REVIEW ON DIFFERENT CHALLENGES OF USING AGRICULTURAL WASTE IN BIOGAS PLANT

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Abstract
The incineration of agricultural wastes (agro wastes) as a fuel, solid fuel, and/or for the same purposes, resulting in land filled ash that in most cases makes an environmental problem due to disposal. These land filled most of the time contain valuable elements such as silica and alumina which are promising alternatives to be used in value-added engineering products. With this regard, the optimal use of these wastes has always been a concern for researchers, and the utilization of them for different purposes is an effective way of management. In, this paper discussed also about the agricultural waste, and its application as a catalyst.
Keywords: Agricultural Residues (Wastes); Soil; development process; ANOVA; Biogas Material Composition

INTRODUCTION

Agricultural wastes are defined as the residues from the growing and processing of raw agricultural products such as fruits, vegetables, meat, poultry, dairy products, and crops. They are the non-product outputs of production and processing of agricultural products that may contain material that can benefit man but whose economic values are less than the cost of collection, transportation, and processing for beneficial use. Their composition will depend on the system and type of agricultural activities and they can be in the form of liquids, slurries, or solids. Agricultural waste otherwise called agro-waste is comprised of animal waste (manure, animal carcasses), food processing waste (only 20% of maize is canned and 80% is waste), crop waste (corn stalks, sugarcane bagasse, drops and culls from fruits and vegetables, prunings) and hazardous and toxic agricultural waste (pesticides, insecticides and herbicides, etc).

Fig. 1 Agricultural waste
(Source:https://wastemanagementreview.com.au/consortium-harness-value-agricultural-waste/)

The primary aim of this paper is to analysis in detail the various application and research carried in the fields of biomass and forecast of the production potential of agricultural biomass.

The detailed study includes the following factors scope of the forecasted consumption of renewable energy in terms of energy types (electrical energy, heat, automotive bio-fuels), energy potential of agriculture (sources of agricultural biomass, utilization structure of agricultural biomass, the volume of production of solid biomass, biogas and bio-fuels, cultivation area of energy crops) and barriers to the utilization of biomass.

Traditional methods such as burning of these residues cause adverse effects on the environment such as greenhouse gas emission and pollution of air and water, while they could be sufficiently converted into valuable products through anaerobic digestion process. In order to enhance the efficiency of anaerobic digestion of the agricultural residues, a sufficient pre-treatment may be necessary to make the feedstock ready for microbial decomposition. Besides, the optimization of microbial activity of anaerobic digestion via manipulation and control of operational parameters is necessary and important. This paper presents a comprehensive review on the latest studies investigating the potential of agricultural wastes as feedstock for biogas. The review includes the investigations on the bio methane potential of agricultural residues as well as the investigated pre-treatments and operational conditions for the improvement of anaerobic digestion of agricultural residues.

Advantage of biogas

1 biogas is a renewable source of energy and its clean fuel which can help in controlling air pollution.

2 biogas reduce soil and water pollution by decomposing sewage ,animal dung and human excreta.

3 biogas eco-friendly operation they are rapid fall in diseases like schistosomiasis and tapeworm

4. biogas plant requires only locally and easily available material for construction.

5. biogas provide nutrient rich (N& P) manure for plant

Disadvantage of biogas

1 biogas generation is also affected by the weather .bacteria need to digest waste is about 37^0. digester required heat

2 its contain so many impurities which are difficult to be controlled even after round of purification .biogas when compressed to be used as fuel ,it highly corrosive to the container

3 biogas plant can not work in all location where as the raw material plentiful supply .rural area are best location construction the bio gas plant.

Challenges of the current processes

In general and as mentioned earlier, the AD of organic material requires combined activity of several different groups of microorganisms with different metabolic capacities. To obtain a stable biogas process, all the conversion steps involved in the degradation of organic matters and the microorganisms carrying out these steps must work in a synchronised manner. Methanogens have longer duplication times (of up to 30 d) and are generally considered as the most sensitive group to process disturbances. It is therefore important to prevent these groups of microorganisms from being washed out from the system, by decoupling the solid retention time (SRT) and the HRT. Major developments have been therefore made during the last decades with regard to development of high rate systems, lowering the effects of toxic compounds, integrating the biological process with membrane separation techniques, as well as better.

