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Bioactivator Based On Organic Waste for Maggot Growth Media

E. Tarigan[1], Yunilas[1], N. Ginting[1*] and N. Saidi[2]

[1]Animal Production Program Study, Faculty of Agriculture, University of North Sumatra, Padang Bulan, Medan 20155, Indonesia

[2]Department of Plant Sciences, Microbiology and Biotechnology, Makerere University, Kampala, Uganda
**Correspondent author:nurzainah@usu.ac.id*

Abstract. Bioactivator is needed for making maggot growth media. This study aims to determine the quality of bioactivator based on various organic waste. The research design used was a 4x3 factorial randomized design (CRD) with three replications. The factor I was various organic wastes (D1 = vegetable waste, D2 = fruit waste, D3 = food processing waste, D4 = mixed waste and Factor II was length of fermentation day (L1 = 7 days, L2 = 14 days, L4 = 21 days), the variables observed were pH, colour, aroma, microbial population, and total acid. pH of media was in the range of 5.4 - 6.7. There was no difference in colour and aroma due to each treatment. Population of microbial in the range of 11.36 x 10^5 - 2.18 x 10^6, 14 days fermentation caused highest microbial population. Total acid range of 2.21 - 3.15. In conclusion bioactivator of vegetable, fruit, food processing and mixed waste almost has the same characteristics on pH, colour, aroma and total acid. However, 14 days of fermentation produced better bioactivator. This study will be continued with the application of bioactivators as maggot media growth.

Keywords: fermentation, local microorganisms, microbial population, organic waste, total acid

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1. Introduction

Organic waste is waste material that is considered useless but managed so as not to endanger the environment and public health. Solid waste is all forms of waste generated from human activities which are usually in solid form and have generally been disposed of, useless or no longer needed [1]. The solid waste service level is targeted to reach 80%. However, in Indonesia only 41.28% of waste is disposed of in landfill, 35.59% is burned, 14.01% is thrown into the river, 7.79% is buried, and only 1.15% is processed for compost or for maggots media. Garbage is a severe environmental problem faced by the people of Indonesia and the world. It can be said that the waste produced by humans daily is countless, be it organic or inorganic. Recently, organic waste recycling activities have been found using the maggot media-making method. The manufacture of maggot media from organic waste reformer through a fermentation process involving living organisms [2].

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According to [3], organic waste is a type of waste composed of organic compounds and is degradable. Living organisms, especially microorganisms, can naturally or quickly decompose it. Organic waste is divided into soft organic waste and solid or hard organic waste. In general, soft organic waste is recycled with composting technology to produce compost [4] and is also processed into maggot media with fermentation technology [5].

2. Materials and methods

This research was carried out in the Animal Production Study Program laboratory. This research took place from July to August 2021.

The materials used in this study were pineapple, banana, papaya, mustard greens, cabbage, cauliflower, tofu dregs, coconut pulp, cassava, fine bran, bioactivatorasses, coconut water, rice washing water, and clean water. The tools used in this study were bottles as a place to ferment bioactivator, a blender to reduce the size of organic waste, scales, a hemocytometer, a pH meter, a microscope, aquades, NaOH, dropper pipettes, plastic, and rubber bands.

2.1 Method

This research was conducted using a completely randomized design (CRD) with a factorial pattern of 4 x 3 with three replications. The first factor was organic waste and the second factor was the length of fermentation time. Each treatment was repeated three times.

The factor I: organic waste

D1 = Vegetables (cabbage, cauliflower leaves, and mustard greens)

D2 = Fruit (papaya, pineapple, and banana)

D3 = Food processing industry (cassava, coconut dregs, and tofu dregs)

D4 = Fruit, vegetable and industrial waste (mixed)

Factor II: fermentation time

L1 = 7 days

L2 = 14 days

L3 = 21 days

2.2 Research Parameters

The observed parameters were :

1. Colour

2. Aroma

3. pH of bioactivator

4. Total microorganism population

5. Total Acid

3. Results and Discussion

3.1 Colour

Table 1. The effect of various organic wastes and fermentation time on the colour of bioactivator

Organic Ingredients	Fermentation Time		
	L1 (7 days)	L2 (14 days)	L3 (21 days)
D1 (Vegetable Waste)	Dark brown	Dark brown	Dark brown
D2 (Fruit Waste)	Light brown	Dark brown	Dark brown
D3 (Industrial Waste)	Dark brown	Dark brown	Dark brown
D4 (Mixed Waste)	Dark brown	Dark brown	Dark brown

"Table 1" shows that the organic waste fermentation at various fermentation times produced bioactivator colours ranging from light brown to dark brown. The bioactivator colour before fermentation had a light brown colour. It was still light brown at seven days of fermentation, and it changed at 14 and 21 days. The colour becomes dark brown. The long fermentation time will support the microbes to destroy the tissues and cells of the bioactivator material, resulting in a blackish brown colour change. The length of this fermentation time is related to the availability of nutrients that microorganisms can use as a source of energy and metabolism [6].

