PROCESSING CORN WASTE INTO ORGANIC COMPOSTING FERTILIZER: OPPORTUNITIES FOR ECONOMIC IMPROVEMENT OF FARMERS IN NAGARI PAKANDANGAN WEST SUMATERA

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Abstract

So far, post-harvest is still a common problem for farmers, including farmers in Nagari Pakandangan. Corn harvest waste in the form of straw and corn cobs becomes waste that has not been organized for disposal. It is predicted that each harvest will produce twice the harvest waste from the corn production itself, even though it can be processed into commercial products that can help improve the community's economy. This is the background for carrying out this research. The aim of this research is to process corn waste into organic compost in Pakandangan village. This research is an experimental research conducted at the MIPA Laboratory of IAIN Batusangkar by taking samples in Nagari Pakandangan. The variables measured in this study were water content, pH, temperature, compost color, levels of N, P, K and C/N. The composted waste produced produces compost products in accordance with SNI 19-7030-2004, with the following analysis results; water content 38%, pH 6.8, temperature equal to ground water temperature, blackish color, odorless (earth odor), composition N 2.26%, P 0.975%, K 1.53% C/N 18.76% .

Keywords: post-harvest, corn waste, SNI 19-7030-2004

A. INTRODUCTION

Garbage, namely all materials that are disposed of as a result of trading, industrial, household and agricultural activities, is facing a big problem, both in urban and rural areas, because the number is increasing over time. This is closely related to the lifestyle of modern society, namely a life that relies heavily on technologically processed products on the one hand, and a lifestyle that wants instant and all-round hygienic living at a time when the level of hedonistic and consumptive is getting higher on the other. (Kahfi, A., 2017)

In facing such a reality, there are some people who respond traditionally in the form of throwing garbage in areas that can cause other pollution to the ecosystem, such as throwing it into the river, as if someone burned it, so that even then it causes environmental pollution such as air, or at least that managed by the government adslah provide a Final Disposal Site (TPA). However, behind it all, not a few observers of waste try to place it no longer as an environmental boomerang, but as something that can be exploited and provide benefits for human life. Among them are making waste like corn cobs, which has been seen by some people as something that is no longer useful, chemically processed, into animal feed, energy sources, plastic seeds, and so on.

Saniah (2018), in his research has made charcoal briquettes from corncob waste into an energy source. However, this kind of treatment certainly requires a relatively more difficult research instrument if it will be treated to many members of the community.

As in other forms, Maya, et.al (2016) in their research have found agricultural waste such as corn leaves can be used as animal feed, because it has active substances that can stimulate livestock productivity. However, a further problem is if during the dry season there is a decrease in energy, minerals, and protein contained in forage feeds. Because the forage plants have experienced a water deficit during their growth. In addition, the availability of forage during this season is also reduced, resulting in a decrease in livestock growth. For this reason, it is necessary to treat the addition of silage to the forage feed, as has been studied.

On the other hand, research by Faza, et.al (2017) proves that corn cobs can actually be modified into several handicraft items in an effort to utilize waste into products (waste to product). This effort has a weakness because it requires a high creative power for the community to create alternative products from the corn waste.

Likewise, research by Ari Susanti, et.al. (2019) has attempted to process corn waste into biodegradable plastic. Corn cobs contain cellulose fiber so that it can be used as a natural polymer as a raw material for making biodegradable plastics. Biodegradable plastic from corn cobs waste is made in two stages, namely pre-treatment and mainprocess. Pre-treatment is carried out by performing physical actions on corn cobs so that it becomes corncob powder with a size of 80 mesh. While in the main-process stage, corncob powder is processed by mixing with other biopolymer materials, stirring until a certain temperature. Then the result is poured into molds and dried in the oven. The results obtained are in the form of plastic ore or plastic sheets. This innovation in processing corn waste into biodegradable plastic, of course, has weaknesses, including a very complicated process that must also be equipped with biopolymer additives which are expensive.