Literature Survey

(Tharasawatpipat and Suwannahong 2008) [1] The biogas from municipal solid waste and agricultural waste were produced in local community of Bangnangli, Amphawa, Samutsongkram province in Thailand. These kinds of waste are needed for a proper management and make some profit back to the community. In this program, 2 of 5 clusters in bangnangli sub district were participated in this program. The production rate of biogas from coconut shell, pummelo peel and municipal solid waste were 2.8- 111.7, 1.1 – 111.6 and 3.8-74.4 mg/kg/day, respectively and last until 19 day per batch. The evaluation results in this program indicated that 80% of the local community were more understand in the biogas production,90% of the local community were satisfied by this program,70% the local community want to expand the biogas production into larger scale and 75% of the local community were participated in every activities. The evaluation in this program was evaluated from the level of attention, questionnaire and level of participation from the local community.

(Energy 2015) [2] The fear of depletion of fossil fuels and their attendant ecological effects and the high cost of renewable energy technology in Nigeria has triggered a need to develop alternative sources of energy, among which is biogas production. The experiment was run for 50 days and assessed for proximate content, biogas generation, organic matter, and mineral content in the digested and un-digested agro-waste materials. The proximate composition showed that while banana peel had the highest moisture (56%), rice husk was highest in the content of ash (64%), crude protein (6.94%), and volatile solids (20%). The weekly cumulative biogas generation increased from 852.6 cm3 for BP/PP sample to 1049.7 cm3 for PP/RH sample for the 7 weeks at the experimental room temperature range of 29^{o}C to 35^{o}C. Sample PP/RH generated the highest volume of gas (biogas, methane, and others) compared to BP/RH and BP/PP samples. In each case the volume of gas production decreased in week 7 from 271.4 cm3 to 152.0 cm3 (for biogas), 161.4 cm3 to 97.1 cm3 (for methane), and 110.0 cm3 to 54.9 cm3 (for other gases). The mineral elements ranged from 0.554 mg/g in the undigested rice husk to 18.155 mg/g in the digested banana peel samples. Fermentation of agricultural wastes to generate biogas and sludge with agricultural value offers an alternative and efficient method of agricultural wastes and energy management in Nigeria.

(Vilniškis et al. 2011) [3] One of the methods for managing biodegradable waste generating in the Lithuanian agriculture is its anaerobic digestion in a bio-reactor. This way of management would allow the recovery of biogas that can be used as an alternative to natural gas. The article analyses agricultural biodegradable waste and its use for the production of biogas in bio-reactors. Before the experiment the substrate was prepared so as the dry matter in its content accounted for 10 % of the total mass. Investigations were carried out in mesophilic conditions (t=35±1 ^{o}C). There were performed measurements of the yield of evolved biogas and methane, oxygen and sulphur hydrogen in it.

(dell'Antonia et al. 2013) [4] The latest directives of the Energy and Environment Policy of the European Union (EU) established a new framework for renewable sources (Directive EC 28/2009; European Commission, 2009). The objective of this work was to determine the potential energy production from anaerobic digestion of animal wastes and agricultural residues in Friuli Venezia Giulia (Nord-East Italy). For an assessment of biogas as an energy source, based on direct conversion by agricultural farms, it is important to establish the amount of the waste. In this study, biogas amount which can be obtained was calculated for all municipalities in the Friuli Venezia Giulia Region (North-East of Italy) by using the number of livestock animals, the cereal area for agricultural residues and also considering various criteria such as the rate of dry matter and availability. The calculated regional biogas potential is about 187 (N)Gm3 when using animal waste, straw and corn stalk. The potential of biogas energy equivalent of Friuli Venezia Giulia is about 3 600 TJ (LHV) may be able to replace 2.6% of final energy consumption in Friuli Venezia Giulia (3339 ktoe) and about 10% of the final electricity consumption (864 ktoe) considering an electrical efficiency of 30% with the biogas engine.

