Utilization of Methane Formed of Urban Waste Management (WASTECO) in Mahakam Lestari Village: Case Study of P.T. Pertamina Hulu Mahakam as PT Pertamina Hulu Energi Subsidiary of Upstream Pertamina

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Abstract

The issue of trash management poses a significant challenge in the region, particularly in urban areas where the quantity of garbage continues to rise. However, the existing waste management strategies are unable to effectively address this escalating trend. Within the realm of household waste, household rubbish encompasses both organic and inorganic waste. The former category includes remnants of vegetables and food, while the latter encompasses items such as food packaging, plastic bags, paper, and bottles. Additionally, household waste extends to encompass water resulting from various washing operations, among other similar sources. The household waste discussed in this study originates from routine activities inside residential settings, with the exception of certain organic waste and refuse materials.

The sanitary authorities collected the household rubbish from their separate regions. Once gathered, the home waste is transported to a temporary disposal location, commonly referred to as a Temporary Processing location (TPS). Following its transportation from the temporary storage facility (TPS), the garbage is further conveyed to the ultimate disposal location known as the final disposal point (TPA). The ultimate destination for waste management is the final discharge location, where waste is disposed of and then reused through recycling and other waste management procedures. One approach involves the conversion of waste materials into methane gas.

Problem Statement. The process of transforming domestic waste into methane gas Methane gas is an invisible, scentless, and extremely combustible gas composed of a single carbon atom and four hydrogen atoms. Methane gas possesses properties that are 25 times more potent than carbon dioxide in terms of its capacity to trap heat within the Earth's atmosphere. If left unmanaged and underutilised, methane gases have the potential to exacerbate the existing levels of greenhouse gases present in the Earth's atmosphere. Methane constitutes a significant component of biogas. Biogas is comprised of various gases, primarily methane (CH4) and carbon dioxide (CO2), with trace amounts of hydrogen sulphide (H2S) and ammonia. Ammonia (NH3) is a compound composed of one nitrogen atom bonded to three

In addition to hydrogen (H2), the presence of sulphur nitrogen, water content, and carbon dioxide (CO2) has been reported. Both organic and inorganic waste materials have the potential to be transformed into methane gas, commonly referred to as biogas. Methane gas (CH4) is a gaseous compound that is produced by anaerobic bacteria, particularly the methanogenic bacterium. Significant quantities of methane gas were detected in the remnants of vegetation, straw, animal waste, grasslands, sedimentary formations, and even straw.

Method. Methane gas is spontaneously generated at the final disposal site through the process of bacterial evaporation, even in the absence of deliberate processing or the inclusion of specific compounds. The burning of methane gas produces thermal energy, making it a viable option for alternative fuel sources or power generation

in a facility.The conversion of waste into methane gas encompasses four overarching process ideas, which include gas collection, gas pressure maintenance, gas distribution security maintenance, and safety management. Biogas is derived from a specialised facility known as a biodegester, which is designed to harness the production of this renewable energy source. Decomposing organic material under anaerobic circumstances, characterised by the absence of oxygen. The optimal circumstances for the creation of biogas are primarily determined by the quality of organic material and the surrounding environmental factors.

The condition is characterised by several criteria, including the organic material type, acidity level, C/N balance, temperature, storage rate, presence of hazardous substances, melting point, beginning material, and retention period. The pace of fermentation by microorganisms is significantly impacted by environmental circumstances. It is crucial to maintain controlled environmental conditions, namely within a pH range of 6.5-7.5 and an ambient temperature of 32-37 degrees Celsius (Wahyuni, 2011). In addition to the utilisation of biodegester technology, the methane gas generated by gas collection is also employed. During the process of open dumping in the TPA (Trash Processing Area), the gas is extracted by means of a suction pump that draws it via a sewage system installed within the waste materials. The gas that was extracted has been gathered at the gas treatment facility for subsequent processing.