However, behind it all, there is no research result that turns corn cobs into organic compost that is processed efficiently and easily managed by the farming community themselves. In terms of many agricultural areas that have the potential to be treated like that. It's like in Nagari Pakandangan, Padang Pariaman Regency, West Sumatra Province, where the majority of the people are corn farmers, and so far they treat corn cobs only to be burned or thrown away. In fact, by treating it as compost, it becomes a great opportunity to increase the economic income of the farming community.

Topography of the Nagari Pakandangan area, which is at an altitude of 15-20 meters above sea level, is more supportive for planting corn compared to other types of agricultural commodities. This is reinforced by Nagari data on commodity production, which states that maize ranks second after rice production. Based on the research data of Iska, et.al. (2020), that from 40 hectares of harvested area, it is able to produce 120 tons of corn each time it is harvested.

So far, post-harvest is still a common problem for farmers. Corn harvest waste in the form of straw and corn cobs becomes waste that has not been organized for disposal. It is predicted that each harvest will produce twice the harvest waste from the corn production itself. If in a year corn production is 120 tons, it is predicted that corn harvest waste will be 240 tons.

From the description above, it is deemed necessary to find an effort to utilize corn waste in the form of straw and cobs into the latest product that is efficient and does not require large costs in its management. Processing corn waste into organic compost is one step that is considered effective to meet this waste product.

B. OVERVIEW

Garbage is the residue of a business or human activity in solid form, both organic and inorganic substances that are biodegradable or non-biodegradable and are considered no longer useful so they are disposed of into the environment The definition of waste according to Law-18/2008 is the residue of human daily activities and/or natural processes in solid form. Garbage is one of the problems faced by many cities and villages around the world today. The higher the population and their activities, the volume of waste continues to increase. As a result, dealing with waste requires a lot of money and an increasingly large area of land. Waste management is intended so that waste does not endanger human health and does not pollute the environment.

Waste can be classified into organic and inorganic waste. Inorganic waste such as plastic and metal cannot be processed by utilizing the activities of other living organisms. So that inorganic waste is also referred to as non-biodegradable waste. Several types of waste which are organic or biodegradable waste are food waste, plants, animals, paper, and manure. According to Siregar (2014) the most sources of waste are from settlements and traditional markets. Market waste such as vegetables, fruits, fish, etc., mostly (95%) is in the form of organic waste so that it is easier to handle and can be decomposed by microbes. Meanwhile, waste originating from residential areas is generally very diverse, but in general at least 75% consists of organic waste and the rest is inorganic.

To deal with the waste problem as a whole, management alternatives need to be carried out. Instead, these alternatives must be able to address all waste disposal problems by recycling all discarded waste back to the community economy or to nature, so as to reduce pressure on natural resources. To achieve this, there are three assumptions in waste management that must be replaced with three new principles. Rather than assuming that society will produce an ever-increasing amount of waste, waste minimization should be a top priority.

Disposed waste must be segregated, so that each part can be composted or recycled optimally, rather than being dumped into the current mixed waste disposal system. And industries must redesign their products to facilitate the recycling process of these products. This principle applies to all types and flows of waste.

C. SPECIAL PICTURE

Corn as the main commodity produced by Nagari Pakandangan after rice has a very important role. Corn production can be seen in Nagari Pakandangan seen in table 1 below.

Table 1. Nagari Pakandangan Commodity Data

No	Sub System/Commodity	Land Area (Ha)	Harvest Area (Ha)	Products (Ton)
	I. Crop			
1.	Rice	372	744	2.765
2.	Corn	20	40	120
3.	Cassava	10	10	98

4.	Chili	2	2	7.4
5.	Banana	25	25	9.0

Data Source: Nagari Data, 2019

From the data in table 1 above, it proves that Nagari Pakandangan is a center for corn plants in the district of Padang Pariaman. The abundance of corn crop production at the same time has an impact on increasing the amount of corn harvest waste. BUMNag Pakandangan which is also engaged in corn production cannot be separated from the presence of this waste. Until now, the remaining corn harvest in the form of corn cobs has only been allowed to accumulate in BUMNag warehouses, as shown in the image below:

