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Determination of the Content of Nitrogen (N), Phosphorus (P), and Potassium (K) in Pellets from Cakalang fish *(Katsuwonus pelamis)* Waste Fermented using Adhesives from Broiler Chicken Feces

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Abstract

Fish offal and broiler faeces are underutilised organic waste; the purpose of this study was to determine the levels of nitrogen (N), phosphorus (P) and potassium (K) contained in the pellets from cakalang fish (Katsuwonus pelamis) waste fermented using adhesive from broiler chicken faeces. Nitrogen levels were determined using a colourimeter, phosphorus levels were determined using a UV-Vis spectrophotometer, and potassium levels were determined using a flame photometer. The results showed that the analysis of nitrogen, phosphorus, and potassium in the pellets from the fermentation of cakalang fish waste obtained an average of 4.2 %, 2.21 %, and 3.85 %, respectively.

Keywords: Cakalang fish, pellets, nitrogen, phosphorus, potassium

Introduction

The fisheries industry's development is increasing rapidly because the enormous potential of fishery resources in Indonesia supports it. In the processing industry and the use of fish in the household sector, many parts of fish, such as the head, tail, bone fins, and innards, are thrown away, which eventually causes waste (Sumiratin & Syarbiah, 2018). Fish waste in industry and household consumption can be used for various purposes. Fish waste consists of offal containing the stomach, intestines, liver, gallbladder, pancreas, spleen, and kidneys (Basmal et al., 2014). Fish innards contain 36 - 57 % protein, 0.05 - 2.38 % crude fibre, 24 - 63 % moisture content, 5 - 17 % ash content, 0.9 - 5 % Ca content, and 1 - 1.9 % P content (Zahroh et al., 2018).

Making organic fertilizer with humic acid in the form of granules. The results of this study show that the nutrient content in the raw materials for integrating organic fertiliser with humic acid in the form of granules of the blooming farmer group is humic acid with element N of 1.46 %, P of 9.15 % and K of 0.42 %. In comparison, Trichoderma has an element N of 0.75 % and 0.52 %, and cow manure has an aspect of 1.24 % P by 0.92% and K by 2.03%. Then, the raw material is formulated to be used as organic fertilizer granules with the addition of 15% and 17% adhesive, showing that the most awaited element content is in the adhesive of 15% with N of 1.921 % and P of 1.311% and K of 0.702 % and humic acid of 1.02 % (Rinaldi et al., 2019).

The utilization of fish waste into organic fertilizer, namely nitrogen (N) at 40% enzyme condition, 10 hours hydrolysis time with a content of 48.021 % nitrogen phosphate (P) at an enzyme concentration of 60 %, hydrolysis time of 4 hours with a level of 17.886 %, and potassium (K) at an enzyme concentration of 60 %, hydrolysis time of 8 hours with a level of 16.14 %. Based on this study, it can be concluded that fish waste is used as organic fertiliser (Hapsari & Welasih, 2010).

Fish innards comprise the stomach, intestines, liver, gallbladder, pancreas, spleen, and kidneys. Fish innards contain 36 – 57 % protein, 0.05 - 2.38 % crude fibre, 24 - 63 % water content, 5 - 17 % ash content, 0.9 - 5 % Ca content, and 1 - 1.9 % P content (Zahroh et al., 2018).

Fish waste contains many nutrients, namely N (nitrogen), P (phosphorus) and K (potassium), which are components of organic fertiliser (Novita & Sari, 2015).

Livestock waste such as feces, urine, and feed residues left without further handling can cause environmental pollution and health problems in the surrounding community on the farm. The processing of peril livestock manure is carried out to reduce environmental pollution. The processing of livestock manure can be done by using livestock manure as manure because the content of Haran

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elements from livestock manure, such as N, P, K, Ca, Mg, S, Na, Fe, and Cu, is needed by plants (Hapsari & Welasih, 2010).

Pariama (2020) researched determining Fe and Cu levels from the fermentation of mujair fish (Oroechromis Mozambique*)* waste using goat manure adhesives.

This paper aims to determine the nitrogen (N), phosphorus (P) and potassium (K) levels in pellets from the fermentation of skipjack fish (*Katsuwonus pelamis)* waste using purebred chicken manure adhesives.

