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Analysis of Nutrient Content of Liquid Organic Fertilizer for Hydroponic Nutrition

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ABSTRACT: Liquid organic fertilizer (POC) is an organic fertilizer produced from a fermentation process and contains nutrients needed for plant growth. This study aims to determine the POC nutrient content of several types of organic waste and its potential as a nutrient in a hydroponic system. This study used 4 types of organic waste, namely banana peels, orange peels, pineapple peels and cow urine and divided into 6 types of POC, namely POC banana peels (P1); POC orange peel (P2), POC pineapple skin (P3); POC of fermented cow urine with MOL of pineapple skin with a ratio of 5:1 (P4); POC of fermented cow urine with MOL of pineapple skin with a ratio of 2:1 (P5) and POC of fermented cow urine with MOL of pineapple skin with a ratio of 1:1 (rP6). Parameters observed with the content of nitrogen (N), phosphorus (P2O5), potassium (K20) and pH of the six types of POC. The results showed that the POC with the highest nitrogen content is P6 (0.35%), the highest phosphorus content is P3 (0.38%) and the highest potassium is P6 (1.85%). The pH value of liquid organic fertilizer is in accordance with the minimum technical standards for liquid organic fertilizer, but the POC whose pH value is suitable for use as a hydroponic nutrient are P4 and P6.

KEYWORDS: Banana Peel, Orange Peel, Local Microorganisms, Cow Urine

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INTRODUCTION

Hydroponics is a system of cultivating plants without using soil, plant roots get nutrients from nutrient solutions (Szekely & Jijakli, 2022). Vegetable cultivation with a hydroponic system is developing rapidly, because this system has several advantages: it can increase growth and production, as well as crop quality (Trejo-Tellez and Gomez. (2021); (Sunaryo et al., 2018). There are 5 types of hydroponic systems: Nutrient Film Technique (NFT), Nutrient Flow Technique (NFLT), Deep Flow Technique (DFT), Dynamic Root Floating Technique (DRFT) and Food and Drain (FAD) (Phibunwatthanawong & Riddech, 2019).

Hydroponic systems generally rely on chemical nutrients to support plant growth. According to Gent, 2003; (Phibunwatthanawong & Riddech, 2019), one of the disadvantages of using chemical nutrition is that chemical residues accumulate in vegetables and into the body/anatomy. One alternative that can be done is to use liquid organic fertilizer.

Liquid organic fertilizer contains nutrients for plant growth and microbes to help decompose organic matter (Muthu et al., 2023). Liquid organic fertilizer made from plant residues and animal waste contains macro and micro nutrients (Haryanta et al, 2022).

Liquid organic fertilizer is fertilizer in liquid form produced from the fermentation process of organic matter. Organic materials such as cow urine, pineapple peel waste, banana peels and orange peels can be used as liquid organic fertilizer because they contain the nutrients needed for plant growth. According to Singh et al, (2018), cow urine contains 95% water and 2.5% urea, whereas according to Pradhan & Verma (2018), cow urine contains minerals, hormones and enzymes. According to Bulkaini et al, (2021), pineapple skin contains 85.78% dry matter, 81.90% organic matter, 8.1% ash, 3.% crude protein, 19.69% crude fiber and 3.49% crude fat. %. Besides according to (Abdullah and Mat, 2008; Ramadhani and Nuraini 2018), pineapple skin contains several bacteria such as; *Azotobacter* Sp, *Rhizobium* Sp., *Azospirilium* SP., *Pseudomonas* Sp., *Bacillus*, Sp.

The purpose of this study was to determine the nutritional content of liquid organic fertilizer from liquid and solid organic waste and the potential use of liquid organic fertilizer as a nutrient in hydroponic systems.

METHODS

Research sites

This research was carried out at the Laboratory and Green House of the Agrotechnology Study Program, Faculty of Agriculture, Universitas Muhammadiyah Makassar, September - October 2022.

The research was divided into 3 stages as follows;

1. Making Pineapple Skin MOL
2. Production of Liquid Organic Fertilizer from fruit peels
   The waste of pineapple skin, banana peel and orange peel was each cut into small pieces and then each was put into a 1.5 liter plastic bottle and 1 liter of water was added, then 20 gr of granulated sugar was added. The bottle was tightly closed and placed in a place that was not exposed to direct sunlight. Every day the bottle cap was opened to release air from the bottle. The bottle was sealed again and this process lasts up to 60 days.
3. Production of liquid organic fertilizer from cow urine
   5 liters of cow urine was prepared in a covered bucket, mixed with local microorganisms from pineapple skin with a ratio of 5:1, a ratio of 2:1 and a ratio of 1:1. Then it was fermented for 30 days, stirring was done every day and the bucket was tightly closed after stirring.