3.2 Aroma

"Table 2" shows that the fermentation of organic waste at various fermentation times produces bioactivator aromas that vary from slightly sour, sour and very sour. The smell of bioactivator before fermentation smells of organic waste. After being fermented, it turns sour. This is because the materials contained in the bioactivator solution have been remodelled so that they affect the physical results of the bioactivator solution, such as colour and odour.

Table 2. Effect of various organic wastes and fermentation duration on bioactivators' aroma

Organic Ingredients	Fermentation Time		
	L1 (7 days)	L2 (14 days)	L3 (21 days)
D1 (Vegetable Waste)	Sour	Sour	Very Acid
D2 (Fruit Waste)	Sour	Sour	Very Acid
D3 (Industrial Waste)	Sour	Sour	Very Acid
D4 (Mixed)	Sour	Sour	Very Acid

Microorganisms break down carbohydrates then produces alcohol, and organic acids [7]. The formation of bioactivator was successful, characterized by a sour aroma. The sour aroma resulted from fermentation produced due to an overhaul that produced organic acids. The fermentation duration affected the aroma changes in fermentation; thus form bioactivator acidity [8]. Furthermore, after biological fermentation, white bubbles will be seen on the surface, a brownish colour, and a characteristic sour smell of fermentation [9].

3.3 pH

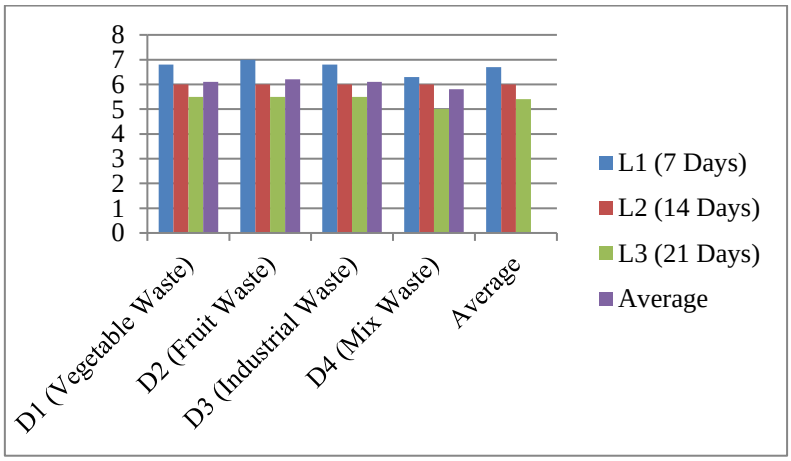

Figure 1. Effect of various organic wastes and duration of fermentation on pH.

Based on the results of the analysis of variance, "Figure 1" showed that various organic waste materials had a very significant effect ($P<0.01$), and the length of fermentation time also had a very significant effect ($P<0.01$). Still, there was no interaction between various organic wastes and the length of fermentation time ($P>0,05$). The results of the study showed that there was a decrease in pH, so it could be concluded that the distribution of organic waste fermented at different times went well. The decrease in pH is due to the presence of lactic acid produced by lactic acid bacteria in their metabolism, so the pH at bioactivator becomes acidic and is not suitable for other microorganisms. The presence of lactic acid bacteria as the cause of the decrease in pH is also supported by the opinion of [10], who said that where the fermentation process resulted in increased microbial activity, decreased pH, and increased acid levels.

