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Analysis on the most Suitable Soaking Time in Decomposition Process of *Penaeus Monodon* Organic Waste into Anorganic Substance

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Abstract : Shrimp farm waste is in the form of feces, food remain and dead plankton. Plankton may die due to decreasing quality of water, bad nutrients or decreasing ability of cells for metabolism. Having analyzed nutrient content in organic waste from the dead plankton, it was revealed that the organic waste contained 4.35% of organic C, 0.81% of total N and 0.32% of P. Certain process that change organic substance in the solid waste into anorganic substance should be carried out in order that phytoplankton can take advantage of the waste. Based on the previous studies, solid waste from vaname shrimp (*L. vannamei*) farm can be used as fertilizer for *Chlorella* sp. culture after soaking process.The study used 7 different soaking treatment namely 24 hours (treatment A), 48 hours (treatment B), 72 hours (treatment C), 96 hours (treatment D), 120 hours (treatment E), 144 hours (treatment F) and 168 hours (treatment G). The main parameters to observein the analysis were level of ammonium (ppm), nitrate (ppm), and phosphate (ppm). The best soaking time was 48 hours (treatment B) that resulted in 3.233 ppm of ammonium, 4.58 ppm of nitrate and 2.033 ppm of phosphate.
Keywords: Penaeus Monodon Organic Waste, Soaking Time, Ammonium Level (Ppm), Nitrate Level (ppm) And Phosphate Level (ppm).

Introduction

Background

There is increasing demand for animal protein of which source is fish due to increasing world population[1]. Based on Garno[2], these conditions encourage shrimp farmers to increase production using high density. High density results in large amount of shrimp feed. As the consequence, the shrimp farmers even forget that excessive amount of food may cause some issues during production; one of the issues is excessive organic substance in the waste.

Solid waste on the water decreases amount of dissolved oxygen. Dissolved oxygen degradation may happen due to shallowing that becomes the result of high sediment and nutrient which eventually will increase production of phytoplankton[3]. Erlania *et al.*[4]states that large amount of solid waste, in the form of food remain or metabolic waste such as urine and ammonia, on the water can increase concentration of nitrogen and phosphate in the water. Shrimp farm solid waste is in the form of feces, food remain and dead plankton. Plankton may die due to decreasing quality of water, bad nutrients or decreasing ability of cells for metabolism. It changes water color and produces bubbles on water surface[5]. One method to eliminate the bubbles is removing them manually using dust pan that is conducted by *Balai Pengembangan Budidaya Air Payau*

(*BBPBAP*), Brackish Water Aquaculture Development Center in Jepara. The bubbles are either removed or dehydrated until they become solid. Some researchers use the solid bubbles as objects for their studies. Based on the analysis, the solid organic waste from the dead planktons contains 4.35% of organic C, 0.81% of total N and 0.32% of P. Phytoplankton uses the nutrients for source of food. The required levels of nitrate and phosphate as the phytoplankton food source are 0.0039 g/l – 0.0155 g/l and 0.00027 g/l – 0.00551 g/l consecutively[6].

Organic substance in *Penaeus monodon* organic waste should be processed into anorganic substance in order that the phytoplankton can use it as source of food. Solid waste from shrimp farm can be used as fertilizer for *Chlorella* sp. culture after soaking process. The soaking process lasts between 24-168 hours because those are the time needed for nitrification and denitrification process of the bacteria.

Purpose

The purpose of the study is to find out how much decomposition time from organic into anorganic substance in the soaking process of organic waste fromPenaeus monodon shrimp farms.

Time and Setting

The study was conducted on April 2016 in *Laboratorium Workshop*, a laboratory located in the Faculty of Fisheries and Marine Science, Brawijaya University. The laboratory was the place for soaking the organic waste from the shrimp farms. The other setting was the chemistry laboratory of Faculty of Mathematics and Natural Science for finding out the level of ammonium, nitrate and phosphate.

Methodology

Research Method

The study is an experimental study. The independent variable is soaking time for the solid waste from *Penaeus monodon* shrimp farms namely 24 hours (treatment A), 48 hours (treatment B), 72 hours (treatment C), 96 hours (treatment D), 120 hours (treatment E), 144 hours (treatment F) and 168 hours (treatment G). The independent variables are ammonium, nitrate and phosphate levels.

Data Analysis

The data analysis method us quantitative analysis which involves ammonium, nitrate and phosphate. They are analyzed using one way ANOVA with the help of Microsoft Excel. The analysis begins with variance and then is followed by smallest significant difference in order to see difference among the treatments; whether or not the difference is significant or not. After that, polynomial orthogonal test is carried out to decide the optimum soaking time.