In relation to the methane gas processing conducted by the community development programme of PT Pertamina Hulu Energi in Mahakam Lestari village, it is worth noting the implementation of the WASTECO programme. The issue of waste management poses a significant challenge in various regions, particularly in urban areas where the quantity of waste continues to rise. However, the existing waste management methods are not sufficiently optimised to effectively address this escalating trend. Within the realm of domestic waste, household rubbish encompasses both organic and inorganic materials. Organic waste includes remnants of vegetables and food, while inorganic waste include items like food packaging, plastic bags, paper, and bottles. Additionally, household waste encompasses other forms such as wastewater generated from washing operations, among others. The household waste discussed in this study originates from routine activities inside residential settings, with the exception of certain organic waste and refuse materials.

The municipal sanitation officers collected the domestic waste from their designated areas. Once gathered, the home waste is transported to a temporary disposal location, commonly referred to as a Temporary Processing location (TPS). Following its transportation from the temporary storage facility (TPS), the garbage is further conveyed to the ultimate disposal location known as the final disposal point (TPA). The ultimate destination for waste management is the final discharge location, where waste is disposed of and then reused through recycling and other waste management procedures. One approach involves the conversion of waste materials into methane gas.

Result. The process of transforming domestic waste into methane gas Methane gas is an invisible, scentless, and extremely combustible gas composed of a single carbon atom and four hydrogen atoms. Methane gas exhibits a far higher heat-trapping capacity in the atmosphere compared to carbon dioxide, with a potency around 25 times greater. If left unmanaged and underutilised, methane gases have the potential to exacerbate the existing levels of greenhouse gases present in the Earth's atmosphere. Methane is a constituent of biogas. Biogas is composed of various gases, primarily methane (CH4) and carbon dioxide (CO2), with trace amounts of hydrogen sulphide (H2S) and ammonia. Ammonia (NH3) is a compound composed of one nitrogen atom bonded to three

In addition to hydrogen (H2), the presence of sulphur, nitrogen, water content, and carbon dioxide (CO2) has been documented. Both organic and inorganic waste materials have the potential to be transformed into methane gas, commonly referred to as biogas. Methane gas (CH4) is a gaseous compound that is produced by anaerobic bacteria, particularly the methanogenic bacterium. Significant quantities of methane gas were detected in various organic wastes, including plant matter, straw, animal excrement, meadowlands, and sedimentary formations. Methane gas is spontaneously generated at the final disposal site through the process of bacterial evaporation, even in the absence of intentional processing or the inclusion of specific compounds. The combustion of methane gas yields thermal energy, rendering it suitable for utilisation as an alternative fuel source or in power generation facilities.

Discussion. The conversion of waste into methane gas encompasses four overarching process ideas, which include gas collection, gas pressure maintenance, gas distribution security maintenance, and safety management. Biogas is derived from a specialised facility known as a biodegester, which is designed to harness the production of this renewable energy source. Decomposing organic material under anaerobic circumstances, characterised by the absence of oxygen. The optimal circumstances for biogas generation are primarily influenced by the quality of organic material and the surrounding environmental factors. The condition is characterised by two factors, namely

the organic material type, acidity level, C/N balance, temperature, storage rate, presence of hazardous substances, melting point, starting, and retention period. The pace of fermentation by microorganisms is significantly impacted by environmental circumstances. It is crucial to maintain controlled environmental conditions within a pH range of 6.5-7.5 and an ambient temperature of 32-37 degrees Celsius Furthermore, the utilisation of biodegester technology facilitates the extraction and subsequent utilisation of methane gas. During the process of open dumping at the TPA (Trash Processing Area), the gaseous emissions are extracted by means of a suction pump, which utilises the sewage system included inside the waste materials. The gas that was extracted has been accumulated in the gas treatment system for subsequent processing.

Keywords: Waste Management, Methane Self-Sufficiency Program, WASTECO, Community Development.

Biographies

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