Figure 1. The rest of the harvest in the form of corn cobs piled up in the BUMNag warehouse

From the picture it can be observed that corn cobs which are the basic ingredients for making compost have not been able to be processed efficiently by BUMNag Pakandangan, even though corn cobs meet the requirements as basic ingredients for compost as explained by Erni Mohammad that the character and type of raw material for corn cobs for composting is an organic material that has a small ratio of carbon (C) and nitrogen (N) (below 30:1), a water content of 40-50% and a pH of around 6-8. The availability of this element can be found in corn waste, starting from straw. the rest of the harvest to the harvest waste cob.

D. ANALYSIS

Based on the potential of corn and real data on the cob, it is processed experimentally in the laboratory, chemically, with the following instruments and processes:

Tools: tarpaulin measuring 3x3 meters, chopper machine, paralon pipe, container, Analytical balance 4 decimal, measuring flask / Kjeldahl flask 100 ml, Erlenmeyer 100 ml, Distillation apparatus, Boiling flask 250 ml, Digital 3 decimal burette/titrator, Hot plate, Dispenser scale 0 – 10 ml, pH meter.

Ingredients: corn waste, Trichoderma and molasses, 96% H_2SO_4, 1% boric acid, 0.050 N sulfuric acid, 40% NaOH solution, Conway indicator, $K_2Cr_2O_7$ 2

The working procedure of making compost: Prepare a tarpaulin measuring 3 m x 3 m which is intended for the mixing container. Prepare agricultural waste corn. Corn waste in the form of corn straw is cut into smaller particles. Prepare a starter of microorganisms consisting of Trichoderma and molasses. Both of these ingredients are dissolved in water. Add the cut corn waste with cow dung in a ratio of 1: 1. Stir the two ingredients. Flush with microorganism starter material. Do the stirring. The mixed ingredients are put into a closed container with a size of 25 ml then flush with water. After 24 hours, the temperature of the compost material will rise to ±65 °C. Leave it for 3 days. On the fourth day do the stirring again. The stirring process was carried out again after the next three days. Let stand until a week later. After one week, the stirring process is done again. The compost is brown in color and the smell has started to disappear. Let stand again until one week later. After one week, it was observed that the compost was evenly brown in color, odorless and loose. This indicates that the composting process has been completed and is ready to be tested in the laboratory.

Determination of pH: Weigh 10 g of fine fertilizer sample, put it in a shake bottle, plus 50 ml of ion-free water. Beat with a whisk for 30 minutes. Soil suspension was measured with a pH meter that was calibrated using a buffer solution of pH 7.0 and pH 4.0.

Determination of moisture content: Carefully weigh 10 g of the original fertilizer sample and 5 g of fine fertilizer each into a porcelain cup with a known weight. Place in the oven and dry overnight at 105°C. Cool in a desiccator and weigh.

Nitrogen Determination: Weigh 0.25 g of the crushed sample into a Kjeldahl flask or 100 ml volumetric flask. Add 2.5 ml of concentrated H_2SO_4 to the flask and include the blank. Simmer for 1 hour on a hot plate. After cooling, dilute with ionized water to the mark of 100 ml, shake until homogeneous. Pipette 10 ml of extract into a boiling flask that has been given a little boiling rock powder and add 100 ml of ionized water. Prepare a distillate container, which is 10 ml of 1% boric acid solution in an erlenmeyer with three drops of Conway's indicator (red solution). Distillate by adding 10 ml of 40% NaOH. Distillation ends when the distillate in the container has reached a volume of 50-75 ml (green solution). The distillate was titrated with 0.050 N H_2SO_4 until a pink color. Record the volume of the sample titar (Vc) and the blank (Vb).

