A Critical Review On Biogas Generation, Slurry Utilization and Uses

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Abstract

Biogas serves as purest and high calorific source of energy. The major content in biogas is Methane which contains a substantial energy content. Biogas production not only serves the domestic as well as industrial energy purpose but also support waste management to a great extent. In this paper, a critical review has been conducted to study various aspects associated with biogas such as biogas generation, slurry utilization and uses.

1 Introduction

Bio-energy research has achieved interest all around the globe because of dwindling gasoline prices and ecological disquiets. In terms of existing energy resources, a vast breach exists among the demand and supply (above 15%) and the energy possessions of the nation are insufficient. On the other hand ,agricultural crop deposits in India is 550 Mt/year and is expected to increase in the upcoming decades. However, harvest residues are processed in unprofitable manner. Waste mass resources comprise a variety of natural and derived materials, for example timbered and herbaceous genus, bagasse, farming dissipates, paper waste, MSW, industrialized waste, residual oil, uncooked oil, marine plant life and algae, etc., which might be possibly employed for creation of constructive fuels, chemicals and energy. The typical bulk of bio energy comprises of timber wastes (64%), community solid waste (24%), farming waste (5%) and landfill gases (5%) [1]. It is proved that the renewable energy is the only sustainable energy in nature. Bio compost energy is the purest or cleanest forms of energy provided by nature. Furthermore, they are extremely beneficial from the perspective of ecological contamination control and a benefit for carbon recognition.

Primarily, the raw stuff for bio-energy is waste matter that is available from farming, gardening, human, animals, and non -edible oils etc. In India, it has been observed that more than 90 million Tons of MSW is produced every year. Hence in this present work literature has been surveyed in order to have records related to the usage of waste in the biogas production.

2 Biogas generation from microbial action

Methane gas is generally employed for the production of heat and electrical energy, and is currently comprehensively used as fuel resource for domestic purposes. It is supplied in the form of national gas pipelines.

Also it can be reprocessed to methanol and can be employed as fuel in internal combustion engines (Morton, 2006) [2]. This type of natural gas resources are obtained from bio-waste. As we know small traces of methane gas has also be present in the environment and it is essentially derivative from microbial exploit in rice paddies and enteric fermentation in animals. It has been considered that methane is the next most significant greenhouse gas after CO_2.

The microbiological process of CH_4 production is found to be long which involves three major biochemical phases, each of which contains microbiological parameters. The early stage involves solubility of composite molecules such as cellulose, fats and proteins, which consumes nearly all the raw waste matter. The left over products which are having low molecular weight in first stage are then transformed to organic acids. It has been observed that at the finishing segment of microbial process, these acids are decayed by the methanogenic microbes to CH_4 and CO_2.

Methane is widely employed as an energy source and has cost-effective value at small-scale manufacturing. However, there is a hesitation about the potential of large-scale business processes for methane generation (Schubert, 2006) [3]. Conversely, urban, manufacturing and agricultural wastes produces net fuel i.e. biogas and the byproducts of these wastes are solid or liquid deposits that can further be used as fertilizers or animal feed.

3 Bio Gas Slurry Utilization

It has been found the treatment of biogas slurry plays an important role. Thus, there is an requirement to extend techniques for production of organic compost based chemical fertilisers which are friendly with flora and fauna of the earth.

Igoni et al. (2008) [4] reviewed various designs of anaerobic digesters for production of biogas from Municipal Solid Waste. Authors reported that there is a need to reduce the size of the digester while keeping other imperative aspects intact to prepare an optimal design of the anaerobic digester.

Aremu et al. (2012) [5] investigated the anaerobic digestion of cow and pig dung at laboratory scales,for the biogas fabrication. The experiment was carried out using cow dung and pig dung individually as substrate and fresh cow manure as source of methanogens. The process of biogas formation is also called as water displacement method. The biogas generated can be stored in gas cylinders and used proficiently for straight heat conversion. It has been found that the process holds the fertilizer value of the original waste products.

Mukumba et al. [6] analyzed batch anaerobic co-digestion of cow dung and donkey manure. Cow dung and donkey manure were processed together. The co-digestion process was conducted using 1.0 m^3 batch biogas field digesters. The volume of biogas produced was measured daily by a biogas flow meter. Anaerobic Digestion has also been incorporated for the treatment of municipal solid-wastes. Vassiliou [8]

4 Sources of biogas

4.1 Uses of biogas

Biogas is a smartest form of energy in many nations of the planet. Indeed, all over the world, biogas has been utilized domestically for heating purposes and electricity generation. In the United Kingdom, Xuereb [9] reported that, though the exploitation of biogas for electricity production was still at its initial stage, which was only 0.5% of the entire electricity generation. It has also been reported that biogas fuels only accounts for 1% of total United States electricity generation. However, biogas assists in environment change comparable to reducing CO_2 emissions by greater than 10%. Burton et. al [10] confirmed that digester gas can be used as a fuel for IC and boiler engines.

Abubakar et al. (2012) [11] studied the Anaerobic digestion of cow dung for biogas fabrication and reported that there was an immediate need to switch to new animal waste dumping techniques. It was found from the study that livestock dung like cow dung , in the deficiency of suitable dumping techniques , can cause ecological and health troubles such as pathogen contamination, odour, green house gases accumulation, etc. Anaerobic Digestion is broadly employed in handling diverse organic wastes, e.g. sewage sludge, municipal solid waste, household waste, animal manure, etc. Anaerobic treatment comprised of disintegration of organic substance in the lack of free O_2 and production of CH_4, carbon dioxide, NH_4 and traces of other gases with lower molecular weight organic acids. In recent times, huge cow dung volume, amplifies annually, usually the majority of which is found to be disposed into landfills or pertained to the field without cure. Anaerobic digestion offers a alternative for energy recuperation and waste treatment. The cow dung in this regard, was evaluated for the use of AD to reduce dumping costs and to generate biogas and ultimately to attain green production of energy.

5 Conclusions

Day by day waste is creating a dilemma and Anaerobic digestion is one of the way in order to accomplish this objective AD has been ignored from decades as an alternative for the stabilization of municipal/sewage slush. However, from last few past years AD is getting attention and the technology has been extended to emphasize treatment and energy recuperation from numerous types of wastes such as industrial waste/sewage water, animal wastes, organic/inorganic industrial waste and source-sorted domestic wastes. In contrast to incineration, AD generates more heat while processing of wastes, that generally contain large water content [12]. It has been found from the studies that the nutrients are generally lost during incineration. Hence Anaerobic digestion process must be utilized to develop advanced technologies.

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