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Generation of Biogas from Kitchen Waste,Bagasse and Garden Waste: A Literature Review

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Abstract:*Energy is important to meet the elemental wishes of lifestyles, to broaden facilities and modernization. The important sources ofenergy which are met our energy demands are mineral oil, coal, typical fuel and firewood. These conventional vigor sources arebeing depleted day by day. So renewable, substitute and strong vigor sources will have to be explored for our nation as good asentire world.This paper reports theutilization of organic waste to be had for anaerobic digestion ofwaste and thus utilization of waste to power. Any subject whichcan also be decomposable via the action of microorganisms in a shortinterval of time is referred to as biodegradable. Most likely meals waste;vegetable waste, bagasse, garden waste are biodegradable. Thesewastes are most likely dumped in dumping websites which whendegraded free up carbon dioxide, methane, ammonia andhydrogen sulphide into the environment thereby contributes toair pollution and odors pollution. In this paper assessment ofexperiment work via special researchers for generation andutilization of biogas by means of organic wastes. This paper even opensnew avenue of waste to energy process of disposal of municipalwaste. These waste if treated in proper system can be utilize forintegrated stable waste administration.*

Keywords-Bagasse, Biogas, garden waste, kitchen waste,renewable source

I. INTRODUCTION

The extent of biogas production from cattle-dung islimited due to its high 1igno-cellulosic content (Hobson et a . 1974) and its resistance to enzymatic and microbiological action (Fan et al . 1980). In India, biogasplants are built to KVIC (Khadi and Village IndustriesCommission) and Janata designs and are mostly operated withcattle-dung. It has been envisaged in the Status Report ofGovernment of India (1989) to increase the biogas productionfrom 0.22 m^ with 55 per cent methane content to 0.40 m^with 65 per cent methane content per kg dung (Xavier andKrishna Nand, 1990). Attempts have been made to improve theyield of biogas with high methane content by feeding thedigester with various substrata. For higher yield of biogasvarious other factors are also important.

A well-working, active biomass is a prerequisite for efficient biogas production processes,why factors affecting microbial growth are crucial to obtain stable processes at the highestpossible organic load/lowest possible hydraulic retention time.The microorganisms need nutrients, i.e. carbon, nitrogen, phosphorus, calcium, potassium,magnesium and iron as well as trace elements such as cobalt, nickel, manganese,molybdenum, selenium and tungsten for growth. The need of nutrients and trace elementsvaries with the substrate digested, the organic loading rate, the process design (e.g. thereactor configuration, the degree of recirculation etc). In addition, the complexity of thechemical reactions controlling the bioavailability of the trace metals is wide, why optimaladdition strategies for trace elements needs to be developed.Substrates as food wastes, sewage sludge, cattle manure, certain energy crops and algae aregood bases to obtain processes with good nutrient- and trace element balances. These kindsof substrates can often be implemented for “mono-substrate” digestion, while substratesdominated by carbohydrates or fats needs to be co-digested or digested in processesmodified by e.g. nutrient- and trace element additions, sludge recirculation, etc. Protein-richsubstrates often include enough nutrients, but can give other process problems (see below).Iron, cobalt and nickel are the nutrients/trace elements given most attention so far.However, molybdenum, selenium and tungsten have also, among others, been showneffective in different AD applications. The effects have, however, mainly been shown onturnover of VFAs and hydrogen (resulting in increased methane formation), while just a fewstudies have addressed their direct effect on rates of hydrolysis, protein-, fat-andcarbohydrate degradation. Selenium- and cobalt-containing enzymes are known to beinvolved in amino acid degradation, while selenium and tungsten are needed in fat- and longchain fatty acid degradation. Enzymes active in hydrolysis of cellulose have been shown tobe positively affected by cobalt, cupper, manganese, magnesium and calcium. This impliesthat trace element levels and availability will directly affect the hydrolysis rates as well asrates and degradation pathways for digestion of amino acids, long chain fatty acids andcarbohydrates. However, their effect on hydrolysis seems neglected, why studies are neededto map the metals present in active sites and co-factors of enzymes mediating these primaryreactions in AD. Further investigations are then needed to elucidate the importance of theidentified metals on the different degradation steps of AD aiming at increased degradationrates of polymeric and complex substrates. It should also be noted that the degradationroutes for amino acid degradation in AD-processes, factors governing their metabolicpathways, and how ATP is gained in the different pathways seem unknown. The differentroutes may result in different degradation efficiencies, why a deeper knowledge within thisfield is called for.

