

## **Long Fermentation Effect on Liquid Fertilizer for Spinach, Green Mustard, Watermelon and Banana Peel Waste Toward Nutrient Ingredients of Phosphor and Potassium with Effective Microorganism4 (Em4) Bioactivator Addition**

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**Abstract**-Spinach, green mustard, watermelon and banana peels are vegetables and fruits that have high nutrients content. Currently, these vegetables and fruits are not fully used as organic fertilizer, even though the content of phosphorus and potassium is high. This research aims to determine the content of macronutrients of Phosphorus (P) and Potassium (K) of liquid organic fertilizer after fermentation with Effective Microorganism-4. This research is completely randomized design (CRD) with the treatment of three level fermentation time (4, 8 and 12 days) and commercial fertilizer as a control. Follow the fermentation is the analysis of levels of total P and total K, using the spectrophotometric method. The results showed that the fermentation time (4, 8, 12 days) gave different level of total P and total K, namely 0,0282%, 0,0271%, 431%, respectively of total P; and 0,3033%, 0,4290%, 0,4236% of total K. In comparison with control (0,06% of total P and 0,49% of total K), these results are lower. The optimal of long fermentation to get the highest total content of P is 12 day. Meanwhile, the optimal of long fermentation to get the highest total content of K is 8 day.

**Keywords:** Fermentation, macronutrients, phosphor, potassium.

### **1. INTRODUCTION**

Fertilizer has very important role in agriculture. It helps the plants to grow and the soil fertility to be increased, but it is different with inorganic fertilizer. The overuse of inorganic fertilizer could leave the chemical residues in the soil which dangerous for its condition. Encounter this problem; there is a solution which is the utilization of liquid organic fertilizer. It is proved that liquid organic fertilizer is friendly environment also increase the fertility of the soil. The best ingredients of liquid fertilizer which uses organic waste are from the waste of fruits or vegetables because of their high content of water.

Sriningsih research (2014), got the result of banana peel utilization with the EM4 addition to be liquid fertilizer was having Phosphor content 106,53 ppm and Potassium content 1686,60 ppm [1]. Furthermore, this banana peel utilization as liquid fertilizer was innovated with the addition of green mustard, spinach, and watermelon peel. Utilization of those additional ingredients is in order to increase the content of P and K in the fertilizer. Meanwhile, the prime ingredients of the fertilizer are included as cost less ingredient and easy to get. Also, it is rich in minerals.

In the process of making liquid fertilizer, there is a need of bacterial to bound the unsure of nitrogen, phosphor, potassium, and some other unsure. Effective Microorganism-4 (EM4) is a microorganism that can be used and was used for this research. Its role is in the fermentation process. There is another important factor which is the fermentation time. The fermentation time function is giving the time to the microorganism to outline organic elements in liquid fertilizer so that can be absorbed by neighboring plants. Mujiatul research (2013), got the result as fermentation time affect the amount of N, P, and K content in liquid fertilizer from tofu's waste with Mexican marigold addition. Mujiatul got the highest amount of N, P, and K content from 4 days fermentation process with N content of 732 ppm, P content of 840,6 ppm, and K content of 7189,8 ppm [2].

There are various ingredients that can be turned into liquid fertilizer. The waste of our surroundings can be utilized. So that a number of soil nutrients or organic elements and the microorganisms also has many varieties. For it, there should be further research to be conducted to analyze the content of any other liquid fertilizer from different ingredients so specific benefit can be known and delivered to the people who needs for the good use.

The purpose of the research is to know the total of Phosphor and Potassium content in liquid fertilizer as the result of the fermentation of spinach, green mustard, watermelon peel, and banana peel with EM4 addition and to know how long does the fermentation takes time to get the highest amount of total phosphor and potassium content in the liquid fertilizer.

## 2. METHODS

The type of this research is a quantitative descriptive research with experimental design. The experimental design is Completely Randomized Design (CRD) with a factorial. The free variable of this research is the fermentation time (4 days, 8 days, and 12 days). The bound variable of this research is Phosphor content (P) and Potassium content (K) in the liquid fertilizer. Meanwhile, the controlled variable of this research is the mass of the primer ingredients, EM4, sugary water or molasses, and each total of P and K commercial liquid fertilizer.

The first step of this research is to make the sample of the liquid organic fertilizer that will be fermented with the continuation of testing the result of fermented liquid fertilizer. The procedures began cutting the primary ingredient, the second mix all the ingredient, and then prepare the fermentation solvent with EM4 and molasses. The next steps are anaerobic fermentation process, and the end analyzed the research of the fermentation.