Tabel 1. Perlakuan Pupuk Organik Cair

Treatment Code	Organic Ingredients
POC 1	Banana peel
POC 2	Orange peel
POC 3	Pineapple Skin
POC 4	Cow urine + Pineapple MOL (5:1)
POC 5	Cow urine + Pineapple MOL (2:1)
POC 6	Cow urine + Pineapple MOL (1:1)

4. Analysis of nutrient content

Samples of liquid organic fertilizer were put in bottles and labeled and then sent to the laboratory to be analyzed for nitrogen, phosphorus, potassium and pH content.

RESULTS AND DISCUSSION

3.1 Nitrogen Nutrient Content

The highest nitrogen content in liquid organic fertilizer is produced in treatment P6, namely POC of cow urine fermented with MOL of pineapple peels with a ratio (1:1) of 0.35% and the lowest was in P1, namely POC of banana peels (Table 2).

Table 2. Liquid Organic Fertilizer Nitrogen Content

Liquid Organic Fertilizer	N (%)
P1	0,17
P2	0,19
P3	0,23
P4	0,22
P5	0,28
P6	0,35

3.2 Phosphorus nutrient content

The highest phosphorus content is produced in treatment P3 (0.38%), namely POC from pineapple skins and the lowest is in treatment P1, namely POC banana peels (Table 3). The phosphorus nutrient content from the results of this study is on average higher when compared to the results of Rinekso et al., (2011); (Rosniawaty et al., 2015) which only contains 0.16% phosphorus.

Table 3. Phosphate Content of Liquid Organic Fertilizer

Treatment	P_2O_5 (%)
P1	0,10
P2	0,30
P3	0,38
P4	0,25
P5	0,32
P6	0,28

3.3 Nutrient Content of Potassium

The highest potassium content is produced in the P6 treatment, namely POC fermented bovine urine with MOL of pineapple skin with a ratio of 1:1 with a value of 1.85% K2O (Table 4). This result is higher when compared to the results of Rinekso et al., (2011); (Rosniawaty et al., 2015), yielding only 0.62%.

The results of the study (Ariyanto & Wisuda, 2019), cow urine contains 1.1% N, 0.5% P and 0.9% K. According to (Vebriyanti et al., 2022), fermentation of cow urine with local microorganisms on average produces a lower nutrient content of Nitrogen, Phosphorus and Potassium compared to fermentation using EM4.

Table 4. Potassium Content of Liquid Organic Fertilizer

Treatment	K_2O (%)
P1	0,84
P2	1,34
P3	1,27
P4	1,19
P5	0,96
P6	1,85

3.4 pH Value

The results of pH measurements from organic fertilizer samples varied between pH 4.65 - 6.05 (Table 5). Liquid organic fertilizer from cow urine shows a higher pH of 5.45 – 6.05 compared to liquid organic fertilizer from fruit peel waste whose average pH value is less than 5. The pH value of liquid organic fertilizer from cow urine fermented with EM4 has a pH value which is higher, namely pH 7.2-8.2 (Ariyanto & Wisuda, 2019). According to Sunaryo et al, (2018), the quality of liquid organic fertilizer is determined by pH and nutrient content in liquid organic fertilizer, the use of microorganisms in fermenting organic matter will produce quality liquid organic fertilizer.

Table 5. pH Value of Liquid Organic Fertilizer

Treatment	pH
P1	4,65
P2	4,38
P3	4,85
P4	5,85
P5	5,45
P6	6,05

The liquid organic fertilizer produced from all treatments has a pH value in accordance with the minimum technical requirements for liquid organic fertilizer according to the Regulation of the Minister of Agriculture No.2/Pert./HK.060/2/2006, namely a pH value between 4-8. However, for use as hydroponic nutrition, liquid organic fertilizers that meet standards are P4 and P5 as announced by Muthu et al (2023), that the nutritional pH for a hydroponic system is 5.5-6.5

CONCLUSION

Liquid organic fertilizer (POC) made from different organic materials, produces different nutrient content and pH values with POC from fermented cow urine with MOL pineapple skin with a ratio of 1:1 (P6) produces the highest Nitrogen content (0.35%) and

Potassium (1.85%), while POC from pineapple skin (P3) produces the highest phosphorus content namely 0.38%. POC pH values have met the minimum technical standards for liquid organic fertilizers and POC that meet the standards for hydroponic nutrition are P4 and P6.

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