II. RELATED WORK

GUJALWAR et.al. (2014) has studied generation of biogas incombination of kitchen waste and cow dung. They have used20 liters air tight anaerobic digester for digestion of kitchenwaste. The digester was installed in EnvironmentalEngineering laboratory of Civil Engineering, Department, atJagadambha College of Engineering and Technology,
Yavatmal, India. Potato chips used as kitchen waste and cowdung used as an inoculums. They concluded that mixing ofextra bacterial seed improves digestion of kitchen waste andproduction of bio gas, generation of biogas increased bystirring of the mixure for homogeneous mixing of substratewith bacteria present in anaerobic bacteria.

Reddy et.al. (2016) has studied Bio Gas Generation fromBiodegradable Kitchen Waste. Kitchen waste likevegetablepeelings, fruit peelings, and Food waste collected fromSiddartha Nagar, Kandivili East at Radha Residence CHS of300 families with a population about more than 1200 peoplelivingin Mumbai city. From the house hold Survey and from
the society offic registers it has beeninvestigated that on anaverage 400 kg of organicWaste is collected from house tohouse.The fresh kitchen waste is mixed with cow dung andwaterto prepare slurry.

Tanimu et.al. (2014) completed a study on effect of carbon tonitrogen ratio of food waste on biogas methane production in aanaerobic digester. Food wastes were collected from TamanSri Serdang, Selangor, Malaysia. Food waste (raw chickenmeat/ beef (5%), kitchen wastes such as rice and noodles(77%), leafy vegetables/ salad (7%), soup (6%) cookedmeat/fish (5%)),vegetable waste (baby corn (5%), lettuce(24%), carrot (5%), broccoli (18%) and green leafy vegetables(48%)), fruit waste (papaya (27%), orange (19%), pineapple(39%), watermelon (11%) and berries (4%)) was collected forproduce biogas. They concluded that methane composition of
biogas increased with increasing C/N ratio with the highestmethane composition of 85% obtained during the digestion offeedstock 3 with C/N ratio of 31.
OjikutuAbimbola O, OsokoyaOlumide O (2014) has studied

Biogas production from kitchen waste. Food waste includesyam peels, plantain peels, orange rind and fish waste wascollected for bio gas production. Mixture of these waste werecarried out in batch type digester for 70 days digestion period.They resulted that the food waste type had significant($P \leq 0.05$) effect on substrate temperature and pH but had nosignificant ($P > 0.05$) effect on biogas production. The meanvalue of biogas production was in the range of 1090 ml/dayand 8016.67 ml/day. The study concluded that anaerobicdigestion of the mixture of the FW enhanced biogasproduction although not significantly ($P > 0.05$). [6]Dhanalakshmi Sridevi V and Ramanujam R.A. (2012) hasstudied Biogas Generation in a Vegetable Waste AnaerobicDigester. Nine reactor of 500 ml capacity lab scale batchreactors are used for generation of biogas at koyembedu,Chennai, india. Carrot, beans and brinjal having pH 5.4, 5.8and 5.7 and moisture content 89.8%, 90.29% and 89.4%respectively were chosen for the study of generation of biogas. Daily generation of biogas was measured by waterdisplacement method. It can be concluded that vegetablewaste contain high carbohydrates are responsible to anaerobicdigestion process and maximum gas production occurredduring 5 to 10 days of digestion. Carbohydrates have beenbroken down much faster than protein and fats present in the vegetable waste and produced gas. [7]Patil V.S, Deshmukh H.V.(2015) has studied Anaerobicdigestion of Vegetable waste for Biogas generation.