Methods

The equipment used is containers, beakers, Erlenmeyers, funnels, measuring cups, spatulas, measuring cups, analytical balances, droppers, sieves measuring 2 - 5 mm, shaker baths, ovens, filter paper, desiccants, Kjeldahl flasks, pellet printers, UV-VIS spectrophotometers, colourimeters, and flame photometers. The ingredients used in our skipjack fish waste (offal, gills, scales, fins, and tail), brown sugar, tomatoes, purebred chicken manure, equates, concentrated H_{2SO4}, Kjeldahl tablets and HNO_3 concentrated 65 %.

The production of skipjack fish waste of as much as 100 grams is cleaned/separated from the waste in the form of offal, gills and scales, fins and tails and offal and gill waste are mashed / in a blender. After that, the fin waste, scales, and tail are washed clean, then dried and mashed until they are in powder form. Molasses are manufactured by grinding 200 grams of tomatoes and 100 grams of brown sugar. The manufacture of organic fertilizer on pellets consists of 100 grams of offal and gill waste mashed/blended with molasses and then put into the Jergen. A mixture of offal, gills and molasses waste is fermented for 14 days, and then scales, fins, tail powders, and 150 mL of concentrated HNO_3 are added to the fermentation results.

Preliminary test

Nitrogen test

Pellet fertilizer weighing 3000 grams is crushed and then put into the Kjeldahl H_2SO_4 pumpkin at a concentration of 0.1 L, and 1 / 2 tablet of Kjeldahl is added to the 50 mL measuring flask. The sample is decomposed until it boils and the solution turns green. The destruction results were filtered, and then the nitrogen content was measured using a colorimeter until it reached 100 mL.

Colorimeter measurement method

First, the solution is made, then put into the cuvette, directly put into the colorimeter, and then calibrated.

Phosphorus test

Weighed a total of 5000 grams of pellet fertilizer samples and ground them into a beaker, and HNO_3 concentrates were added until dissolved and then filtered. The filtered solution of as much as 2 mL was pipetted and put into the flask measuring 25 mL added molybdate-vanadate reagent of as much as 2 mL was then diluted using aquades to the limit mark and in absorbance, the solution in the cuvette was measured with a spectrophotometer at a wavelength of 400 nm.

Kalium test

5000 grams of pellet fertilizer samples are ground and then put into a concentrated HNO_3 chemical glass, added until dissolved, filtered the filtered solution, and pipetted 5 mL into a 500 mL measuring flask. Dilute using equates to the limit mark. Potassium level (K) using a flame photometer.

Data analysis

The data from the measurement of the standard solution of phosphorus and potassium was graphed, and the data obtained was analyzed to obtain concentration in the sample using the linear regression equation as follows:

$$Y = a + bX \quad \ldots (1)$$

Where:

Y = Absorbance (A)
a = Intersect with the y-axis
b = Line slope tg α
X = Concentration of sample solution

The levels of Nitrogen, Phosphorus and Potassium in the sample were obtained using the following samples:

$$\%Rate = (1)\frac{C \times V \times Fp}{W} x\ 100\% \quad \ldots(2)$$

Where:

C = Concentration of elements in the sample (mg/L)
V = Work flask volume (mL)
Fp = Dilution factor
W = Weight of the sample used (g)
(Surya & Suyono, 2013; Masrie et al., 2017)

Results and Discussion

Nitrogen test

The process in fish waste is a fermentation process; in this case, it is carried out like the fermentation process of making "baking" soil with a process for 14 days, and there was a disconnection (Sovacool et al., 2021).

The nitrogen content of skipjack fish waste pellets was determined using the Kjeldahl method. The method's principle is to empirically determine the number of proteins based on the number of N in the material. After the material is oxidized, ammonia (the result of the conversion of N compounds) reacts with the acid into ammonium

sulphate. The Kjeldahl method consists of three stages: destruction (destruction), distillation, and titration (Legowo et al., 2004).

The nitrogen analysis in this study used destructive resistance, where a sample of 3000 grams was put into the Kjeldahl flask. Then, one tablet of Kjeldhal was added in 0.1 L of concentrated sulfuric acid. The function of Kjeldahl tablets as a catalyst is to accelerate the increase in the boiling point of sulfuric acid, where sulfuric acid can accelerate oxidation because it is a potent oxidizing agent. The destruction process removes the content of other ions so that errors in readings during analysis can be minimized because, in the destruction process, organometals are reshuffled into inorganic forms that are ready to be analyzed (Deringer et al., 2021). Destruction is successful if a clear solution is obtained (Mazaya et al., 2013).

