RJOAS: Russian Journal of Agricultural and Socio-Economic Sciences
ISSN 2226-1184 (Online) | Issue 11(155), November 2024

UDC 637

FOOD SAFETY STUDY: A PRELIMINARY ANALYSIS OF ORGANOLEPTIC AND TOTAL PLATE COUNT IN MEAT OF CHANNOS CHANNOS' OBTAINED FROM TRADITIONAL POND FARMING

Kartikaningsih Hartati*, **Djamaludin Heder**, **Yahya**, **Putri Anjari Sukma Dewanti**, **Trisnanda Reni Wahyu**
Study Program of Fish Product Technology, Faculty of Fisheries and Marine Science, University of Brawijaya, Malang, Indonesia
*E-mail: hartatikartikan@ub.ac.id

ABSTRACT
Final Disposal Sites as the final place of waste processing that implements the open dumping system have the risk of environmental pollution. Leachate comes from the results of decomposition or degradation of decomposed and dissolved waste. The presence of leachate content also has a negative impact on the environment, especially on the decline in water quality and disruption of the metabolism of aquatic organisms. The environment of traditional *Channos channos* ponds has the potential to be contaminated by leachate. This study was conducted by taking samples of pond water and farmed *C. channos* by sampling in 3 different zones. Zone 1 ponds were within a radius of less than 1 kilometer, zone 2 was within a radius of 1 to 2 kilometers and zone 3 was in the zone near the sea within a radius of more than 2 kilometers from the landfill. The research procedure carried out was total bacterial contamination tests. Based on the results of study, *C. channos* in zone 1 have a higher total bacterial value compared to zones 2 and 3. This is related to the pond area in zone 1 having the closest radius from the site, which is less than 1 kilometer. However, the total plate count in fish meat samples from zones 1, 2, and 3 exceeds the safety threshold for fresh fish food. The presence of bacterial contamination that exceeds the standard limit can have a negative effect on consumers. Therefore, it is important to know the safety of food before consuming food so that the body is protected from toxins from food sources.

KEY WORDS
Contamination, final disposal sites, fish, leachate, total plate count.

The problem of waste is something that must be considered along with increasing population growth (Abdel-Shafy and Mansour, 2018). This is a problem that causes pressure on the waste management system to become uncontrolled, so that waste is piled up in the Final Disposal Site (Zhang *et al*., 2024). The Final Disposal Site as the final place for waste processing can potentially cause environmental pollution if it is not operated properly (Siddiqua *et al*., 2022) which implements an open dumpling system has the risk of environmental pollution in the form of leachate which can damage the environment because it contains organic and inorganic pollutants (Dagwar and Dutta, 2024). The presence of leachate content has a negative impact on the environment, especially on reducing water quality and disrupting the metabolism of aquatic organisms because it contains degraded organic materials and heavy metals that are chronic for the environment (Sossou *et al*., 2024).

The environment of traditional *Channos channos* ponds has the potential to be contaminated by leachate. Traditional ponds have the closest distance to the location, which is less than 1 kilometer, while the furthest distance from the landfill is more than 2 kilometer. Leachate can seep into groundwater to a depth of 500 meters (Marendra and Tangahu, 2020). This can cause the *C. channos* pond environment to be polluted by leachate from both the soil and river flow. The presence of leachate content can affect human health because leachate contains various organic, inorganic, and pathogenic bacteria (Torres-González *et al*., 2021). Leachate contains inorganic and organic compounds including pathogenic bacteria that can affect food safety (El-Saadony *et al*., 2023). The presence of

pathogenic bacteria will have a negative impact on the environment and affect food safety which can cause public health problems.

So far, there has not been much research data discussing organoleptic and total plate count in *C. channos* originating from traditional ponds adjacent to Final Disposal Sites. Food safety requirements must be met so that consumers can avoid the spread of foodborne diseases. Therefore, this study aims to analyze the study of food safety, especially organoleptic and total plate count in *Channos channos* located in traditional ponds due to leachate contamination in the cultivation pond environment.

MATERIALS AND METHODS OF RESEARCH

The main materials used in this study were pond water samples and *C. channos* meat from traditional pond farming. The materials used for microbiological analysis were Plate Count Agar, 95% ethanol, cotton, tissue, 70% alcohol, spirits, and distilled water. This study uses two variables, namely independent variables and dependent variables. The independent variable in this study was leachate contamination in ponds originating from the Final Disposal Site, while the dependent variables were organoleptic and total plate count in pond water samples and also *C. channos*'s meat. The research design used a Randomized Block Design consisting of three sampling locations and each location had three groups and repetitions.

