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RESEARCH ARTICLE

HEATING VALUE AGAINST WATER LEVEL IN ORGANIC WASTE AT TEMPORARY WASTE DISPOSAL

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ABSTRACT

Waste in each area is very various and depends on total of public areas and residence in the area. Reasearchaimsto analyze the influence of water level against heating value of organic waste at temporary waste. This research was analytical and observational design. Meanwhile, data analysis in this research utilized Linear Regression. The results showed that the average of water level in organic waste at temporary waste disposal was 15,84%. The average of heating value of organic waste at temporary waste disposal was 2362,62 kkal/kg. Moreover, the analysis result which utilized statistic test showed that the significance of heating value of organic waste was p=0,239.

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INTRODUCTION

According to Statistics of Surabaya City (BPS, 2018), Surabaya is as a metropolis which becomes a place to find work. This makes population growth increases continuously. Throughout January until the end of November 2017, it is noted that the population growth is 30.675 people. Economic growth and population growth also trigger the increase of waste production. Waste total which enters into landfill of Surabaya, Indonesia in 2017 was 2.100 ton/per day, in2016 was 1.500 ton/ per day, in 2015 was 2.000 ton/per day, in 2014 was 1.400 ton/ per day. The proportion was consisted of 60% for organic waste and 40% for inorganic waste. In 2017, there was a significant enhancement of waste influx to landfill (DKRTH, 2018). In order to overcome waste, it could be conducted 3R (Recycle, Reduce, and Reuse) and could be used through Refuse Derived Fuel (RDF), which meant the process of separating solid waste between combustible waste fraction and non-combustible waste fraction. The waste that was treated through RDF system could minimize the waste volume, the heating value was constant, hence, it was stable if it was used as fuel for producing in the industry and it was economize for production process in the industry. The average of combustible landfill types from three temporary waste disposals, which were Pasar Sederhana, TPS of Astana Anyar, and TPS of Cibeunying, were consisted of garden waste, 57% of leftovers, 13% of stereofoam, and 30% of Textiles. This showed that waste in Bandung, Indonesia had big potency as raw material of RDF, which the 90% of the waste could be burnt. Several types of waste were still known that heating value and water level had not qualified the standard. The lowest heating value was in food waste from temporary waste disposals of Cibeunying, which was 2725 kkal/kg, meanwhile, the highest water level was found in leftovers from temporary waste disposals of Pasar Sederhana, which was in 72%. Therefore, it was needed further treatment for reducing water level, thus, it could increase the heating value (Lokahita, 2010).

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MATERIALS AND METHODS

This research was an analytical research. Design of this research was observational in order to analyze a significant influence of water level, ash level, and volatile level against heating value of waste at temporary waste disposal. Data that was obtained was presented in table and narration, then, it was analyzed by using statistic test with α=0,05. Besides, the statistic test that was used was through using Linear Regression in order to investigate the influence of water level against heating value of municipal waste.

RESULTS

According to research result that had been conducted in temporary waste disposal regarding waste types as followed: Research result showed that the water level of organic waste at temporary waste disposal was as below:

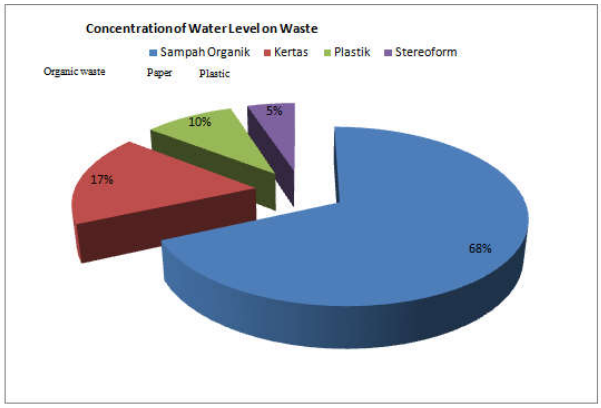

Diagram 1. Types of Organic waste

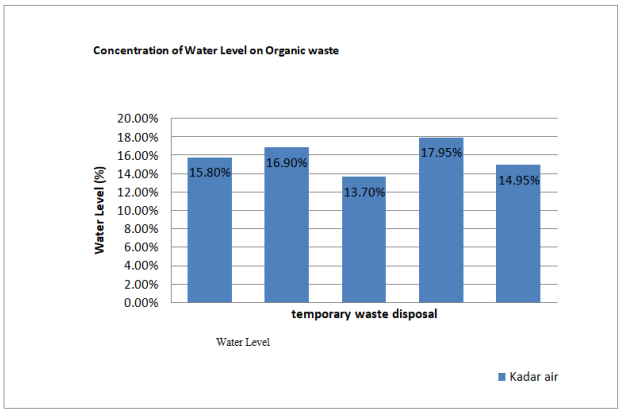

Diagram 2. Concentration of Water Level

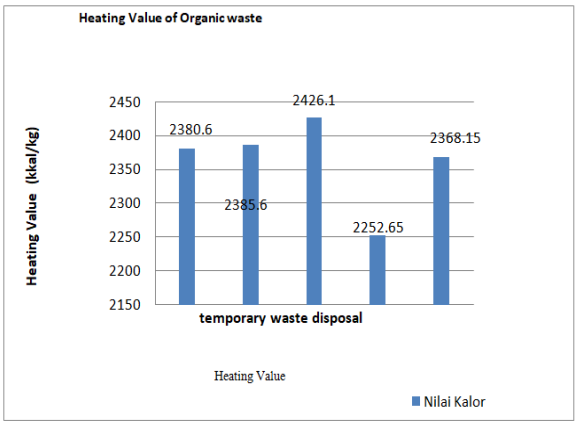

Diagram 3. Heating value of Organic waste

According to diagram 2 above, it could be known that the examination result of parameter of water level average on organic waste at temporary waste disposal was 15,86%, water level in organic waste at "A" temporary waste disposal was 15,8 %, "B" temporary waste disposal was 16,90%, "C" temporary waste disposal was 13,70%, "D" temporary waste disposal was 17,95%, and "E" temporary waste disposal was 14,95%. Furthermore, the water level was inversely proportional to heating value, thus, the decrease of water level would cause the increase of heating value (Romatua, 2007).High water level in waste, such as in organic waste, would influence the heating energy that was needed to evaporate the water and the lower heating was generated from burning because evaporation process was occurred firstly in burning process (Damanhuri, 2006).

According to diagram 3 above, it could be known that heating value in organic waste at temporary waste disposal was 2362,62 kkal/kg. Meanwhile, the average of paper waste was 2232,85 kkal/kg, the average of plastic waste was 2318,20 kkal/kg, and the average of stereoform waste was 2032,70 kkal/kg. According to (Hartanto, 2010) , he stated that in order to obtain energy, waste must have high heating value. Water level of $\geq$ 15% in organic waste would reduce heating power of organic waste in the burning process. Another waste, such as leaves, was only 500 calories. Moreover, energy level of municipal waste contained around 50% of combustible substance.

DISCUSSION

Result of laboratory examination was analyzed by using linear regression. The purpose of statistic test analysis in this research was in order to investigate the influence of water level against heating value of waste. Analysis result of the influence of water level against heating value of waste was not significant and it was >0,05, which exactly was 0,477.Thus, it could be concluded that there was no significant correlation between water level parameter and heating value of organic waste. Food waste and market still had very big percentage in waste composition in Indonesia. The similar pattern was also occurred in other developing countries, such as India, Malaysia, and Vietnam (Narayana, 2009). As we knew that, organic waste actually had quite high HHV value. However, the presence of water was very big. It had big role in reducing heating value.

HHV of this waste was around 4400-9800 kkal/kg in dry type, but LHV was only around 300-5000 kkal/kg. This waste was rarely used in WTE concept by processing thermally or RDF because its heating value was very small. Waste that contained many biodegradable organic was often used for making compost (in aerobic processing) or by anaerobic digester for obtaining biogas (Trang, 2018). Furthermore, the lower the water level, the higher the carbon level. This was in accordance with theory which carbon level was a reduction of total for water level, ash level, and volatile level which were contained in charcoal (ASTM, 2010). Water level was categorized very low, which was < 1%, except for PET, which was 3.5%, LHV of plastic was not different significantly with its HHV.

By this very high heating value, plastic really had potential for being burnt to incinerator or being used as RDF. When plastic, particularly for PVC, was burnt to incinerator, HCl would be formed. This HCl could corrode the boiler and it released dangerous gas, such as organohalogen compounds that could cause pollution. One way to overcome it was through conducting dechlorinating against plastics waste of PVC before being to incinerator (Takeshita, 2004). PVC thermal decomposition mechanism could be conducted on high pressure on hot water or through the dissolution of chlorine in NaOH at certain temperature and time (Sotoma, 2010). Dechlorination could be conducted on municipal waste by hydrothermal treatment method, which the decomposition of organic material on certain temperature was by using water as its medium. The formed chlorine was inorganic chlorine which was soluble in water. Due to its solubility, the cleaning of this product could be conducted for removing inorganic chlorine totally (Marya, 2018).

Conclusion

It could be concluded that based on research result that had been conducted at temporary waste disposal showed that heating value of organic waste was 2362,62 kkal/kg which could not be used as one of alternatives in municipal solid waste treatment. Refuse Derived Fuel (RDF) was alternative fuel that was from residues or material which had high heating value.

Recommendation

Recommendation that could be given for other researchers was examining heating value on plastic waste based on types and category according to applicable regulations, and could be used as reference for implementing waste to energy concept.

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