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Management Household Food Waste : Processing and Characteristic Compost

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ABSTRAK

Nasi yang tidak dikonsumsi menjadikannya limbah rumah tangga, tapi dapat dimanfaatkan kembali. Salah satunya dengan menjadikan limbah nasi sebagai kompos. Nasi merupakan material organik yang mengandung unsur karbohidrat dan dapat digunakan sebagai bahan utama kompos. Penelitian ini bertujuan untuk mengetahui karakteristik kompos cair yang dihasilkan dari limbah nasi. Desain penelitian bersifat pra eksperimen dengan *post test only design*. Metode dalam pengomposan ini yaitu semi anaerobik. Jumlah kompos cair yang dihasilkan yaitu 11 liter dari 38 kg nasi. Untuk nilai C/N rasio melebihi nilai maksimum, sedangkan parameter yang lain seperti nilai tembaga, nitrogen, seng, *fecal coliform*, karbon organik, fosfor, kalium kurang dari nilai maksimum dan minimum, nilai *Salmonella sp* negatif/25 ml, pH 3 termasuk asam. Untuk nilai BOD yaitu >3000 mg/l dan COD yaitu >1500 mg/l. Hasil BOD dan COD dibandingkan dengan baku mutu air limbah bagi usaha dan/atau kegiatan yang belum memiliki baku mutu air limbah yang ditetapkan. Untuk nilai BOD, lebih dari standar golongan I dan golongan II begitupula dengan nilai COD. Kompos cair dari limbah nasi memiliki karakteristik yang melebihi nilai maksimum serta kurang dari nilai maksimum dan minimum.

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ABSTRACT

Rice can be recycled but is not edible, thus it ends up in the trash. Making compost out of leftover rice is one of them. This study aims to determine the characteristics of liquid compost produced from rice waste. The research design was pre-experimental with post test only design. The method in composting was semi anaerobic. Composting process that in 1 month it produces 11 liters of liquid compost from 38 kg of rice waste. The result from laboratory test the value that exceeds the maximum value characteristics of liquid compost was C / N ratio, the value was less than the maximum and minimum value characteristics of liquid compost were copper, nitrogen, zinc, fecal coliform, organic carbon, phosphorus in fertilizer, potassium. Salmonella sp negative / 25 ml; pH 3. BOD values was >3000 mg/l and COD was >1500 mg/L. For the BOD value was more than the standard of class I and class II as well as for the COD value. Liquid compounds from rice waste have characteristics that exceed the maximum values and less than the maximum and minimum values.

1. INTRODUCTION

There have been many researches related to compost using rice husk, rice bran, and rice straw. However, there is still little discussion related to research on the utilization of household waste in the form of rice waste which is processed into liquid compost. The research still needs further research for the development of science. Household waste usually used foranimal feed from rice waste. The study aims is to determine the characteristics of amliquid compost produced from rice waste.

The results of research related to rice bran, showed that tannery wastes can be developed through composting into a humus like substances, tannery sludge rice bran cow manure with aeration and effective microorganisms are the best combination that can be applied to enhanced soil fertility, the characteristics of compost indicated that it was mature (Lambu , 2019). Another results of research related to rice,

showed that between rice bran and fertilizers, rice bran played better role than inorganic fertilizers in case of only sulfur concentration. Rice bran in combination with chemical fertilizers could be applied to achieve better concentration and uptake in different organs, oil and protein content in seeds of sunflower (Alauddin , 2020).

The results of research related to rice straw, showed that the maximum final C:N ratio and germination index obtained at a composting mixture with initial C:N ratios of 30 compared to the other two composting mixtures. To economically manage the increasingly quantities of rice straw ash and food waste produced each year, composting of these two waste materials with initial C:N ratio 30 is recommended with aeration rate of 0.6 L/min.kg and burning the rice straw at 400°C for 30 minutes (Khalib , 2019).

The results of research related to rice husk, showed that the combined addition of 10% eggshell waste and 25% rice husk produced the highest quality compost in the shortest time. To produce a stable and mature product, two-stage composting of green waste required 30 days without additives but only 20 days with the combined addition of 10% eggshell waste and 25% rice husk. The optimal treatment prolonged the thermophilic phase, enhanced the particle-size distribution, accelerated nitrification, increased microbial numbers and enzyme activities, and decreased the phytotoxicity of the compost product (Wang , 2021). Another results of research related to rice husk, showed that a significant effect of rice husk biochar at higher doses (10 and 20 t ha^{-1}). The positive effect of rice husk biochar and rice straw compost on soil water content is more obvious when the soil is dry. Application of rice husk biochar and rice straw compost did not increase rice yields; the first crop, but increased yields of the second crop; soybean (Barus , 2022).