Fish organoleptic testing was carried out according to Indonesian National Standard 2729:2013 with several observation parameters including appearance, meat, odor, and texture of fish. Fish organoleptic observations are carried out with detailed assessments looking at the scoresheet table for fish in the range of 1-9.

Making Plate Count Agar (PCA) media using the Indonesian National Standard 2332.3:2015 method. Making PCA media begins with weighing 5.063 g of PCA media using an analytical balance. Next, the weighed media was put into a 250 mL Erlenmeyer and 225 mL of distilled water is added. Then, a magnetic stirrer was put into the Erlenmeyer and placed on a plate stirrer to be homogenized. After being homogenized, the magnetic stirrer was removed, then the mouth of the Erlenmeyer was closed again with cotton coated with aluminum foil and tied with rubber. The final stage, the PCA media was sterilized using an autoclave for 15 minutes at 121°C and 1 atm.

The TPC testing procedure based on the Indonesian National Standard 2332.3:2015 method was as follows: a sample that has been homogenized with BFP diluent was pipetted 1 mL into a test tube containing 9 mL of BFP solution. Furthermore, it was homogenized using a serological pipette by pulling and removing the diluent 25 times and a dilution of 10^{-1} was obtained. Furthermore, 1 mL of the 10^{-1} dilution was pipetted and inserted into a test tube containing 9 mL of BFP solution, and the same thing was done to produce a dilution of 10^{-3}. This procedure was carried out until the dilution was 10^{-5}. After the dilution was carried out, 1 mL of each dilution of 10^{-2}; 10^{-3}; 10^{-4}, 10^{-5} was taken using a serological pipette and put into a petri dish, each 1 petri dish was given 1 mL. Then marked with dilutions 10^{-2}; 10^{-3}; 10^{-4}, and 10^{-5} using label paper. PCA media stored in a water bath was then poured into all petri dishes that have been given a dilution of 10^{-2}; 10^{-3}; 10^{-4}, 10^{-5} in duplicate. Furthermore, it was homogenized by moving the petri dish like the number 8 and the media was left to form agar. After the PCA media forms agar, the petri dish was turned over with the lid of the petri dish at the bottom. And incubation was carried out using an incubator for 48 hours. After the incubation is complete, the bacterial colony counting stage was continued using a colony counter. The counting process was carried out by pressing each colony point on the petri dish using a marker.

RESULTS AND DISCUSSION

Organoleptic analysis for the freshness of *C. channos* from different zones was carried out by assessing using a score sheet with a range of values 1 (lowest value) to 9 (highest value). There are several parameters of fish freshness including eyes, gills, mucus, meat,

odor, and texture. Each parameter has a different value that refers to the organoleptic assessment sheet of fresh fish Indonesian National Standard 2729:2013. The results of organoleptic observations of *C. channos* freshness show that each zone has a different value. The results of the organoleptic value of *C. channos* freshness can be seen in Figure 1.

