels.

However, green mussels in Tambak Lorok are reported to contain high levels of heavy metals, particularly Pb and Fe. Lahati et al. (2022) found that green mussels from Tambak Lorok near the coast had Pb metal contents of 168-1,860 mg.kg-1. Meanwhile, Triantoro et al. (2017) stated that the Fe metal content in Tambak Lorok green mussels was 102.52-129.72 mg.kg-1. In fact, the maximum limit of heavy metal contamination in green mussels based on BPOM RI Regulation No. 5 of 2018 is 0.20 mg.kg-1 for Pb, while based on KMNLH / No. 51/2004, the content of heavy metals in shellfish should not be ≥1 ppm. The quality standard limit is set because these metals are toxic to marine organisms and the human body, even in small amounts.

The Tambak Lorok community, especially the members of the processing and marketing group (Poklahsar) named Teratai, use tamarind as a chelating agent (Solihah, et al., 2016) (Nurdiyati, et al., 2017) in the processing of green mussels. As a result, the taste of green mussels is influenced by tamarind and is not suitable for some people.

Ecoenzyme is a liquid produced by fermentation of fruit or vegetable residues, which produces useful complex compounds and is rich in microorganisms (Rusdianasari et al., 2021). Hemalatha & Visantini (2020) reported that these microorganisms, especially lactic acid bacteria and yeast, have the ability to degrade heavy metals in soil due to their tolerance mechanism to toxic metals.

Based on some of the problems in Tambak Lorok and some previous related research, the UNDIP 2022 Thematic KKN team conducted research on reducing heavy metal levels in green mussels using ecoenzymes, especially Pb and Fe metal content. Then, the ecoenzyme that was shown to reduce Pb and Fe heavy metals in green mussels was socialised to Poklahsar Teratai. Subsequently, an organoleptic test was conducted to determine the level of public preference for eco-enzyme treated mussels. The aim of this activity is to reduce the levels of heavy metals, especially Pb and Fe, in green mussels so that they meet the maximum standard limit of heavy metal levels in food according to the Indonesian National Standardisation (SNI) and do not reduce the organoleptic properties of green mussels. This programme was conducted in RW. 15 Tambak Lorok, Tanjung Mas Urban Village, North Semarang Subdistrict, Semarang City, Central Java, focusing on KUB Mitra Bahari for 2-3 weeks. This programme used various materials and tools such as fresh green mussels from Tambak Lorok, eco-enzymes, knives, basins, kitchen spices, as well as stoves and pans, whose activities started with observation, literature studies, experiments, followed by laboratory tests, production of final products and organoleptic tests.

1.1. Observation

Observation was carried out to identify the problems of the Tambak Lorok community, the efforts made to overcome these problems and the weaknesses of these solutions. A literature review was also carried out at this stage in order to provide alternative solutions to the problems faced by the local people from a perspective that is in line with the KKN students' programme of study.

1.2. Literature Review

The literature review was conducted by searching for references from various sources, both through journals, books and newspapers, related to the reported levels of heavy metals in green mussels in Tambak Lorok, the benefits of ecoenzymes and the methods used in the sustainability of this programme.

1.3. Experiments

Experiments were conducted by referring to reviews from various literatures on the appropriate composition for the application of ecoenzymes.

1.4. Laboratory tests

Laboratory tests were conducted by sending untreated mussel samples as controls and mussels treated with ecoenzymes at the experimental stage to Saraswanti Indo Genetech (SIG) Laboratory in Semarang, Central Java. The aim of this stage is to determine the levels of heavy metals Pb and Fe in the mussels using the ICP-OES method.

1.5. Production of final product

The final product was manufactured at the house of one of the members of Poklahsar Teratai. This stage started with the socialisation of the ecoenzyme and its application. Then 1 kg of green mussels was soaked in 100 ml of concentrated ecoenzyme dissolved in 1 litre of water and left for 1 hour. The mussels were stirred occasionally during the first 15 minutes of soaking. After 1 hour, the mussels were rinsed and cleaned and then processed as desired.

1.6. Organoleptic test

The cooked mussels were presented to 9 panelists who were not residents of Tambak Lorok to objectively assess the colour, taste, aroma and texture. The ratings were made on a scale of 1-5 and the data were statistically analysed and presented graphically.

2. RESULTS AND DISCUSSION :

No	Parameter	Unit	Simplo	Duplo	Limit Of Detection	Method
1	Lead (Pb)	mg / kg	0.17	0.17	-	18-13-14/MU/SMM-SIG (ICP MS)
2	Iron (Fe)	mg / 100 g	12.57	12.40	-	18-13-1/MU/SMM-SIG (ICP OES)

(a)

No	Parameter	Unit	Simplo	Duplo	Limit Of Detection	Method
1	Lead (Pb)	mg / kg	0.10	0.10	-	18-13-14/MU/SMM-SIG (ICP MS)
2	Iron (Fe)	mg / 100 g	11.74	11.20	-	18-13-1/MU/SMM-SIG (ICP OES)

(b)

Figure 1. Levels of heavy metals Pb and Fe in (a) untreated and (b) ecoenzyme-treated samples (SIG Lab, 2022).

