Utilization of semi-aerobic bamboo lid to decrease organic matter

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Abstract. Catfish cultivation will produce wastewater with a high content of organic matter from feces and uneaten feed. If the wastewater is discharged directly into common waters, it will disturb the aquatic ecosystem. So, it is necessary to treat wastewater before it is discharged into common waters. The purpose of this study is to determine the difference in the percentage of experimental media using wicker bamboo lid towards the organic matter in the wastewater of catfish farming. The research was conducted from September to October 2019 at the Laboratorium Hidrobiologi Divisi Sumberdaya Ikan, Universitas Brawijaya. The research method used was an experimental method with a 2-factor factorial completely randomized design. The first factor was the percentage of bamboo wicker lid (25%, 50%, 75%, 100% and 0% (control)). The second factor was the observation time (12, 36, 48, 60 and 72 hour). The results indicated that organic matter could decrease to 82.19% (73.31 mg / L to 13.06 mg / L) in the 75% lid treatment at 48 hours. The results of water quality measurements except carbondioxide are in accordance with water quality standards. The presence of bamboo cover can reduce organic matter in waste water. However, it needs treatment for carbondioxide.

1. Introduction
Any fish farming activities can increase the total organic matter (TOM) in the wastewater. Organic material is a heterogeneous mixture of organic compounds consisting of proteins, sugars, carboxylic acids, nucleic acids and aquatic humic substances [1]. High organic matter in fish farming wastewater is due to the accumulation of organic matter from feces, remaining feed, organism metabolism, and uneaten feed [2]. The high level of organic matter in fish farming wastewater can indirectly affect the organisms, but it can reduce dissolved oxygen levels in the wastewater [3]. Disposal of untreated liquid waste may pollute the aquatic environment; thus, there is a need to perform wastewater treatment.

Total organic matter content (TOM) from the inlet to the outlet increased from 27.98 mg/L to 89.31 mg/L [4]. The addition of a Kijing Taiwan (Anadonta woodiana) biofilter in the process of lowering the high level of organic matter in the wastewater could decrease the level by 82% within 36 hours [5]. Meanwhile, wastewater treatment by using Bacillus subtilis bacteria was able to decrease organic matter by 83.8% within five days [6]. The high level of organic matter needs to be appropriately processed by utilizing aerobic and anaerobic microorganisms. Organic material can a negatively
impact if there is no water treatment process. Organic materials can be a media for transporting heavy metals in water and other organic pollutants [7].

Prevalent degradation of liquid waste containing organic matter is processed through anaerobic digestion (fully covered). This decomposition can decrease the high level of organic matter [8]. In this research, the remaining water is treated biologically through facultative anaerobic digestion. In this study, the wastewater from the fish farming activity was treated biologically through facultative anaerobic degradation. It was performed by using bamboo wicker lid called "besek" to cover the media. Besek is facultative anaerobic because it still has pores and can inhibit oxygen penetration from outside the media. The different percentages of treatments on media consisting of 25%, 50%, 75% and 100% were carried out to determine the level of reduction in organic matter with different oxygen exposures.

This study aimed to determine the effect of differences in the percentages of experimental media using wicker bamboo lid "besek" towards the organic matter in the wastewater of Sangkuriang catfish (Clarias gariepinus) farming.

2. Research Method
The research was conducted from September to October 2019. This study employed an experimental method with a completely randomized factorial design (CRD) consisting of 2 factors. The first factor the percentage of media lid (5 levels) by 0% (without cover as a control) 25%, 50%, 75%, and 100% with 3 repetitions. The second factor, the time of measurement (6 levels) was starting from 12 hours, 24 hours, 36 hours, 48 hours, 60 hours and 72 hours.

The wastewater sample was obtained from UPT PTPBP2KP Kepanjen at the outlet of the Sangkuriang catfish (Clarias gariepinus) brood stock pond. The experimental research and measurement of water quality was then carried out at the Hydrobiology Laboratory of the Fish Resources Division of Faculty of Fisheries and Marine Sciences, Universitas Brawijaya. Four liters of wastewater was put into the pail with a volume of 10 liters and then covered by bamboo wicker lid “besek” according to the treatment without any additional aeration. The water quality parameters such as temperature, pH, dissolved oxygen, carbon dioxide, and organic matter (TOM) were also measured.

3. Result and Discussion
3.1. Total Organic Matters
Most of the levels of organic matter decreased during the study, as shown in Figure 1. During the experiment, the levels of organic matter ranged from 13.06 mg/L - 60.25 mg/L. Giving treatment with different percentages of the bamboo lid for 72 hours could decrease the organic matter level in the wastewater of Sangkuriang catfish (Clarias gariepinus) farming. The results of the factorial analysis of variance (ANOVA) showed a significant value lower than α (0.05). Then, the use of bamboo wicker lid with different percentages on the experimental media and the 72-hours measurement time affected the decreasing level of organic matter in the wastewater from Sangkuriang catfish farming. These results were evidenced by the levels of organic matter in all treatments using bamboo wicker lid for 72 hours; the treatments decreased the levels of organic matter range from 19.38 mg/L to 26.12 mg/L. The level of organic matter obtained is in accordance with the Government Regulation No. 82 of 2001 in which the maximum limit of organic matter for Category III is 50 mg/L so that the wastewater from fish farming can be disposed into public waters.