Result and Discussion

Level of Ammonium (ppm) during Soaking Process of Organic Waste from Shrimp Farms

Figure1 described level of ammonium (NH_4^+) during the soaking process of the organic waste from the shrimp farms.

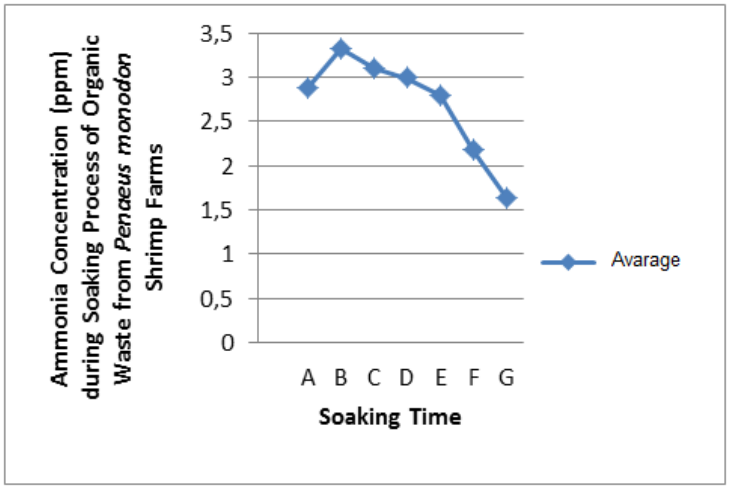

Figure1. Ammonia Level (ppm) during Soaking Process

Figure1 showed that level of ammonia after 24 hours of soaking time was 2.89 ppm and increased to 3.233 ppm on the second day after 48 hours of soaking time (treatment B). The highest level of ammonia was obtained after being soaked for 48 hours (treatment B). According to Howitt and Udvardi[7], ammonium was one type of nitrogen. Plants absorbed nitrogen in the form of ammonium or nitrate. Ammonium was believed to be the main source for agricultural growth and responsible for the growth of the nature. Planktons could directly use ammonia during amino acid synthesis[8].

Treatment B, 48-hour soaking process, resulted in increasing level of ammonia compared to treatment A, 24-hour soaking process. It happened due to increasing decomposition of organic substances by microorganism. Some factors that influenced decomposition of organic substances were C/N ratio, pH, temperature and DO[9].

Level of Nitrate (ppm) during Soaking Process of Organic Waste from Shrimp Farms

Figure2 described level of nitrate (NH_4^+) during the soaking process of the organic waste from the shrimp farms.

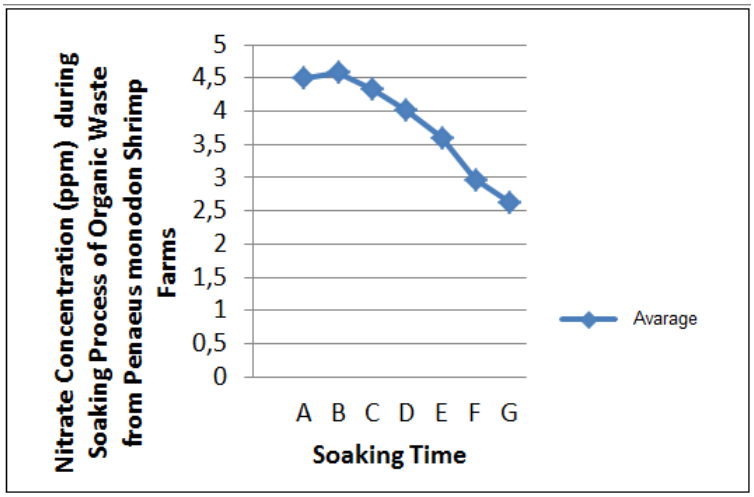

Figure 2. Nitrate Level (ppm) during Soaking Process

Figure 2 showed that level of ammonia after 24 hours of soaking time was 4.49 ppm and increased to 4.58 ppm on the second day after 48 hours of soaking time (treatment B). Longer soaking time decreased level of phosphate. The highest level of phosphate is obtained after being soaked for 48 hours (treatment B).