Primary parameter that will be observed is the phosphor and potassium content in the liquid fertilizer using spectrophotometry method. Phosphor using spectrophotometer UV-Vis and Potassium using spectrophotometer AAS. Data that is collected will be statistically analyzed through Analysis of Variance (ANOVA) One Way with SPSS application. The value of F critical for  $\alpha = 0,05$ . If the value of  $F_{obs} > F_{irst}$ , it will be *significant* [3].

## 3. RESULTS AND DISCUSSION

These are the average of total Phosphor (P) and Potassium (K) content in the liquid fertilizer as the result of spinach, green mustard, banana peel, and watermelon peel fermentation (in percentage %) from different fermentation time.

**Tabel 3.1. Average Total Phosphor Content in Liquid Fertilizer as the result of spinach, green mustard, banana peel, and watermelon peel fermentation**

No	Treatment	Measurement Result (%)			Average
		U1	U2	U3	
1	4 days fermentation	0,0277	0,0308	0,0262	0,0282
2	8 days fermentation	0,0275	0,0325	0,0215	0,0271
3	12 days fermentation	0,0418	0,0466	0,0429	0,0437

Note :

U1 : 1<sup>st</sup> Repetition

U2 : 2<sup>nd</sup> Repetition

U3 : 3<sup>rd</sup> Repetition

From the result of laboratory analyses about the phosphor content, the researcher got a different average percentage of total phosphor content according to the treatment.

Average total phosphor content from 4 days, 8 days, and 12 days fermentation time (in %) are 0,0282; 0,0271; and 0,0437. The phosphor content from commercial liquid fertilizer is 0,06%. If the result to be compared with commercial liquid fertilizer (positive control), the total phosphor content from fermentation process is much smaller.

According to 3.1 table, the highest amount of total P content in liquid fertilizer from spinach, green mustard, banana peel, and watermelon peel fermentation is from 12 days fermentation treatment with 437 ppm (0,0437%) and the lowest amount of total P content is from 4 days fermentation treatment with 282 ppm (0,0282%).

Also from the data analysis, the researcher got the result that the total phosphor content in liquid fertilizer is significantly affected by the fermentation time. The factor that possibly significantly affect the data is the activity of micro bacteria *Lactobacillus* sp., *Streptomyces* sp., cellulose-degrading fungus, and yeast that can reform phosphor which leaves the total P content raise [4]. Other than that, it can be affected by the substrates in organic used.

As for the potassium content laboratory analyses, the data also had differences according to the fermentation time treatment. Average total Potassium content in liquid fertilizer from spinach, green mustard, banana peel, and watermelon peel fermentation can be seen in 3.2 table.

**Tabel 3.2. Average Total Potassium Content in Liquid Fertilizer as the result of spinach, green mustard, banana peel, and watermelon peel fermentation**

No	Treatment	Measurement Result (%)			Average
		U1	U2	U3	
1	4 days fermentation	0,3198	0,2998	0,2926	0,3033
2	8 days fermentation	0,4284	0,4218	0,4383	0,4290
3	12 days fermentation	0,2050	0,1932	0,8731	0,4236

Note :

U1 : 1<sup>st</sup> Repetition

U2 : 2<sup>nd</sup> Repetition

U3 : 3<sup>rd</sup> Repetition

Average total potassium content from 4 days, 8 days, and 12 days fermentation time (in %) are 0,3033; 0,4290; and 0,4236. The potassium content from commercial liquid fertilizer is 0,49%. If the result to be compared with commercial liquid fertilizer (positive control), the total potassium content from fermentation process is much smaller.

From the data analysis, the researcher got the result that the total potassium content in liquid fertilizer is not significantly affected by the fermentation time. Another way, the researcher can say that through all the treatment, there were no significant differences.

#### 4. CONCLUSIONS

The conclusions from the research are:

1. Total phosphor content in liquid fertilizer from spinach, green mustard, banana peel, and watermelon peel with EM4 addition for 4 days, 8 days, and 12 days fermentation are 0,0282%, 0,0271%, and 0,0431%. Total potassium content in liquid fertilizer from spinach, green mustard, banana peel, and watermelon peel with EM4 addition for 4 days, 8 days, and 12 days fermentation are 0,3033%, 0,4290%, and 0,4236%.
2. Optimum fermentation time to get the highest amount of total phosphor content is 12 days, and total potassium content is 8 days.

#### 5. REFERENCES

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