Determination of the content of C: Weigh carefully 0.05 - 0.1 g of the fertilizer sample that has been mashed into a 100 ml volumetric flask. Add successively 5 ml of 2 N $K_2Cr_2O_7$ solution, shake, and 7 ml of H_2SO_4 pa. 98%, shake again, allow 30 minutes if necessary, shaking occasionally. For a standard containing 250 ppm C, pipette 5 ml of a standard solution of 5000 ppm C into a 100 ml volumetric flask, add 5 ml of H_2SO_4 and 7 ml of a 2N $K_2Cr_2O_7$ solution as described above. Also work on the blanks used as standard 0 ppm C. Each was diluted with ionized water and after cooling the volume was adjusted to the tera mark of 100 ml, shaken back and forth until homogeneous and left overnight, then measured with a spectrophotometer at a wavelength of 651 nm.

Determination of P and K levels: Accurately weigh 0.5 g of the mashed fertilizer sample into the digestion flask/Kjeldahl flask. Add 5 ml of HNO_3 and 0.5 ml of $HClO_4$, shake well and leave overnight. Heat in the block digestor starting with a temperature of 100°C, after the yellow steam runs out the temperature is increased to 200°C. Destruction was ended when white steam had come out and the remaining liquid in the flask was about 0.5 ml. Cool and dilute with H_2O and the volume is adjusted to 50 ml, shake until homogeneous, leave overnight or filtered with W-41 filter paper to obtain a clear extract (extract A).

Making Organic Compost Fertilizer From Corn Waste

Management of corn waste into organic compost can seen in the image below:

Organic composting is made in an anaerobic way. Anaerobic composting is made without the help of oxygen. According to Krisdianty, N., et al (2014), anaerobic composting is influenced by several factors, such as feed composition, water content, acidity and temperature. The bait used usually has the main nutritional content in this case serves as a source of energy and body building elements. The addition of molasses and trichoderma can be seen in Figure 3. In this case, the addition of molasses to corn waste is an effort to provide an energy source for optimizing microbial growth provided by trichoderma.

According to Krisdianty, N., et.al (2014) in order to function normally, biogas-producing microbes require a substrate with a moisture content of 90% and a solid content of 8-10%, therefore in this study a watering process was carried out as shown in Figure 7 The watering process is only done once. After standing for 3 days, the compost made was stirred again. During the standing process, the compost will experience an increase in temperature. This stirring process aims to lower the temperature and can be evenly distributed throughout the product.

The harvested compost was analyzed using chemical parameters. Following are the results of the analysis of compost measurements:

Table 4.4 Laboratory Analysis Results

	Compost Measurement Parameters									
	pH	Water Content	Temperature	Color	Smell	Particle Size	Element N (%)	Element P (%)	Element K(%)	C/N Ratio
Results	6,8	38%	Ground Water Temperature	Black	Smell of Earth	-	2,26	0,97	1,53	18,76

Source: Lab test analysis results

To see the comparison of the quality of the compost quality, it is compared with table 4. 5 which is the compost quality standard based on SNI 19-7030-2004.

Table 4.5 Compost Quality Based on SNI 19-7030-2004

	Parameters MeasurementCKompost									
	pH	Water Content	Temperature	Color	Smell	Particle Size	Element N (%)	Element P (%)	Element K(%)	C/N Ratio
Results	6,8 – 7,49	50%	Ground Water Temperature	Black	Smell of Earth	0,55 – 25 mm	0,40	0,10	0,20	10-20

Sourch: SNI 19-7030-2004

From the laboratory analysis data, it can be concluded that the compost made has met the compost quality standard based on SNI 19-7030-2004. This is viewed from the following factors:

1). The value of pH and temperature, the pH of the compost made in this study was 6.8. If standardized with SNI 19-7030-2004 then the pH of the compost from this research can be categorized as good. Annisa'Ul Barorah (2015) stated that the decomposition process produces organic acids. This acidic condition can cause mold growth and encourage the decomposition of cellulose and lignin contained in the composting material. Therefore, good compost conditions should be in the acid to neutral range to ensure that the compost is of good quality.

