REIMAGINING THE PURPOSE OF ENERGY EDUCATION BEYOND CONSERVATION

Editors

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A REVIEW ON WASTE TO GREEN ENERGY TECHNOLOGY IN SOLID WASTE MANAGEMENT

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Abstract

The current annual generation of municipal solid waste i India is calculable to be around forty-two million tones which ca be increased due to urbanization and living standards o individuals. The municipal solid waste (MSW) generation range from 0.25 to 0.66 kg/person/day with a mean of 0.4 kg/person/day. Moreover, huge quantities of solid and liquid wast are generated by industries on the other hand. Most of the wast generated is deposited into land and water bodies without prope treatment, these wastes emit greenhouse gases like Methan (CH4), Carbon dioxide, etc., leading to suspicious odour, an increase in air pollution. This drawback will be considerab eased through adoption of environment-friendly waste-to-energ technologies for the treatment and process of wastes befor disposal. It'll not solely cut back the amount of waste; howeve additionally generate substantial quantity of energy. India, th world's fifth-biggest energy client and is expected to surpas Japan and Russia to require the third place by 2030. India *economy has shown a strong growth in recent years and is making an attempt to sustain this growth to achieve goals of alleviation. About 1900 MW potential of green energy can be generated in India and this can be regulating by encompass different forms of solid waste. Nowadays hardly 50 MW power is being generated through waste-to-energy choices. Waste combustion provides integrated solutions to the issues of the trendy era, otherwise lost energy and thereby reducing our use of precious natural resources and thereby scaling down of greenhouse gas emission. This paper focuses in waste to energy as a green and relevant answer for solid waste drawback, vice versa and its importance as renewable supply of energy.*

Keywords: *Municipal solid waste, Green energy, Renewable energy, Greenhouse gas.*

I. INTRODUCTION

The increase in population over the years have increased the amount of waste generated and made it an important issue for the urban world, especially in developing countries, where economic development and expansion have significantly increased the generation of waste. In recent years, proper waste management and generation of electricity from waste is gaining attention around the world. Waste management includes collection, transport, disposal and monitoring of waste materials. The harmless disposal of waste is important to reduce the burden on fossil fuels and to develop environment-friendly society and thereby reduce pollution, improve the living environment and level of ecological civilization, and achieve scientific urban development. Most effective form of disposing waste is through electricity generation and moreover, the solid waste treatment plants not only reduce the amount of waste sent to landfills, and thereby producing useful energy as heat and power. [1-5]

II. WASTE TO ENERGY CONVERSION METHODS

The Waste to Energy technologies aims at safe disposal of waste along with extraction of energy; however, it has economic and environmental constraints. Therefore, it is very essential to select the efficient technology available.

a. Aerobic Composting

Aerobic composting is decomposition of organic matter victimization microorganisms that need gas. Gas from the air diffuses in to the wetness and is preoccupied by the microbes. The by-products of aerobic composting are heat, water and Carbon dioxide. Aerobic composting method takes solely 8-10 days. No leachate is made, wetness is extracted as vapour which might be condensed and used for watering close vegetation [6, 7, 8]

b. Anaerobic Digestion

Anaerobic digestion may be a biochemical method. Here the bacterium decomposes the organic part of the waste within the absence of gas. This method ends up in production of biogas composing of 50-75% Methane, 25-50% greenhouse gas and 1-15% of alternative gases (such as vapour, NH3, H2S, etc.) and remaining solid-liquid residue which can be used as a fertilizer or reborn into alternative merchandise. Biogas can be used as electricity and warmth, or is processed into biofuel. In anaerobic conversion it begins with chemical reaction of complicated waste compounds into easy and soluble compounds like sugar. This is often followed by fermentation within anaerobic conditions resulting in formation of organic acids, Carbon dioxide and Hydrogen. Finally, the methanogenesis takes place during which gas is made by reaction of Carbon dioxide with Hydrogen. [9, 10].

c. Landfills

Waste disposed in landfills is rotten by undergoing biochemical reactions. The decomposition of organic part of waste enerates lowland gas (LFG). The conversion of waste takes place erobically manufacturing Carbon dioxide until gas is consumed om the system. Then reactions undergo anaerobically leading to eneration of gas (around 55%) and CO2 (around 45%) with trace nounts of volatile organic compounds, ammonia and H ompound. The initial aerobic part is impermanent and produces a as principally composed of CO2. Since gas is apace depleted, a ng-run degradation continues below anaerobic conditions, and yproducts as 55% of gas and 45% of CO2 with traces amounts of olatile organic compounds. LFG generated is extracted and use to enerate power in turbine, biofuel for vehicle or for any chemical ocess. [11]

. Gasification

Gasification is used to produce syngas by thermal conversion ocess. The gasifying agents like air, oxygen or oxygen and steam reacted with the waste at 500-1800 °C to produce combustible ases. The syngas can be used to produce both heat and electricity rotating the turbine. Furthermore, it can also be used for emical processing. Process of gasification is generation of ectricity and heat from waste the syngas produced is made up of ammable gases (CO, H2, CH4, small amounts of higher hydro rbons), CO2, moisture, N2 if air is used, various contaminants ch as small carbon particles, ash and tars. However, the syngas mposition and calorific value is depended on the conditions, pe of waste and type of gasifying agent. [12, 13]