Mixing and composting rice husk biochar in poultry litter with C/N ratio of 25 helps in reducing the NH3 volatilization and CO2 emissions, while reducing the overall operational costs of waste disposal by shortening the composting time alongside nitrogen conservation and carbon sequestration (Alarefee , 2023) .Some deficiencies of these individual treatment technologies are hard to be ignored, such as energy loss and liquid digestate/leaching discharge. Solid-state anaerobic digestion and aerobic composting can alleviate these issues with fully synergizing the characteristics of two treatment units for multi-target products (Qi , 2022). The proposed compost has a potential to be used as a supplementary in paddies in smaller farming systems, or in greenhouse or vegetable-based cultivations (Kadoglidou , 2019). There are 97.75% of farmers admit not to compost their rice straw due to their lack of knowledge on the way and means of rice straw composting (Muliarta, 2019). The application of inorganic additives in the mechanical co-composting of poultry waste and rice husk lessens the humifcation period and C/N ratio, which enhanced the nitrogen mineralization (Mushtaq , 2019).

Rice and wheat are growth significantly ($p \leqslant 0.05$) increased by an-aerobically decomposed municipal solid waste followed by co-compost, aerobically decomposed municipal solid waste, farm yard manure, gypsum and control (Murtaza , 2019). Mixing of 20% mustard oilcake and 30% sugarcane press mud or poultry manure or cow dung with 50% municipal solid waste compost had markedly improved the nutrient value of municipal solid waste compost. This study showed that fertilizer management and recommendation strategies for different crops and soils (Sultana , 2021). The combined use of gypsum and microbial-enriched MSW compost in sodic soils and cultivation of salt-tolerant varieties of rice and wheat were proved as cost-effective sustainable sodic soil reclamation technology which can also be helpful for the efficient utilization of municipal solid waste (Singh , 2022). The application of microbial consortia-enriched municipal solid waste compost t 10 Mg·ha−1 can successfully substitute 25% of recommended chemical fertilizer dose in rice grown under direct-seeded conditions (Dharminder , 2021). The vegetative growth, yield and nutritional qualities were significantly affected by the compost characteristics compared to chemical fertilizer because of increased nutrient uptake and biostimulation functions (Faysal , 2022). Composts 1, 3 and 4 do not present characteristics of mature compost to be used as fertilizer in crops. Compost 2 can be used as organic fertilizer (Tratsch , 2019). All the parameters of the final product were in alignment with the regulations, thereby providing assurances on the quality of the compost, favoring its acceptability in agricultural purposes and also inflating the local circular economy (Chung , 2022). The crystalline rice straw was reduced to a brown crumpled and compact value-added composted biofertlizer with a high carbon and crude protein content (Kaur , 2019). The addition of sludge containing microbial consortium seed can improve the composting process of oil palm biomass waste and is possible on the semi-commercial and industrial scales (Zainudin , 2022).

2. MATERIALS AND METHODS

The research design was pre-experimental with post test only design. The method of composting was semi-anaerobic. Composting implementation time was 1 month.

A. Tool :
   1. Composter unit from a plastic barrel
      Function: As Composter
   2. Water faucet
      Function: As a diverter liquid compost
   3. Measuring cup
      Function: As a place to measure the volume of rice
   4. Atomizer / Sprayer
      Function : As a place for compost activator starter and to spray compost activator starter on rice
   5. Thermometer
      Function : As a tool to measure the temperature of the compost

B. Material :
   1. Rice waste
   2. Compost activator starter (1 : 50)

C. Step :
   1. Measure 1 - 1.5 liters of rice with a measuring cup.
   2. Open the composter and check the temperature and presence of mold.
   3. Put the rice in the composter.
   4. Spray the compost activator starter liquid as much as 10-20 sprays evenly on the rice.
   5. Close the composter tightly again.
   6. Do activities number 1-5 every day for 1 month.