2). Moisture Content The ideal water content of compost according to SNI (2004) is 50%. Bachtiar (2018) in his research explains that the humidity or water content that is good for optimizing the work of bacteria is in the range of 40-60%. If it is below or above this range, the decomposing bacteria can die so that it will interfere with the decomposition process. In the study obtained a water content of 38%, meaning that the compost is said to have sufficient value for water content.

3). Compost Color, The ideal color for compost is blackish like soil. Gaur in Barorah (2015) explains that microbes will decompose organic matter during the decomposition process. In this process, microbes will absorb water, nutrients and oxygen from organic matter and will release carbon dioxide and water. This process also causes the release of heat so as to free the nitrogen bonds in the lignin. The condition of the release of nitrogen is what causes the blackish brown color of the compost.

4). Primary Macro Nutrient Content (N, P, K). In the study, it was found that the levels of N, P and K were 2.26%, 0.97% and 1.53%, respectively. This data is categorized as very good because it is above the maximum value set by SNI (2004). This maximum value was obtained presumably due to the addition of Thricoderma which helps EM-4 in producing microbial decomposers. The number of microbes plays a role in the mineralization process. Fauzi in Barorah (2015) explains that the mineralization process is the process of releasing a number of minerals such as nitrogen, phosphorus, calcium, phosphorus and sulfur. The greater the number of microbial decomposers, the greater the mineral content produced. Bachtiar (2018) explains that Nitrogen is needed by plants. With the addition of nitrogen levels in the soil can help encourage vegetative growth of plants, besides that nitrogen also plays a role in the formation of proteins that help root growth.

Elvi Zuriani (2005) explains that the phosphorus contained in compost functions in the process of respiration and photosynthesis so that it can accelerate the harvest period. The addition of potassium to the soil through compost can improve soil quality. Potassium is an important enzyme activator in plant growth. So it can be concluded, the greater the primary micronutrient content provided by compost, it is expected to improve soil quality so that plant growth can be optimal. (v) C/N ratio levels, C/N ratio levels in the study were within the range set by SNI (2004), which was 18.76%. Surtinah (2013) explained that the C/N ratio is a measure of compost maturity, the higher the C/N ratio, it can be said that the compost has not been completely decomposed. The value of the C/N ratio obtained in the study is almost at the maximum limit, although based on Surtinah's (2013) statement it is claimed that the compost made is immature, but there are allegations that the process of analyzing the C/N ratio level is too fast is also the reason why the level of C/N ratio is too fast. the C/N ratio is quite large.

When compared with the results of research by Jalaludin et al (2016) who used vegetable and fruit waste as raw material for composting, the results obtained were pH 6.9, N element content 2.8%, P element 0.64%, K element 1.1% then Organic compost fertilizer from corn waste turns out to have the same elemental characteristics as compost from vegetable and fruit waste. This is reinforced by the research of Sarjono et al., (2013) on the manufacture of liquid fertilizer and biogas from a mixture of vegetable waste. The initial data obtained from this study were 88.78% water content, 7.68 pH, and 33.56 C/N ratio. The final data with optimal results were obtained on day 25 with the composition of EM4 350 ml, namely N 1%, P 1.98%, K 0.85% and C/N ratio 30%, total solid 34.78%, Chemical Demand Oxygen (COD) 2386 mg/L, biogas 13 ml and pH 5.55.

E. CONCLUSION

The waste processing model developed produces compost products in accordance with SNI 19-7030-2004, with the following analysis results; water content 38%, pH 6.8, temperature equal to ground water temperature, blackish color, odorless (earth odor), composition N 2.26%, P 0.975%, K 1.53% C/N 18.76% . And this has great potential to be used by farmers in Pakandangan, in an effort to improve their economy.

