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Review Article

An Insight into Research and Studies on Biogas Generation from Waste

Sunil J. Kulkarni

Datta Meghe College of Engineering, Airoli, Navi Mumbai, Maharashtra, India.

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ABSTRACT

The sustainable development to fulfill the needs of mankind is driving force behind technical and scientific research. The increase in population in developing countries has two major effects on economy in addition to food crises, the generation of waste and increase in energy requirement. The waste treatment is important aspect because of its odor, its effect on soil and ground water. The domestic, kitchen, vegetable, poultry, canteen and hotel waste causes major disposal problems. The use of this waste for biogas production is very attractive alternative. It serves twin purposes, waste treatment and energy generation. The waste after biogas production can be used as fertilizer. Various investigators have carried out research on production of biogas from domestic, vegetable, animal, canteen, hotel and poultry waste. The results obtained are very encouraging. The current review summarizes research and studies on biogas production from various waste, its analysis and studies on factors affecting the biogas production.

Key words: Biomass, bioremediation, yield, organic loading, anaerobic digestion, bioconversion.

INTRODUCTION

The ever increasing population and never ending human wants calls for rapid industrialization. The increasing in population is accompanied by increase in solid, liquid and gaseous waste. The energy demand also increases. The treatment of domestic waste is major problem faced by municipal bodies. The liquid waste contains organic matter measured as chemical or biological oxygen demand (COD or BOD). This is generally treated by using physical, biological and chemical treatment steps.

Various investigations have shown that activated sludge process, adsorption and various biological methods can be used for domestic wastewater treatment. [1-3] Industrial waste water can also be treated with these treatments with some modification in treatment facility to account for composition and quality of effluent. [4-7] The energy crisis calls for research on non conventional energy sources. Solar and tidal energy can be used as non conventional energy sources. [8-10] Biogas production from different types of waste serves the purpose of minimizing waste and energy generation. The current review is aimed at summarizing research and studies on biogas production for waste.

Research and Studies on Biogas Production from Waste

A review on anaerobic digestion of vegetable waste was carried out by Patil and Deshmukh. [11] According to the review, the temperature, pH and organic loading rates have significant effect on biomass remediation. Use of appropriate catalyst increases biomass yield. Biomass remediation also reduces organic loading. Chulalaksananukul et. al. carried out

investigation on bioconversion of Pineapple solid waste under anaerobic condition. [12] They tried to obtain optimum conditions for maximum biogas production. They studied conditions affecting biogas production such as type of microorganism, pH value, carbon to nitrogen ratio, as well as the organic loading rate. By using indigenous microorganisms they obtained methane gas with an attractive concentration of 48% at 20 days.

Sebola et.al. reviewed biomass production by using different types of waste. [13] They carried out investigation on production with best suitable substrate. According to these studies the biomass production largely depends on feedstock. The relative proportion of the component, the amount of the mixture and other physical variables such as temperature and pressure are few important factors affecting biogas production. Apte et.al. carried out investigation on kitchen waste for biogas production. [14] They carried out characterization of kitchen waste from several kitchens. They explored the possibility of production of biogas from this waste. Bagudo et.al. Evaluated biogas samples from selected organic wastes. [15] They used paper waste, saw dust, cow dung, rice husk and millet husk for biogas production. They obtained highest quality biogas (72.59%) with paper waste and lowest (58.08%) quality biogas with millet husk. In terms carbon dioxide content, millet husk biogas had highest carbon dioxide contain. The paper waste biogas had minimum carbon dioxide content. The paper waste biogas had highest hydrogen sulphide content. On the basis of yields cow dung was best substrate for biogas production. Ofoefule et.al. carried out investigation on production of biogas from paper waste and its blend with cow dung. [16] They blended cow dung and paper waste in 1:1 proportion. They charged metal prototype biodigesters with 3:1 proportion of water to waste. They observed that the blending of cow dung increased biogas production by 50 percent than paper waste alone. They observed that paper waste was very good feedstock for biogas production. They also observed that blending of paper waste with cow dung or any other animal waste gave sustained flammability throughout digestion period.

Dupade and Pawar carried out experimental analysis for biogas generation from kitchen waste. [17] According to them, it is necessary to have organic processing facility in order to have economical, efficient and environment friendly production of biogas. Additional sodium hydroxide was required during the process for maintaining the pH. They found considerable decrease in the parameters such as COD, BOD, pH, acidity and alkalinity. Wikandari et.al. carried out investigation in order to improve biogas production from orange peel. [18] An antimicrobial agent, limonene is present in orange peels. This affects the biogas production adversely. They pretreated the orange waste to remove limonene by leaching. They used hexane as solvent for the leaching. Also solvent recovery of 90 percent was achieved by vacuum filtration. The hexane residue had negative effect on biogas production.

Agrahari and Tiwari carried out research on production of biogas from kitchen waste. [19] They used portable floating type biogas plant for the purpose. They carried out an investigation with different kitchen waste ratios. They also analyzed the constituent of biogas, pH, volume and rate of biogas production at different level of temperature. Considering the biogas production and carbon credit, Aluminum biogas system is better than plastic plant. But these Al made plants are costly and also have life half of plastic plants. The metal plant can be black coated to increase its life. Ray et.al. carried out review on biogas production from waste with pretreatment. [20] According to this review, anaerobic digestion produces biogas with approximately 60 percent methane content. The digestate, solid and liquid residue after biogas production can be used as a soil conditioner to fertilize the land.

Similar research on production of biogas from kitchen waste was carried out by Ziauddin and Rajesh. [21] They used canteen waste for biogas production with satisfactory results.

Momoh et.al. used cow dung and water hyacinth in batch reactors for biogas production. [22] They studied effect of waste paper on biogas production. They varied addition of waste paper for a fixed amount of cow dung and water hyacinth till maximum biogas production was achieved. The proportion was 3.5:1:1 for waste paper, cow dung and water hyacinth. Meggyes and Nagy used different types of agricultural wastes for biogas production. [23] They used variants of mixtures of liquid pig manure and plant additives for biogas production. The biogas production can be integrated with waste disposal system. It is important to gather information such as necessary and optimum inputs for the plant for better and economical operation of plant. Singh et.al. used chicken waste for biogas production. [24] In poultry industry also waste minimization is important factor. They studied factors such as the substrates, fertilizing value of digested poultry waste, assessment of odor level. They used 42 kg of waste with equal amount of water. They were able to produce 3000 kg/day of biogas.

CONCLUSION

Biogas production from waste can reduce energy requirement. It has potential to fulfill the energy requirement of housing complexes, poultry farms, hostel and many other units which generate sizeable amount of domestic waste. The waste disposal problem also can be partly solved.

The waste, after biogas production can be used as fertilizer as it is rich in organic matter content. It is important to operate the biogas plant with adequate water to waste ratio, pH and organic loading for maximum biogas production. Proper design and efficient operation of biogas plant can be considered as cost effective and efficient method for energy generation and waste minimization.

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