Incineration

Incineration is used for a variety of waste but usually it is ilized for less dense wastes which contain high percentage of ganic non-biodegradable matter and low moisture content that bsequently reduces mass and volume by 70% and 90% spectively. The waste, received is a mixture of organic substances, minerals, metals and moisture, which is combusted an excess supply of air (1.2 to 2.5) leading to the production of flue gas having a temperature range of 800 -1000 °C. Electric generation is done through the hot flue gases which are used high pressure feed-water boiler and the steam is used for rotating the turbine. Incineration technology has a net electrical efficiency of around 23–40%. [14]

f. Pyrolysis

Pyrolysis is a thermal conversion process of degradation chemical particles under the influence of a sufficiently high temperature in anaerobic environment (or trace amounts of oxygen). Pyrolysis is the thermal conversion of fuel in a closed system, so there is no external supply of additional substrate (especially oxygen). It is also known as thermal distillation and thermal de-polymerization. The main advantage of pyrolysis is that It can convert waste that are of no value or difficult to recycle into fuels, or other valuable products that can be further processed. The byproducts are pyrolysis gas, oil and char including methane, hydrogen, carbon monoxide, and carbon dioxide. Composition of process varies according to the thermal conditions, time, heat, nature and waste size, and reactor. However, pyrolysis yields mainly oil, wax and char at low temperatures, less than 500 -550 °C [15]

III. DISCUSSION

A major challenge and success of Waste to Energy technology depends on the potency, technical, environmental and economic factors. The combustion technology is commercially used for energy production within the kind of heat, electricity etc. This can be because of lower annual capital and operational prices, less advanced technology creating it easier to work, high potential, fast method, addressing differing kinds of waste and reducing volume by half of it. However, it produces pollutants in each solid (highly leachable ash and bottom ash). Gasification/pyrolysis has bound blessings over combustion because of less greenhouse emissions (meeting existing emissions limits), reducing waste volumes by 95%, less energy needed in flue gas cleansing and fashionable chemical action units go with enclosures, that effectively scale back the prospect of water and soil contamination. Undiversified wastes like used tyres, paper, electrical waste, power potency of plants and syngas cleansing systems, high operational and capital prices compared to incineration plants as a result of ash melting in gasifiers or treatment of water waste or solid waste in shift or quality of the plant square measure a hurdle for gasification/pyrolysis technologies to be established commercially worldwide.

Comparing to combustion and alternative thermal conversion technologies, anaerobic digestion method has very cheap capital and operational prices. The closed system makes it compact and promotes the employment of this technology at little scale in rural areas. Anaerobic digestion offers a great deal of benefits because it is renewable supply of energy manufacturing a bit of solid (which will be used as a fertilizer), reduction of odors and production of vital fuel referred to as biogas. Production of biogas from anaerobic digestion is quicker because it is reportable that it will turn out 2-4 times a lot of in three weeks than of lowland gas technique in 6-7 years. Waste treatment is slower compared to thermal conversion (typically 20-40 of microorganism reactions), The plant has higher area necessities and at last, it's sensitive to method parameters like increase in ammonia and salt concentrations will stop the methanogenesis method because of presence of Nitrogen made compounds and cations. Landfill is generally favorable in some developing countries as a result of it's an applicable method. Biogas made will have style of applications, versatile labor isn't needed, returning of natural resources to s and conversion of barren lands into helpful areas. However, i terribly slow method, requiring high prices for transporting wa and employing a giant expense, it adversely impacts surroundin because it risks the contamination of well water or water strea nearby leachate, highest greenhouse emissions and attainab fires/explosion because of production of paraffin. Earlier, method of anaerobic digestion was used for the treatment various varieties of organic waste solely; however, it provid biogas that is economically and environmentally possible creati it a viable possibility for energy

IV. CONCLUSION

Waste to Energy technology is considered a renewable sour of energy which not only decreases the dependence on fossil fu and reduces greenhouse emissions but it also reduces the problen associated with uncontrolled landfill technique. An attempt made to compare the current Waste to Energy technologies a after reviewing them the technologies can be used effective depending upon the waste stream. For high organic waste (li food waste, animal manure) anaerobic is a suitable solutio incineration for mixed waste, gasification and pyrolysis f homogenous waste (like tyres, wood or biomass waste) and la filling for inert wastes. Lastly, Government policies a regulations, financial support and R&D programs across the gl can lead to develop and improve technologies like pyroly gasification process in the future and pose a strong competitor conventional incineration and land filling techniques.

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This book constitutes the refereed proceedings of the First International Conference on Sustainable Energy Education, ICSEE 2021, held in Department of Education, University of Kerala, on 10-12, January, 2022 in the online mode. The conference discussed "WHAT" of energy education - should be. It then asks the contributors to bring forth their best ideas regarding "HOW" to implement the education process, and finally "WHY" we should be educating about energy. We hope that the interesting scholarly work and case studies that the contributors have brought us, will trigger an on-going dialog about how to frame energy education in the much bigger picture of energy cycles and their fundamental importance to powering our life, and its increasingly energy - hungry industrialized, urbanized and digitized infrastructure. The book serves as a reference resource on sustainable energy education for researchers and practitioners in academia and industry.

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