3. RESULTS AND DISCUSSION

Table 1. Laboratory Test

Parameter	Unit	Test Result
BOD	mg/l	>3000
COD	mg/l	>1500
C/N ratio	-	32,31
Copper	mg/kg	0,612
Total Nitrogen	%	0,156
Zinc	mg/kg	2,996
Fecal coliform	APM/ml	<3
Salmonella sp	Coloni/25 ml	Negative / 25 ml
C organic	%	5,041
Phosphor	%	0,010
Potassium	%	0,009
pH	-	3

Table 1 reveals that activation solely with Sodium hydroxide resulted in a minimum adsorption rate of 93.3% and a maximum of 98.3%, making additional activation with Hydrochloric acid unnecessary. According to Table 2, a chicken feather weight of 1.7 grams, when activated with Sodium hydroxide, exhibited the highest adsorption capability for aqueous lead nitrate.

According to Badan Standardisasi Nasional : Spesifikasi kompos dari sampah organik domestik 2004 Laboratory test results of liquid compost are compared with SNI 19-7030-2004 except for BOD and COD. The C/N ratio value exceeds the maximum value, which is 32.31. The copper value, it is less than the maximum value of 0.612 mg/kg. The nitrogen value, it is less than the minimum value of 0.156%. The zinc value, it is less than the maximum value of 2.996 mg/kg. Fecal coliform values less than the maximum value, it is <3. Negative Salmonella sp values/25 ml. The value of organic carbon, it is less than the minimum value of 5.041%. The value of phosphorus in fertilizers, it is less than the minimum value of 0.010%. The potassium value, it is less than the minimum value of 0.009%. The pH is considered acidic, it is 3. The results of liquid compost laboratory tests are compared to the Regulation of the Minister of Environment of the Republic of Indonesia Number 5 of 2014 for BOD and COD. The BOD value is >3000 mg/l and COD is >1500 mg/l. BOD and COD results are compared with wastewater quality standards for businesses and/or activities that do not yet have established wastewater quality standards. According to Peraturan Menteri Lingkungan Hidup Republik Indonesia Nomor 5 Tahun 2014 Tentang Baku Mutu Air Limbah,for the BOD value, it is more than the standard for group I, which is 50 mg/L and for group II, which is 150 mg/L and for the COD value, it is more than the standard for group I, which is 100 mg/L and for group II, which is 300 mg/L . The amount of liquid compost produced is 11 liters from 38 kg of rice.

An increase in human population has led to an increase in food availability, one of which is rice which is the main food of the population in Indonesia. However, the rice consumed also leaves rice waste which is household waste. This rice waste cannot be consumed anymore and needs sustainable utilization. One of them makes rice waste as the main ingredient of compost. Through the processing of waste, especially those made from main rice into compost, can create a clean environment. Besides being useful to fertilize the soil and support plant growth, economic value compost that can be sold. Compost is one type of organic fertilizer derived from organic materials that have decayed / due to interactions between decomposing microorganisms. In addition to compost, there are other organic fertilizers, such as green manure, manure, chemical fertilizer, humus, solid and liquid compost. Use of liquid compost by spraying it on the leaves or watering it on solid soil. The use of solid compost by sowing or immersing it in the soil (Carey , 2018). The use of rice waste because rice is one of the organic materials that contain carbohydrate. Carbohydrates are chemical compounds that contain elements of C, H and O or can be referred to as more complex sugar groups. Composting of organic waste is a process that involves the interaction between organic matter, microbes, oxygen, and moisture (Carey, 2018). Composting occurs in aerobic and anaerobic conditions. Anaerobic composting produces methane (alcohol), CO2, and compounds such as organic acids. Aerobic composting produces CO2, water and heat acoording to Kementerian Lingkungan Hidup Dan Kehutanan Direktorat Jenderal Pengelolaan Sampah. Based on the results of data input carried out by 144 districts/cities throughout Indonesia in 2022 by the National Waste Management Information System (SIPSN), waste generation is 17,729,071.73 tons/year, waste reduction is 27.17%, waste handling is 49, 95%, 77.12% managed waste, 22.88% unmanaged waste. The composition of waste based on the type of waste for food waste occupies the highest position is 42.3%. The composition of waste based on the source of waste for households occupies the highest position is 37.6% according to Kementerian Lingkungan Hidup Dan Kehutanan Direktorat Jenderal Pengelolaan Sampah 2022.