3.4 Total Microbial Population

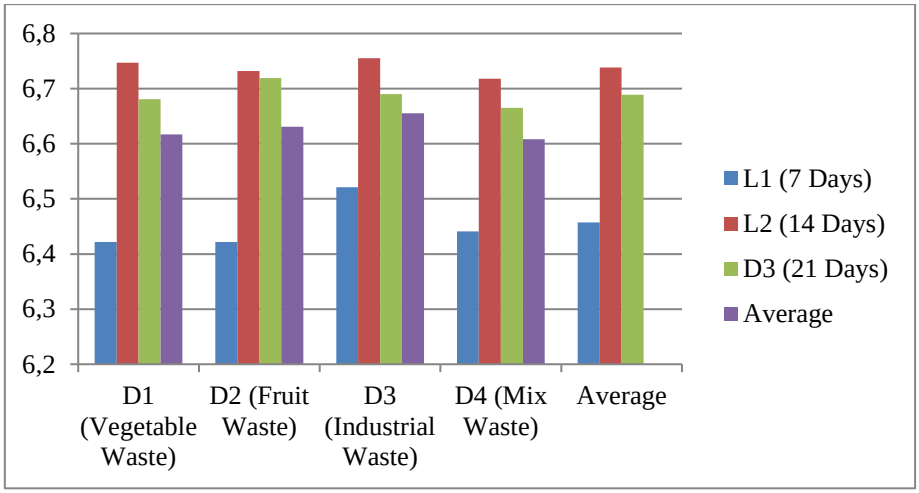

Figure 2. Effect of various organic wastes and duration of fermentation on total local microbial population (CFU/ml)

The results from "Figure 2" show that the total microbes transformed by various organic wastes and fermentation time ranged from 6,026 to 6,356 CFU/ml. Based on the results of the analysis of variance, there was no interaction between various organic wastes and the length of fermentation time, various organic wastes had no significant effect ($P>0.05$), but the length of fermentation time had a very significant effect ($P<0.01$) on the total microbes. [11] also stated that during the microbial fermentation process, there will be synergies so that there are more opportunities to grow and produce enzymes that will be used to degrade fibre components contained in the substrate, the end product of degradation of crude fibre in the form of glucose which is used as an energy source for life. Microbes. In addition, generation time calculations are needed to predict the population of each microorganism within the same period and the activeness of metabolic processes [12]. According to [13], in some circumstances, followed by an analysis of the cells, the turbidity and the number of microbes directly counted can decrease, and the decrease in live microbes. There is a further accumulation of disruptive metabolite products and essential nutrients in the depleted medium.

3.5 Total Acid

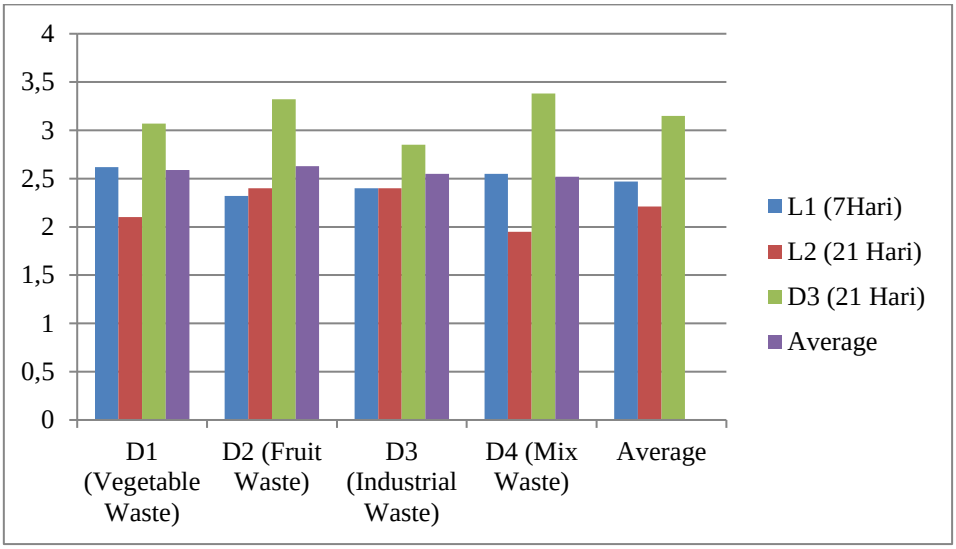

Figure 3. Total acid yield (%)

The results of "Figure 3" show that the average total acid of various organic wastes and fermentation time ranged from 2.21 to 3.15. it can be seen that there is no interaction between various organic wastes and the length of fermentation time, various organic wastes have no significant effect (P>0.05), and the length of fermentation time has a significant effect (P>0.05). According to [14], the measurement of the total titrated acid is based on the acid components present in the solution, and both dissociated and undissociated, acetic acid is one of the primary metabolites produced in the fermentation process. Therefore the fermentation process can change the physical or chemical properties which consist of total acid and pH.

4. Conclusion

Various organic wastes can be used in the manufacture of bioactivator. However, the best fermentation time is 14 days.

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