BIBLIOGRAPHY

Ari Susanti, dkk. (2019). Pembuatan Plastik Biodegradable dari Tongkol Jagung: Studi Kasus Desa Dawuhan Mangli, Kecamatan Sukowono, Jember, Indonesia. *Jurnal Warta Pengabdian*. December 2019, Warta Pengabdian 13(4):193 DOI:10.19184/wrtp.v13i4.13849

Bachtiar, dkk. (2016). Kebutuhan Nitrogen Tanaman Kedelai Pada Tanah Mineral dan Mineral Bergambut dengan Budi Daya Jenuh Air. *Penelitian Pertanian Tanaman Pangan*. Vol. 35 NO. 3, 2016

Bachtiar, R. (2018). Komposisi Unsur Hara Kompos Yang Dibuat dengan Bantuan Agen Dekomposer Limbah Bioetanol Pada Level Yang Berbeda. *Jurnal Sains Peternakan*, 63-68. Vol 16, No 2 (2018)

Baroroh, A., & dkk. (2015). Analisis Kandungan Unsur Hara Makro Dalam Kompos Dari Serasah Daun Bambu dan Limbah Padat Pabrik Gula. *perpustakaan.uns.ac.id*

Damanhuri, E. (2015). Some Prinsipal Issues On Munipal Solid Waste Management in Indonesia. *Expert Meeting on Waste Management in Asia-Pacific Islands*.

Elvi, Z. d. (2015). Pengolahan Sampah Organik dan Anorganik Oleh Ibu-Ibu Rumah Tangga Kelurahan Pasir Nan Tigo. *Jamaika*. Vol 1, No 2 (2020)

Faza Wahmuda, d. (2020). Alternatif Desain Produk Dari Sampah Tongkol Jagung Dilihat Dari Jenis Tongkolnya (Dalam Upaya Pengendalian Pencemaran Lingkungan). *E-journal ITATS. Proseeding Seminar Nasional Sains dan Teknologi Terapan*.

Ghufron, M. (2017). Pelatihan Pengolahan Sampah Organik Menjadi Kompos Dengan Media Keranjang Takakua. *J-ABDIPAMAS*, Vol 1, No 1 (2017)

Jalaluddin, d. (2016). Pengolahan Sampah Organik dan Buah-Buahan Menjadi Pupuk dengan Menggunakan Effektif Mikroorganisme. *Jurnal Teknologi Kimia Unimal*, Vol 5, No 1 (2016)

Kartini Istiqomah, d. (2011). Analisis Nilai Ekonomi Sampah pada Tempat Pengelolaan Sampah . *Prosiding Seminar Nasional Multidisiplin Ilmu Universitas Bali Luhur*.

Kahfi, A., (2017), Tinjauan Terhadap Pengelolaan Sampah, *Jurnal Jurisprudentie*, Vol.4, No. 1

Kristiyawan, P. (2017). Pengelolaan Sampah dengan Teknologi Hidrothemal. *Jurnal Rekayasa Lingkungan* Vol. 10 No. 1 (2017):

Krisdianty, N., dkk., Pengaruh Penggunaan Hhey dan Feses Sapi Madura sebagai Substrat Biogas Terhadap Produksi Metan, Kecernaan Bahan Organik dan pH Slurry, *Jurnal Teknologi Hasil Pertanian*, Vo. VII No. 2, Agustus 2014

Lehmann, S. (2011). Zero Waste and Sustainable Consumption as Paradigms in Urban Development, Sustainable Development Law & Policy . *Resourc Recovery and Materials Flow in the City*.

Marfuatun. (2013). *Potensi Pemanfaatan Sampah Organik. Laporan Pengambdian Masyarakat Jurusan Pendidikan Kimia Fakultas Matematika dan Ilmu Pengetahuan Alam.* Universitas Negeri Yogyakarta.

Maryuni. (2008). *Pembangunan Bumdes dan Pemberdayaan Pemerintah Desa*. Bandung:CV: Pustaka Setia.