(Divya et al. 2015) [5] this study has been designed to meet enhanced biogas and methane production from various substrates through co-digestion with cow dung. In spite of optimum C/N ratio, the substrate mixtures like poultry waste-cow dung (1:1), municipal solid waste-cow dung (1:2), fruit-vegetable waste-cow dung (1:1), agricultural waste-cow dung (1:2) and kitchen waste-cow dung (1:1) were prepared and then allowed to digest in a laboratory scale anaerobic digester, until 30th day. The parameters such as pH and temperature were increased during the digestion process. The biochemical characterization of initial and final substrate showed that there was a gradual decrease in chemical characteristics except nitrogen content from 0th day to 30th day. The characterization of biogas at different time intervals revealed that poultry waste- cow dung mixture produced biogas with highest methane content of 72.6% at 30th day. Hence the study concluded that a mixture of poultry waste–cow dung (1:1) can be promising for efficient production of biogas to accomplish economic feasibility in the meanwhile.

(Barz, Delivand, and Dinkler 2018) [6] Recent studies report that anaerobic di- gestion (AD) is an efficient alternative technology that combines bio-fuel production with sustainable waste management, and various technological trends exist in the biogas industry that enhance the production and quality of biogas. Further investments in AD are expected to meet with increasing success due to the low cost of available feed-stocks and the wide range of uses for biogas (i.e., for heating, electricity, and fuel). Bio- gas production is growing in the European energy market and offers an economical alternative for bio-energy production. The objective of this work is to provide an overview of biogas production from lingo cellulosic waste, thus providing information toward crucial issues in the biogas economy.

(Neeraj kumar 2014) [7] Biogas from biomass appears as an alternative source of energy, which is potentially enriched in biomass resources. This article gives an overview of present and future use of biomass as an industrial feedstock for production of fuels, chemicals and other materials. Results suggest that biogas technology must be encouraged, promoted, invested, implemented, and demonstrated, but especially in remote rural areas. Different types of wastes are used for production of biogas .these wastes are found very easy and an every palace. This article helps to make biogas form different wastes. From this study, it can be concluded that this method not only contributed to renewable biogas production but also improved the effluent quality

(Prateek et al. 2009) [8] A laboratory experiment was conducted to find out the biomethanation potential of dried and powdered Jatropha cake along with buffalo dung at 6% total solids. The experiment was run on daily feeding basis in five litre capacity glass digesters for 180 days. Biogas production was recorded at 24 h interval. Quality of biogas and nutritive value of effluent slurry was also determined. Results show significantly higher (139.20%) biogas production in test (Jatropha cake + Buffalo dung) over control (Buffalo dung only) digesters with methane content of 71.74%. Co-digestion results in 92.94% decrease in chemical oxygen demand

(Merlin and Boileau 2014) [9] Anaerobic digesters can turn these wastes into biogas as renewable energy, containing at least 50% of methane, and the solid residues into fertilizers rich in nutrients. A review of the main types of agricultural waste digesters used around the world, from the simplest to the most sophisticated will be made by presenting advantages and disadvantages of each including environmental impact. It will also compile state-of-the-art information related to new developments in anaerobic technology applied to agricultural waste treatment

(Azouma et al. 2018) [10] The paper focuses on the research, development, and application of simple, reliable, efficient, and low-maintenance technology for the production of biogas from local organic agricultural wastes in the Republic of Togo. The paper briefly outlines the current state of small-scale biogas production in Africa. Several reviews of the already existing and operated facilities in the mentioned area are named and evaluated. Specific opportunities, limitations, and experience are discussed and the results of the biogas production studies using pineapple waste, carried out at Augsburg University of Applied Sciences and at Brno University of Technology, are presented.

Conclusion

India is a major developing country, and the major source of economy is agriculture. Due to tremendous growth of agricultural science in the last couple of decades, crop production has increased and so has the awareness about plantation. Associated with it is the accumulation of agricultural waste in enormous quantity as biomass. Biomass in the form of cellulose, hemi cellulose and lignin represents an important energy and material resource. Due to its energy resources, which are renewable in nature, lingo cellulosic has attracted considerable attention as an alternative feed stock .For the various waste sources discussed, it was found that they can be used as partial cement replacements or aggregate materials in concrete. If properly treated, the ashes have pozzolanic properties and contribute to the hydration and hardening of concrete. If properly designed, such concretes are not inferior to OPC concretes and, in fact, they can show improved workability and long-term durability, together with reduced heat of hydration. This makes such wastes suitable candidates for various specific applications, e.g., for creating durable concrete or massive concrete structures.

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