Figure 1. Rice Waste

Figure 2. Moldy Rice Waste

Figure 3. Drum Composter

Figure 4. Liquid Compost

4. CONCLUSIONS

The values that exceed the standard characteristics of liquid compost is C/N ratio, the values that are less than the standard characteristics of liquid compost are copper, nitrogen, zinc, fecal coliform, organic carbon, phosphorus in fertilizers, potassium. The weakness of this study has not been tested on plants, so the effectiveness of liquid compost derived from household waste in the form of rice waste didn't know. This study only reported descriptive results of the content of substances in liquid compost. In the future, further research will be carried out to find out how effective this liquid compost for plants.

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REFERENCES

Alarefee, H. A., Ishak, C. F., Othman, R. in Karam, D. S. (2023). Effectiveness of mixing poultry litter compost with rice husk biochar in mitigating ammonia volatilization and carbon dioxide emission. *Journal of Environmental Management*, *329*, Article 117051. https://doi.org/https://doi.org/10.1016/j.jenvman.2022.117051

Alauddin, M., Mohsin, G. M., Ali, A. H. M. Z. in Rahman, M. K. (2020). Interactive effects of rice bran compost and chemical fertilizers on macronutrients, oil and protein content in sunflower (*Helianthus annuus L.*). *International Journal of Agricultural Research Innovation & Technology*, *10*(2), 91-99. https://doi.org/https://doi.org/10.3329/ijarit.v10i2.51582

Barus, J., Ernawati, R., Wardani, N., Pujiharti, Y., Suretno, N. D. in Slameto. (2022). Improvement in soil properties and soil water content due to the application of rice husk biochar and straw compost in tropical upland. *International Journal of Recycling of Organic Waste in Agriculture*, *12*(1), 85 - 95. https://doi.org/https://doi.org/10.30486/IJROWA.2022.1942099.1355

Carey, R. M., Whelton, P. K. in Committee, A. A. H. G. W. (2018). Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults: Synopsis of the 2017 American College of Cardiology/American Heart Association Hypertension Guideline. *Annals of Internal Medicine*, *168*(5), 351-358. https://doi.org/https://doi.org/10.7326/M17-3203

Chung, W., Shim, J., Chang, S. W. in Ravindran, B. (2022). Effect of Biochar Amendments on the Co-Composting of Food Waste and Livestock Manure. *Agronomy*, *13*(1), 35. https://doi.org/https://doi.org/10.3390/agronomy13010035

Dharminder, Singh, R. K., Kumar, V., Pramanick, B., Alsanie, W. F., Gaber, A. in Hossain, A. (2021). The Use of Municipal Solid Waste Compost in Combination with Proper Irrigation Scheduling Influences the Productivity, Microbial Activity and Water Use Efficiency of Direct Seeded Rice. *Agriculture*, *11*(10), 941. https://doi.org/https://doi.org/10.3390/agriculture11100941

Faysal, G. M., Khandaker, S., Hassan, J., Hossain, M. T. in Saha, G. C. (2022). Cotton Spinning Waste as Useful Compost for Organic Indian Spinach (*Basella alba*) Production in Bangladesh. *International Journal of Recycling of Organic Waste in Agriculture*, *11*(1), 61-84. https://doi.org/https://doi.org/10.30486/IJROWA.2021.1923350.1201

Indonesia, M. L. H. R. (2014). *Peraturan Menteri Lingkungan Hidup Republik Indonesia Nomor 5 Tahun 2014 Tentang Baku Mutu Air Limbah*.

Kadoglidou, K., Kalaitzidis, A., Stavrakoudis, D., Mygdalia, A. in Katsantonis, D. (2019). A Novel Compost for Rice Cultivation Developed by Rice Industrial By-Products to Serve Circular Economy. *Agronomy*, *9*(9), 553. https://doi.org/https://doi.org/10.3390/agronomy9090553

Kaur, P., Singh Kocher, G. in Sachdeva Taggar, M. (2019). Enhanced bio-composting of rice straw using agricultural residues: an alternate to burning. *International Journal of Recycling of Organic Waste in Agriculture*, *8*(1), 479-483. https://doi.org/https://doi.org/10.1007/s40093-019-0263-9