Nitrate is the main form of nitrogen on the water and is important for growth of plants and algae. Nitrate dissolves very easily on the water. Nitrate is decomposition process of ammonium by microorganism, *Nitrosomonas* bacterium. The bacterium will oxydize ammonium into nitrite and eventually nitrate[10]. The amount of nitrification is closely related to level of pH. Longer soaking time for nitrate will decrease the amount of nitrate as well as pH. Change of pH relies upon ammonification and nitrification process from nitrogen into ammonium and nitrate. Reaction that forms nitrate will release H^+ that results in decrease of pH[11]. pH that keeps decreasing will slow down decomposition process down due to decreasing activity of microorganisms. pH measured during the treatments is yang diukur selama perendaman berturut-turut dari perlakuan A, B, C, D, E, F, G dan H yaitu 8.03 for treatment A, 8.2 for treatment B, 7.7 for treatment C, 7.14 for treatment D, 6.86 for treatment E, 6.35 for treatment F, and 5.9 for treatment G.

Level of Phosphate (ppm) during Soaking Process of Organic Waste from Shrimp Farms

Figure 3 described level of phosphate during the soaking process of the organic waste from the shrimp farms.

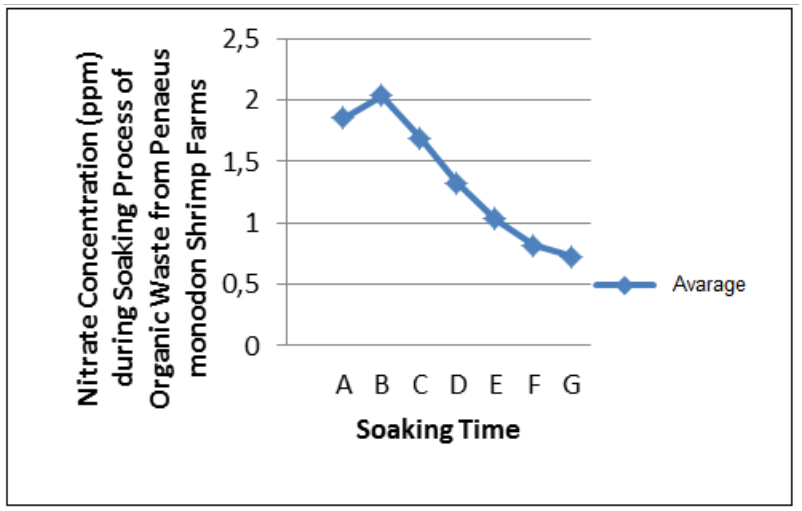

Figure3. Phosphate Level (ppm) during Soaking Process

Figure3 showed that the highest level of phosphate, 2.033 ppm, was obtained after being soaked for 48 hours (treatment B). The level of phosphate kept decreasing until it fell to 0.733 ppm in treatment G.

Source of phosphate on the water (suspended or dissolved one) is generally decomposition of dead organism. It is in the form of either anorganic (ortophosphate and poliphosphate), or organic (sugar phosphate compounds and the results of oxidation, nucleoprotein and fosfoprotein). Anorganic phosphate generally contains several compounds, phosphoric acid ion, H3PO4. 10% of anorganic phosphate consists of PO43- ions and 90% of HPO42-[12]. Rumhayati[13] states that phosphate comes in different shapes but only polyphosphate and other phosphates that can easily be changed into orthophosphate using physical (decorption), chemical (dissolvent) or biological (enzymatic process) reaction that can be used directly by algae on the body of water.

Microorganisms such as Bacillus sp, Pseudomonas sp , Bacterium sp and Escherichia sp and sp have the ability to dissolve insoluble P in order that it is available for the algae. These micro-organisms produce organic acids such as citric acid, fumaric, tartaric and keto butarat . These microorganisms also produce amino acids, vitamins and growth promoting substance such as gibberellins acids that can promote plant growth[14]. Phosphate decomposition activity can be affected by pH , humidity , temperature and other factors[15].

In conclusion, the highest level of ammonium, nitrate and phosphate during the soaking process of organic waste from Penaeus monodon is obtained after 48 hours of soaking process. The longer soaking time

will decrease the level of ammonium, nitrate and phosphate. The factors that affect decomposition of organic substances are C/N ratio, pH, temperature and DO. PH change depends on the process ammonification and nitrification of nitrogen into ammonium and nitrate . Formation of nitrate will release H+ resulting in lower pH. The microorganisms that can break down phosphates include Bacillus sp, Pseudomonas sp, Bacterium sp and Escherichia sp. These microorganisms also produce amino acids , vitamins and growth promoting substance such as gibberellin acid that can improve plant growth . Phosphate decomposition activity can be affected by pH , humidity , temperature and other factors.

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