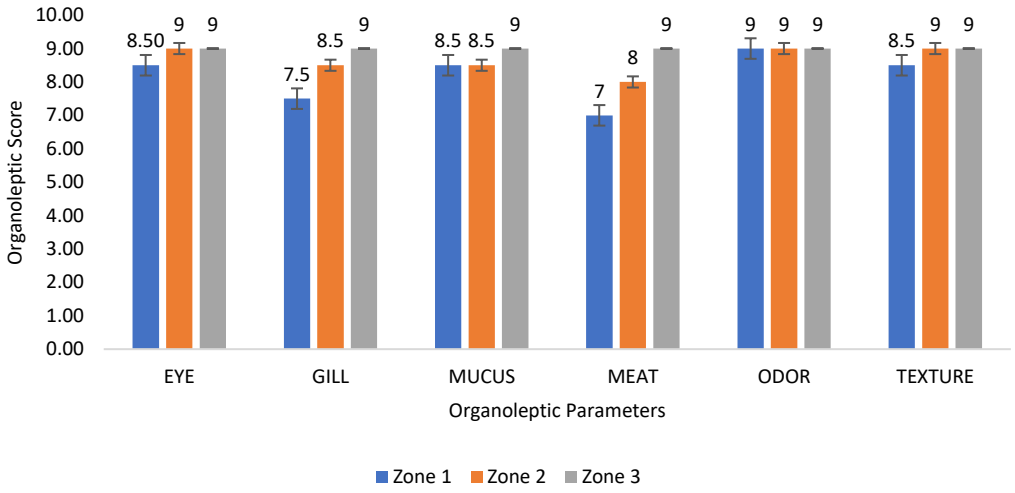

Figure 1 – Organoleptic Analysis Results

Based on Figure 1, each parameter in each zone has a different value. The organoleptic assessment of fish in zone 1 has the lowest value compared to fish in zone 2 and fish in zone 3. Fish in zone 1 have an average organoleptic value of eye appearance with a score of 8.5; gills 7.5; mucus 8.5; meat 7; odor 9; and texture 8.5. Fish in zone 2 have an average organoleptic value of eye appearance with a score of 9; gills 8.5; mucus 8.5; meat 8; odor 9; and texture 9. Fish in zone 3 have an average organoleptic value of eye appearance with a score of 9, gills 9, mucus 9, meat 9, odor 9, and texture 9. Milkfish from zones 2 and 3 are included in the very fresh fish category while fish from zone 1 are included in the fresh fish category. The difference in the freshness category of this fish can be influenced by the location of the zone 1 pond which is very close to the Final Disposal Sites, which is < 1 kilometer away.

The level of fish freshness is one of the indicators of food safety. Fish that are still considered fresh have a maximum organoleptic value with a score of 8 for each freshness indicator. One of the causes of the decline in quality and freshness in fish can be influenced by the activity of microorganisms that occur in the fish's body (Tavares *et al*., 2021). Research conducted by Chen *et al*. (2019), states that the place where rotting bacteria develop faster is in the gills of fish, because they have higher blood content. The process of fish rotting occurs faster if the gills have a large number of bacteria.

Figure 2 – Colony Growth on PCA Media

The total bacterial contamination test was carried out using the Total Plate Count (TPC) method to determine the presence of bacterial contamination using quantitative analysis. The samples used were pond water samples and milkfish meat from traditional cultivation. Each sample was diluted four times (10^{-2}, 10^{-3}, 10^{-4}, 10^{-5}). The 10^{-1} dilution was not calculated because the colonies could not be counted. Based on the results of sample inoculation on Plate Count Agar (PCA) media, bacterial colonies were obtained as in Figure 2.

Based on Figure 2, the results were obtained in the form of round (circular) and white bacterial colonies on PCA media. PCA media is a non-selective media used for the growth of Gram-negative and Gram-positive bacteria. This method is used to determine the total number of bacterial colonies that do not determine a particular type of bacteria. The calculation of total bacteria using the SNI 2332.1:2015 method was carried out three times and was carried out in duplicate. The average calculation of the colonies that grew in each zone can be seen in Figure 3.

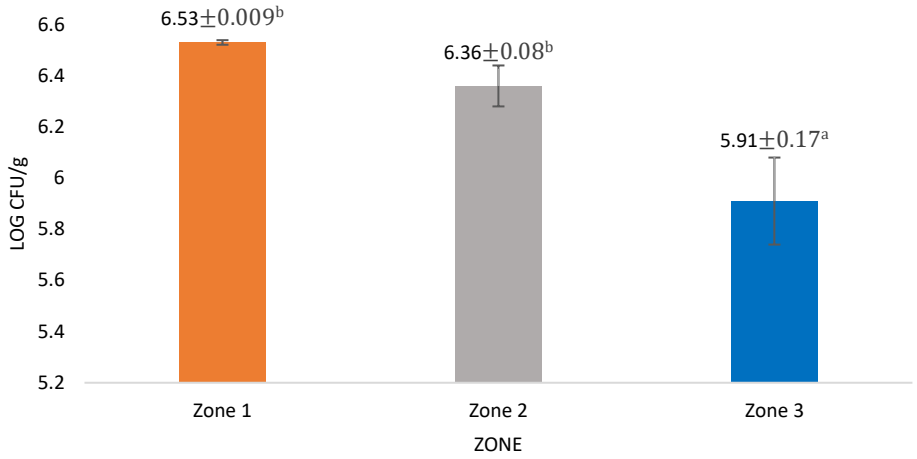

Figure 3 – Results of TPC Analysis of Pond Water

Figure 3 shows the results of the analysis of total bacterial contamination in pond water, each zone has an average value, namely in zone 1 of 6.53 Log CFU/g, zone 2 of 6.36 Log CFU/g, and zone 3 of 5.91 Log CFU/g. The difference in the average value of total bacteria is influenced by the environmental conditions around the ponds adjacent to the landfill. Zone 1 (the zone closest to the landfill) has the highest average total bacterial value compared to zone 3. This is because zone 1 has the potential to be contaminated with more bacteria from the landfill. The data from the analysis of total bacteria in pond water samples were then analyzed using Analysis of Variance (ANOVA) with a confidence level of 95%. The results of data analysis using the ANOVA showed a P-value < 0.05, which was 0.013, so it was necessary to continue the Duncan test. The Duncan test results showed that zone 3 was significantly different from zone 1 and zone 2.