Kementerian Lingkungan Hidup dan Kehutanan Direktorat Jenderal Pengelolaan Sampah, L. d. B. D. P. S. (2022). *Capaian Kinerja Pengelolaan Sampah*

Khalib, S. N. B. B., Zakarya, I. A. B. in Izhar, T. N. B. T. (2019). Utilization of rice straw ash during composting of food waste at different initial C/N ratios for compost quality. *IOP Conference Series: Materials Science and Engineering*, *551*(1), 1-7. https://doi.org/https://doi.org/10.1088/1757-899X/551/1/012101

Lambu, Z. N., Shamsuddeen, U., Yahaya, S., Kawo, A. H., Shehu, A. A., Aliyu, A. S., . . . Yasir, A. M. (2019). Composting of tannery waste with cow manure and rice bran. *Bayero Journal of Pure and Applied Sciences*, *12*(1), 259 - 267. https://doi.org/http://dx.doi.org/10.4314/bajopas.v12i1.40S

Muliarta, I. N. (2019). A study on rice field farmer implementation of rice straw composting. *IOP Conference Series: Earth and Environmental Science*, *343*. https://doi.org/https://doi.org/10.1088/1755-1315/343/1/012001

Murtaza, B., Zaman, G., Imran, M., Shah, G. M., Amjad, M., Ahmad, N., . . . Murtaza, G. (2019). Municipal Solid Waste Compost Improves Crop Productivity in Saline-Sodic Soil: A Multivariate Analysis of Soil Chemical Properties and Yield Response. *Communications in Soil Science and Plant Analysis*, *50*(8), 1013-1029. https://doi.org/https://doi.org/10.1080/00103624.2019.1603305

Mushtaq, M., Iqbal, M. K., Khalid, A. in Khan, R. A. (2019). Humification of poultry waste and rice husk using additives and its application. *International Journal of Recycling of Organic Waste in Agriculture*, *8*(1), 15-22. https://doi.org/https://doi.org/10.1007/s40093-018-0224-8

Nasional, B. S. (2004). Spesifikasi kompos dari sampah organik domestik. V.

Qi, C., Yin, R., Gao, X., Chen, J., Wang, R., Xu, Z., . . . Li, Y. (2022). Development of Solid-State Anaerobic Digestion and Aerobic Composting Hybrid Processes for Organic Solid Waste Treatment and Resource Recovery: a Review. *Current Pollution Reports*, *8*(3), 221-233. https://doi.org/https://doi.org/10.1007/s40726-022-00223-w

Singh, Y. P., Arora, S., Mishra, V. K. in Singh, A. K. (2022). Synergizing Microbial Enriched Municipal Solid Waste Compost and Mineral Gypsum for Optimizing Rice-Wheat Productivity in Sodic Soils. *Sustainability*, *14*(13), 7809, Article 7809. https://doi.org/https://doi.org/10.3390/su14137809

Sultana, M., Jahiruddin, M., Islam, M. R., Rahman, M. M., Abedin, M. A. in Solaiman, Z. M. (2021). Nutrient Enriched Municipal Solid Waste Compost Increases Yield, Nutrient Content and Balance in Rice. *Sustainability*, *13*(3), 1047, Article 1047. https://doi.org/https://doi.org/10.3390/su13031047

Tratsch, M. V. M., Ceretta, C. A., Silva, L. S. d., Ferreira, P. A. A. in Brunetto, G. (2019). Composition and mineralization of organic compost derived from composting of fruit and vegetable waste. *Soil Science and Plant Nutrition*, *66*(4), 307-315. https://doi.org/https://doi.org/10.1590/0034-737X201966040009

Wang, W., Zhang, L. in Sun, X. (2021). Improvement of two-stage composting of green waste by addition of eggshell waste and rice husks. *Bioresource Technology*, *320*, Article 124388. https://doi.org/https://doi.org/10.1016/j.biortech.2020.124388

Zainudin, M. H. M., Zulkarnain, A., Azmi, A. S., Muniandy, S., Sakai, K., Shirai, Y. in Hassan, M. A. (2022). Enhancement of Agro-Industrial Waste Composting Process via the Microbial Inoculation: A Brief Review. *Agronomy*, *12*(1), 198. https://doi.org/https://doi.org/10.3390/agronomy12010198