Based on the ¬Eco-Enzyme Nusantara module, Eco-Enzyme is generally applied in a ratio of 1:1:1. Therefore, the eco-enzyme treatment was carried out at the ratio of 1 kg of green mussels: 1 dl of eco-enzyme: 1 litre of water. The results of the laboratory tests (Figure 1) showed that ecoenzyme can reduce the content of heavy metals Pb and Fe in green mussels. The Pb heavy metal content decreased from 0.17 mg.kg-1 to 0.10 mg.kg-1, while the Fe heavy metal content decreased from 1.26 mg.kg-1 to 1.12 mg.kg-1, so that the percentage reduction of heavy metal content was about 41.18% and 10.90%, respectively. At this level, the mussels are safe for consumption because the content of heavy metals Pb and Fe in the treated mussels is 0.10 mg.kg-1 and 1.12 mg.kg-1, respectively. This refers to SNI 7387 Year 2009 issued by the Indonesian National Standardisation Agency regarding the maximum

limit of heavy metal contamination in food is 1.5 mg/kg. However, further tests need to be conducted to further reduce the heavy metal content, such as with different ecoenzyme concentrations. Based on the research results of Sembiring, et al. (2021), different concentrations of ecoenzymes have different effects on the production of Kembang Telang (Clitoria ternatea). Pratamadina and Wikaningrum (2022) also successfully degraded detergents using ecoenzymes with a large amount of reduction after testing at several concentration levels.

Figure 2 Green mussel processing after treatment with eco-enzyme

After that, the final product was made together with members of Poklahsar Teratai (Figure 2) and presented to panelists (Figure 3), as representatives of the community, to determine the level of preference for the colour, aroma, taste and texture of green mussels processed through ecoenzyme treatment.

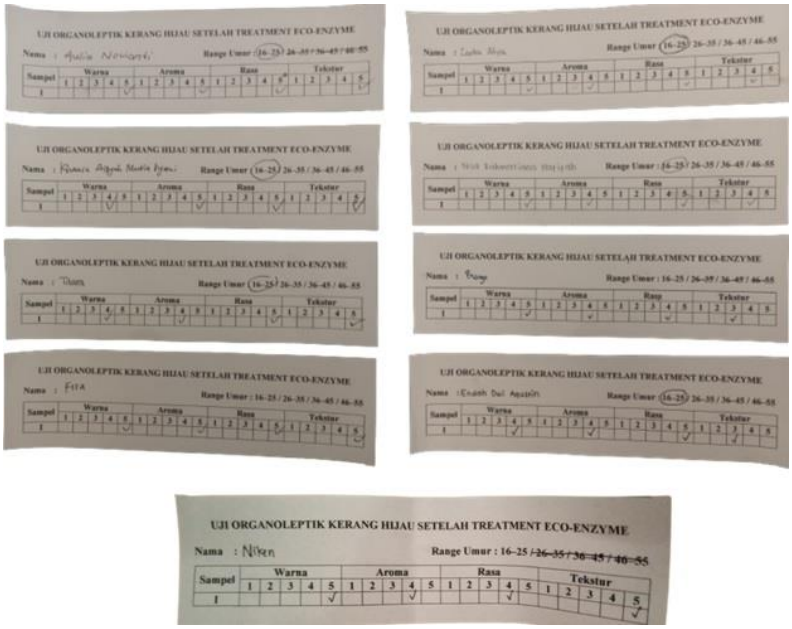

Figure 4 Organoleptic test result sheet of green mussels treated with eco-enzyme

Based on the organoleptic test results (Figure 4), it is known that there were 6 panelists who gave a score of 5 and 3 panelists who gave a score of 4 for color, then 3 panelists gave a score of 5 and 6 panelists gave a score of 4 for aroma, while for taste there were 7 panelists gave a score of 5 and 2 panelists gave a score of 4, and for texture there were 5 panelists gave a score of 5, 2 panelists gave a score of 4 and 2 other panelists gave a score of 3. The results of statistical analysis presented in the form of a graph as shown in Figure 5 indicate that the panelists really liked the green mussels treated with eco-enzyme, where the average level of preference in terms of color, aroma, taste and texture were 4.67; 4.33; 4.78 and 4.33, respectively. The average level of liking that is >4 indicates that the product is accepted among the wider community. This value of 4 is the satisfaction index of the texture of green mussels.

3. CONCLUSION :

The use of eco-enzyme in the treatment of green mussels with a ratio of 1 kg of green mussels: 100 ml eco-enzyme: 1 liter of water can reduce the levels of heavy metals Pb and Fe in green mussels up to 41.81% and 10.90%. In addition, the green mussels are also accepted by the community in terms of color, aroma, taste and texture, where based on organoleptic tests have a score >4 so that it can increase consumer interest as seen from the increasing

number of requests, and improve the economy of the Tambak Lorok community, in addition to maintaining the health of the local community when consuming it. Further research is needed to determine the effect of ecoenzyme concentration on reducing heavy metal content, as well as tests for other heavy metal content.

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