Adding HNO_3 after the process and adding chicken manure adhesives and decomposing compounds in simpler chicken manure can also decompose the protein from the rest of the fish waste (Lubis et al., 2021). The measurement of nitrogen content using a colorimeter is 4.2 %. Previous research also showed that the nitrogen content obtained was less than 5% (Rezende-de-Souza et al., 2022). The tool used, namely the colorimeter test device, is a tool to analyze the concentration of certain substances in the medium. Only after being calibrated can the device be used to determine the density and concentration of other solutions (Setiayawan, 2018)

Nitrogen is one of the most important elements in plants' early growth. Plants need enough nutrients to perform their physiological processes (Gigir et al., 2014).

Phosphorus test

The process to determine the phosphorus level in the pellet sample of skipjack fish waste. Namely, it can be done by adding concentrated HNO_3 to convert all metaphosphate and pyrophosphate present in the sample into orthophosphate. Then, a molybdate-vanadate adhesive is added so that the orthophosphate in the sample will react with the adhesive and form a yellow vanadimolybdiphosphate acid complex (Thi Kim Vo et al., 2018). Moreover, diluted using aquades to the limit mark and absorbed by the solution in the cuvette.

Based on the results of the calculation of phosphorus content in pellets analyzed using a UV-Vis spectrophotometer, the phosphorus content in the sample was 2.21 % of the sample. UV-Vis spectrophotometers can produce light from a spectrum of a specific wavelength, and a photometer measures the intensity of transmitted or absorbed light. Thus, spectrophotometers measure energy relative to whether that energy is transmitted, reflected or emitted as a function of wavelength. The advantage of spectrophotometers over photometers is that the wavelengths of white light can be more selective and obtained with decomposers such as prisms, grants or optical gaps (Khopkar, 2003).

Phosphorus is the most important element for plants after nitrogen. This element is absorbed as $H_2PO_2^-$; a small part can be absorbed in HPO_4^{2-}. Phosphorus is an energy source for photosynthesis, respiration, energy transfer and storage, cell division and enlargement, and plant growth and development. If the plant lacks phosphorus, crop growth can be inhibited.

Potassium Test

The process of potassium levels in the pellet sample of skipjack fish waste. HNO_3 concentrate is added to a chemical glass until dissolved; the function of adding HNO3 concentrate is to dissolve the pellet fertilizer sample so the sample dissolves (Prabawa & Nurmilatina, 2017).

Then the filtered solution was filtered and then pipetted and diluted using aquades until the limit mark was then analyzed using a flame photometer and obtained, the potassium level was 3.85 % of the sample. A flame photometer is an analysis method based on measuring the amount of specific monochromatic light emission in a particular wave emitted by an alkaline metal or alkaline earth when incandescent in a lit state. This magnitude is a function of concentration. From the metal components, the amount of the intersection of this beam is proportional to the level of elemental content in the solution, so the flame photometer method is used for quantitative purposes by measuring its intensity relatively.

Table 4.4. Results Total levels of nitrogen (N), phosphorus (P), and potassium (K) in skipjack fish waste pellets

Paramate	Skipjack Fish Pellets
	Sample (%)
Nitrogen (N)	4.20 %
Phosphorus (P)	2.21 %
Potassium (K)	3.85 %
(N+P+K)	10.26 %

The results obtained from the study on the levels of Nitrogen (N), Phosphorus (P) and Potassium (K) from skipjack fish waste pellets used a calorimeter to measure nitrogen levels, phosphorus using a UV-Vis spectrophotometer to measure phosphorus levels. In contrast, potassium used a photometer to measure calcium levels in skipjack fish.

Conclusions

Based on the calculation of the determination of nitrogen (N), phosphorus (P) and potassium (K) levels in pellets from the fermentation of skipjack fish waste using purebred chicken manure adhesive. Therefore, it can be concluded that the nitrogen content is 4.2 %, the phosphorus content is 2.21 %,

and the potassium content is 3.85 % in the organic pellet fertiliser sample.

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