The TPC results in the pond water samples in zone 1 had the highest value compared to zones 2 and 3, which could be caused by the distance of the pond in zone 1 which is close to the landfill. Leachate from the landfill can flow on the ground surface and affect the quality of groundwater and river water. This can affect the quality of traditional pond water. According to Sulianto *et al*. (2020), the quality of groundwater around the landfill also decreases as the distance between the water source and the landfill gets closer. This is because the source of pollution can seep and move horizontally and vertically downwards with rainwater that seeps into the ground. These results are in accordance with the research of Yuspita *et al*. (2018), which states that waters close to the landfill have the highest distribution of bacterial abundance. It is suspected that the high abundance value in waters near the landfill is caused by the concentration of total organic matter dissolved from the landfill.

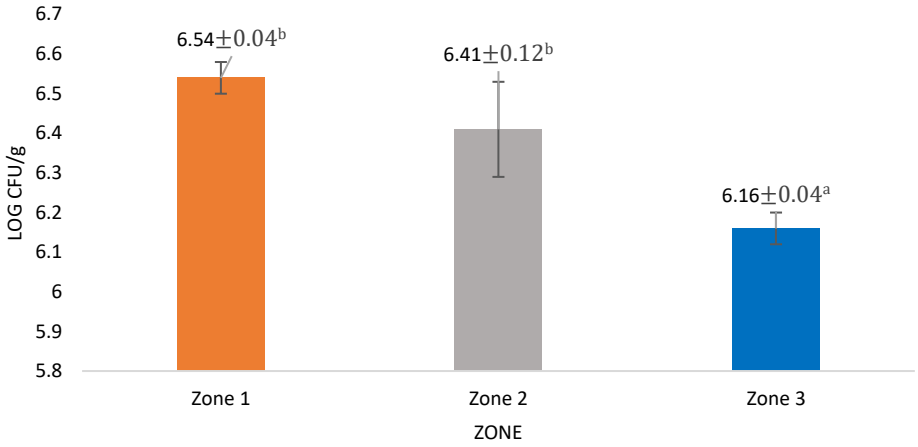

Figure 4 – Results of TPC Analysis of *C. channos* Meat

Based on Figure 4, the highest total bacterial count data in *C. channos* meat were in zone 1 with an average total bacterial value of 6.54 Log CFU/g, while the lowest was in zone 3 with an average total bacterial value of 6.16 Log CFU/g. The results of the total bacterial count in all sample of *C. channos* meat exceeded the maximum microbial threshold according to Indonesian National Standard 2729:2013 of $5.0x10^5$ CFU/g or 5.69 Log CFU/g. The total bacterial count data in pond water samples were then analyzed using the Analysis of Variance (ANOVA) with a 95% confidence level. The results of the data analysis using the ANOVA showed a P-value < 0.05, which was 0.003, so it was necessary to continue the Duncan test. The results of the Duncan test showed that zone 3 was significantly different from zone 1 and zone 2.

The *C. channos* cultivation pond in zone 1 is located not far from the center of the Final Disposal Sites. This affects the total value of bacteria in pond zone 1. The abundance of bacteria can be influenced by the results of the decomposition of waste dissolved in pond water. The abundance of bacteria is closely related to the concentration of organic content in the pond water. The organic content is used as a source of nutrition for the survival and reproduction of bacteria (Yuspita *et al*., 2018). The abundance of these bacteria can affect the quality of *C. channos* cultivated in traditional ponds. The *C. channos* from traditional ponds obtain food from the environment around the pond. According to Arfiati *et al*. (2021), *C. channos* have the nature of eating plankton and natural feed such as moss or algae. Thus, if the environment has been polluted by bacteria, it will affect the safety of food due to the bacterial content in the fish.