Theyconcluded that VW have high carbohydrate and high moisturecontent. It is a good substrate for the production of biogasthrough biomethanation. Biogas yield reported is in the rangeof0.360 L/g of VS to 0.9 L/g VS added. The biogas yield isaffected by temperature, pH, organic loading rates and designof reactor. Biomethanation process reduces the load of organicpollutants in reduction of total solids, volatile solids, biochemical oxygen demand and chemical oxygen demand. [8]Muhammad Rashed Al Mamun, Shuichi Torii (2015) hasstudied Production of Biomethane from Cafeteria, Vegetableand Fruit Wastes by Anaerobic Co-Digestion Process. Thestudy was conducted to determine the optimal mixing ratio ofcafeteria, vegetable waste and fruit waste in generation ofbiogas and methane yield using batch type anaerobic digesterat mesophilic temperature. The mixing ratio used werecafeteria waste: vegetable waste: fruit waste (0.5: 1:1.5, 1: 1.5:0.5, 1.5:0.5:1, 1:1:1) .200 L digester was used for biogasproduction. At four mixing ratio tested, after 35 days ofdigestion, the biogas yield was determined to be Cafeteriawaste: Vegetable Waste: Food Waste (0.5:1.0:1.5, 1.0:1.5:0.5,1.5:0.5:1.0 and 1.0:1.0:1.0) were 13.38, 15.85, 17.03 and19.43 L/day, respectively. The biogas yields obtained in thestudy for the cafeteria (CW), vegetable (VW) and fruit wastes(FW) mixture were in the order of (1.0:1.0:1.0 > 1.5:0.5:1.0 >1.0:1.5:0.5 >0.5:1.0:1.5).). The higher methane contents andyields were obtained from the Cafeteria waste: VegetableWaste: Food Waste (1.0:1.0:1.0) mixture ratio than those fromthe Cafeteria waste: Vegetable Waste: Food Waste(1.5:0.5:1.0, 1.0:1.5:0.5, and 0.5:1.0:1.5). it can be Concludedthat maximum yield within 35 days hydraulic detention timewithout inoculums added.[12]

III. FUNGI IN DEGRADATION OF SUBSTRATE FOR BIOGASPRODUCTION

Abdel-Monem et al . (1984) isolated Penici11iumfuniculosum 6B from sugai—beet bagasse and found thisisolate produced cellulolytic enzymes in culture filtratewhich can degrade the substrate for biogas production.Gulati and Gaur (1988) reported that a few fungi such asAspergillus niger, Fusarium sol ani, Penici11ium funiculosum,Trichoderma reesei are capable of producing high-qualityenzymes that can hydro!yse cellulose substrate for biogasproduction.

Mehta et al . (1990) used Pleurotus florida cultivatedspent rice straw for production of biogas. The spent strawcontained 22 per cent protein, less cellulose, more nitrogenand ash. There was eight-fold increase in biogas productionfrom the spent straw when compared with the original straw.Akao et al . (1992) used five fungi isolates such asAspergilTus sp. A-1 , A-2, A-3, Penicill ium sp. P-1 and P-2to treate Citrus unshu peels to produce methane. Of

fivefungi isolates, Aspergi llus sp. A-1 had the highest activity
in macerating Citrus peels. From the citrus peels about 95.8per cent of oil was removed by 48 h enzyme treatment, andthe Citrus peels were utilized for anaerobic fermentation ofmethane.

Raw materials for methane production:
Sathianathan (1975) stated that the raw materialsprovide nutrients for the proliferation of micro-organismspresent in the digester. It includes cellulose,hemicellulose, starch, simple sugars (carbon source),protein, non-protein nitrogenous substances (nitrogensource), macro and micro elements and vitamins. If thesenutrients are present inadequately, the biogas production isdiminished Hence, it is inevitable to provide sufficientquantity of raw materials for proper action of the microbesas well as functioning of the biogas digester.Biogas from weeds

Deshpande et al . (1979-) used water-hyacinth as an additive in biogas production and obtained methane 3 to 8per cent for 5 to 13 days of fermentation; 10 to 60 per centfor 14 to 28 days of fermentation; 57 to 62 per cent for 29to 49 days of fermentation and 60 to 64 per cent for 50 to60 days of fermentation.Gunnarson et al . (1985) obtained biogas throughanaerobic digestion of Jerusalem artichoke {He!ianthustubgrosus L.) fresh and ensiled materials (stem andfoliage). The plant materials produced 480-680 cc biogasper kg organic material.Zubr (1986) recycled fresh and ensiled plant materialssuch as tops of Beta vulgaris, HeT ianthus tuberosus, Sinapis
alba, Brassica napus. Rheum rhaponticum and Symphytumasperum and leaves of Brassica oleracea var. arvensis and B.oleracea var. capitata in two phase anaerobic fermentation.He produced biogas ranging from 61.1 per cent to 69.5 percent from fresh material, and minimum of 67.2 per cent tomaximum of 72.0 per cent of methane content in silagematerial.Gunaseelan (1987) used Parthenium as ^an additive withcattle manure and generated biogas through anaerobic.

IV. CONCLUSION

Kitchen waste, vegetable waste, bagasse, and garden waste isvery essential for biogas production. Accompaniments of bacterialgrowth are very essential for enhancement biogas productionand digestion of kitchen waste, vegetable waste, bagasse,garden waste. Pretreatment methods like acid, alkaline,mechanical pretreatment are very good for enhancement ofbiogas production from sugarcane bagasse. Digestion ofkitchen waste and production of bio gas.

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