The decrease of the organic matter within 72 hours with 25% bamboo lid covering area was 65.51% (73.31 mg/L to 25.28 mg/L). Then, the percentage with 50% bamboo lid covering area was 75.56% (73.31 mg/L to 19.38 mg/L). The percentage with 75% bamboo lid covering area was 70.11% (73.31 mg/L to 21.91 mg/L) and with 100% bamboo lid covering area was 73.31 mg/L to 24.44 mg/L. The highest percentage of decrease in organic matter content was found in the treatment of 75% bamboo lid covering area within 48 hours by 82.18%; the initial organic matter content was 73.31 mg/L, and it became 13.06 mg/L. Meanwhile, the lowest percentage of decrease in organic
matter content was found in the 48-hour treatment without using a bamboo wicker lid by 17.81%; the initial level was 73.31 mg/L, and it became 60.25 mg/L. The level of organic matter in each treatment decreased mostly within 12 to 48 hours. A small portion of organic material is used by microorganisms for growth or addition of microbial biomass and mostly for metabolism [9]. During hydrolysis, organic compounds such as proteins, carbohydrates and lipid are broken down into amino acids, sugars and long chain fatty acids [10]. Most of the results from the 60-hour and 72-hour measurement of organic matter increased. Organic matter for some time will be decomposed by microbes and some of the C carbon in the microbes will be oxidized to CO$_2$ [11]. Carbon dioxide contributes 3% to 30% of the decomposition of organic matter while amino acids account for 2% to 15% [12]. Total organic matter will decrease over time [6]. However, the organic matter will increase at certain times due to the decomposers decrease in degrading organic matter or the inactive decomposers [13]. Organic material will change every second, hour and even day. Organic matter in water is estimated to consist of 10-20% certain compounds and 80-90% consisting of complex compounds that cannot be broken down into simple compounds [14].

![Figure 1](image-url)  
**Figure 1.** The average level of organic matter (TOM)

### 3.2. Water quality parameter

One of the determining factors of the success rate in decreasing organic matter is water quality measurement. The decomposition of organic matter by decomposers can be appropriately processed according to each water quality parameter's standard level. The measurement of water quality during the research included physical parameters such as temperature and chemical parameters such as pH, dissolved oxygen (DO), and carbon dioxide. The measurement results of water quality parameters can be seen in Table 1.

| No | Parameter          | 0% Bamboo Cover | 25% Bamboo Cover | 50% Bamboo Cover | 75% Bamboo Cover | 100% Bamboo Cover |
|----|--------------------|------------------|-------------------|-------------------|------------------|-------------------|
| 1  | Temperature ($^\circ$C) | 25.13 – 28.8     | 25.1 – 28.8       | 25.17 – 28.8      | 25.3 – 28.8      | 25.13 – 28.8      |
| 2  | pH                 | 7.67 - 8         | 7.67 - 8          | 7.67 - 8          | 7 - 8            | 7 - 8             |
| 3  | Dissolved Oxygen (mg/L) | 0.67 – 2.8     | 0.77 – 2.8        | 0.73-2.8          | 0.67 – 2.8       | 0.67 – 2.8        |
| 4  | Carbon dioxide (mg/L) | 45.28 – 59.93   | 39.95 – 59.93     | 38.63 – 59.93    | 34.63 – 59.93    | 46.61 – 59.93     |
The results of the temperature measurements in the catfish brood stock pails ranged from 25.13 to 28.8°C (Table 1). During the experiment, the temperature range was still classified as appropriate for microorganisms to degrade organic matter in the wastewater of Sangkuriang catfish (Clarias gariepinus) fish farming. A temperature range of 26°C to 30°C can boost microorganisms' activity in breaking down organic matter [15]. Increasing the temperature can also boost the enzyme activity to an optimal point; however, this condition will decline if the enzyme is denatured [16, 17].

The results of pH measurement during the experiment or in the pails ranged from 7 to 8. pH conditions ranging from 6 to 8 are considered optimal for decomposers to degrade organic matter [18]. Bacteria can function and produce enzymes that become catalysts and accelerate reactions in an optimum pH condition [19].

The results of dissolved oxygen measurements in the experimental pails ranged from 0.67 mg/L to 2.33 mg/L (Table 1). The decomposers can degrade organic matter in wastewater when the dissolved oxygen levels is less than 1 mg/L [20]. The decrease of dissolved oxygen level in the water is due to decomposers that need more oxygen to decompose organic material [3]. Meanwhile, increasing water's dissolved oxygen level is due to the inactive decomposers; therefore, decomposers do not use oxygen in the water to carry out metabolic processes. respiration, and growth [21].

The results of carbon dioxide measurements in experimental pails ranged from 34.63 mg/L to 75.31 mg/l with 75% bamboo lid covering area within 48 hours by 82.19%; the initial organic matter level was in percentage. The decrease in organic matter with the highest percentage was found in the treatment bamboo wicker lid or "besek" can decrease the level of organic matter resulting in different decreases in percentage. The decrease in organic matter with the highest percentage was found in the treatment with 75% bamboo lid covering area within 48 hours by 82.19%; the initial organic matter level was 73.31 mg/l, then it became 13.06 mg/l.

4. Conclusion
It can be concluded that the difference in the percentage of covering the experimental media using bamboo wicker lid or "besek" can decrease the level of organic matter resulting in different decreases in percentage. The decrease in organic matter with the highest percentage was found in the treatment with 75% bamboo lid covering area within 48 hours by 82.19%; the initial organic matter level was 73.31 mg/l, then it became 13.06 mg/l.

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