CONCLUSION

Channos channos in zone 1 have a higher total bacterial value compared to zones 2 and 3. This is related to the pond area in zone 1 having the closest radius from the site, which is < 1 kilometer. However, the total plate count in fish meat samples from zones 1, 2, and 3 exceeds the safety threshold for fresh fish food. The presence of bacterial contamination that exceeds the standard limit can have a negative effect on consumers. Therefore, it is important to know the safety of food before consuming food so that the body is protected from toxins from food sources.

ACKNOWLEDGEMENTS

The authors would like to thank Faculty of Fisheries and Marine Science (FFMS), Universitas Brawijaya (UB) for the funding support of this study through *Pendanaan Penelitian Dosen Fakultas Perikanan dan Ilmu Kelautan Tahun 2024* (Contract No. 54/UN10.F06/KS/2024).

REFERENCES

1. Abdel-Shafy, H.I., & Mansour, M.S. 2018. Solid waste issue: Sources, composition, disposal, recycling, and valorization. Egyptian Journal of Petroleum, 27(4), 1275-1290.
2. Zhang, Z., Chen, Z., Zhang, J., Liu, Y., Chen, L., Yang, M., & Yap, P.S. 2024. Municipal solid waste management challenges in developing regions: A comprehensive review and future perspectives for Asia and Africa. Science of the Total Environment, 172794.
3. Siddiqua, A., Hahladakis, J.N., & Al-Attiya, W.A.K. 2022. An overview of the environmental pollution and health effects associated with waste landfilling and open dumping. Environmental Science and Pollution Research, 29(39), 58514-58536.
4. Dagwar, P.P., & Dutta, D. 2024. Landfill leachate a potential challenge towards sustainable environmental management. Science of The Total Environment, 171668.
5. Sossou, K., Prasad, S.B., Agbotsou, K.E., Souley, H.S., & Mudigandla, R. 2024. Characteristics of landfill leachate and leachate treatment by biological and advanced coagulation process: Feasibility and effectiveness–An overview. Waste Management Bulletin, 2(2), 181-198.
6. Marendra, S.M.P., & Tangahu, B.V. 2020. Study of Leachate Penetration in Shallow Groundwater Around Jabon Landfill Sidoarjo. In IOP Conference Series: Earth and Environmental Science, 506(1), 012034).
7. Torres-González, O.R., Sánchez-Hernández, I.M., Flores-Soto, M.E., Chaparro-Huerta, V., Soria-Fregozo, C., Hernández-García, L., & Flores-Fernández, J. M. 2021. Landfill leachate from an urban solid waste storage system produces genotoxicity and cytotoxicity in pre-adolescent and Young Adults Rats. International Journal of Environmental Research and Public Health, 18(21), 11029.
8. El-Saadony, M.T., Saad, A.M., El-Wafai, N.A., Abou-Aly, H.E., Salem, H.M., Soliman, S.M., & AbuQamar, S.F. 2023. Hazardous wastes and management strategies of landfill leachates: A comprehensive review. Environmental Technology & Innovation, 31, 103150.
9. Tavares, J., Martins, A., Fidalgo, L.G., Lima, V., Amaral, R.A., Pinto, C.A., & Saraiva, J.A. 2021. Fresh fish degradation and advances in preservation using physical emerging technologies. Foods, 10(4), 780.
10. Chen, H., Wang, M., Yang, C., Wan, X., Ding, H. H., Shi, Y., & Zhao, C. 2019. Bacterial spoilage profiles in the gills of Pacific oysters (Crassostrea gigas) and Eastern oysters (C. virginica) during refrigerated storage. Food Microbiology, 82, 209-217.
11. Sulianto, A.A., Kurniati, E., & Rahmawati, C.T. 2020. Sebaran kualitas air sumur di sekitar TPA Randegan Kota Mojokerto berbasis sistem informasi geografis. Jurnal Sumberdaya Alam Dan Lingkungan, 7(1), 28-35.
12. Yuspita, N.L.E., Putra, I.D.N.N., & Suteja, Y. 2018. Bahan organik total dan kelimpahan bakteri di Perairan Teluk Benoa, Bali. Jurnal of Marine and Aquatic Sciences, 4(1), 129-140.
13. Arfiati, D., Zabadiah, Z., Inayah, Z.N., Pratiwi, R.K., Lailiyah, S., & Farkha, K. 2021. Composition of Plankton in Water and Stomach Milkfish at Brackish Water Ponds. In Proceedings of the International Conference on Green Technology, 11(1), 1-5.