Departemen Pertanian, (2005), *Petunjuk Teknis Analisis Kimia, Tanah, Air dan Pupuk. Balai Penelitian Tanah. Badan Penelitian dan Pengembangan Pertanian*.. Wibsite:http://balittanah.litbang.deptan.go.id

Puspasari, GR. (2016). Peran Kelembagaan Dalam Pengelolaan Persampahan diKabupaten Trenggalek. *Jurnal Pembangunan Wilayah Kota*. Vol 12, No 4 (2016) DOI: https://doi.org/10.14710/pwk.v12i4.13505

Romadhoni, H., & Wesen, P. (2014). Pembuatan Biogas Dari Sampah Pasar. *Jurnal Ilmiah Teknik Lingkungan*. Vol. 6 No. 1

Saniah, MS, (2018), Pembuatan Briket Arang dari Limbah Tongkol Jagung, Repository Poltekkesjogja, http://poltekkesjogja.ac.id

Sari, M. (2016). Pemanfaatan Limbah Jagung Untuk Pembuatan Biskuit Pakan Hijauan Di Kecamatan Lima Kaum Batusangkar. *Jurnal Saintek*. Vol 8, No 2 (2016)

Siregar, I.R. "Pemanfaatan Sumber Daya Alam Indonesia yang Belum Maksimal", 01 April 2014 : https://kabar24.bisnis.com/read/20140401/380/215207/pemanfaatan-sumber-daya-alam-indonesia-yang-belum-maksimal.

Sudiro, dkk. (2018). Model Pengelolaan Sampah di Kelurahan Tanjung Sekar Kota Malang. *Plano Madani*, *Jurnal Perencanaan Walayah dan Kota*, Vol. 7 No.1 (2018)

Sujarwo, d. (2014). *Pengolahan Sampah Organik dan Anorganik.* Yogyakarta: UNY.

Sukerti, N. dkk., (2017). Perilaku Masyarakat dalam Pengelolaan Sampah dan Faktor-faktor yang Mempengaruhi Di Kecamatan Denpasar Timur, Kota Denpasar. *Jurnal Ecotrophic*. Vo. 11 No. 2 (2017)

Surjandari, I., Hidayanto, A., & Supriyatna, A. (2009). Model Dinamis Pengelolaan Sampah Untuk Mengurangi Beban Penumpukan. *Jurnal Teknik Industri*. Vol. 11 No. 2 (2009): DECEMBER 2009 DOI: https://doi.org/10.9744/jti.11.2.PP.%20134%20–%20147

Surtinah. (2013). Pengujian Kandungan Unsur Hara Dalam Kompos Yang Berasal Dari Serasah Tanaman Jagung Manis (Zea Mays Saccharata). *Jurnal Ilmiah Pertanian*. Vol. 11 No. 1 (2013) **DOI:** https://doi.org/10.31849/jip.v11i1

Iska,S dkk. (2020). Developing a Model for Economic Based Management Garbage. *Solid State Technology*, Vol. 63, Issue 5.

Undang-undang No.18 Tahun 2008 tentang Pengelolaan Sampah

Undang-undang No.6 Tahun 2014 tentang Pemerintahan Desa

Wahyu, W. L. (2008). Studi Kualitas Hasil dan Efektivitas Pengomposan Secara Konvensional Versus Modern di TPA Temesi-Gianyar Bali. *Tesis Program Pascasarjana Universitas Udayana Denpasar*.

Zaman, A., & Lehmann. (2011). What is the " Zero Waste City Concept? Zero Waste SA Research Centre for Sustainable Design and Behaviour (sd+b), School of Art, Architecture and Design, University of South Australia (UniSA), GPO Box: 2471, SA 5001, Australia. July 2011

Zubachtiroddin, M. P. (2017). Wilayah Produksi dan Potensi Pengembangan Jangung. Balai Penelitian Tanaman Serealia.