ISSN: 0974-5823 Vol. 7 No. 1 January, 2022

International Journal of Mechanical Engineering

Development of self- regulating Medical waste to electricity generation system using online access control system

Kaushalkumar K Barot

Parul University

Dr.SSPM Sharma

Parul University

Abstract - Effective system of Medical waste management is needed and can be handle with care for the Waste to electricity generation. In medical waste medical plastic waste is produce in bulk of qty in hospital. Different methods can be used for WTE (Waste to Energy) generation like incineration, gasification, Pyrolysis, Anaerobic digestion etc. The internet of things (IoT) counted as a physical object networking with the use of embedded software and electronic sensors that permits the devices to receive and send information from each other.

The internet of things carries out collection of data, sensing, storing data and processing by linking physical devices to internet. Waste to Energy conversion is an automated system delineated to improve the effectiveness and exactness of an action by automatically controlling the waste conversion process.

The system moreover encompasses with client server technique where a user can immediately do his reciprocal actions with the web-based requisitions to handle the WTE system of any location from distinct locality.

Index Terms – Medical Waste, Waste to Energy, Internet of Things

I. Introduction

With the rapid diminution of Natural resources and developing a realization related to impacts on environment [1].The major thrust in the present circumstances is to develop renewable energy sources. The waste generated by world expected to grow much higher due to rapid urbanization, Industrialization and population growth, which is presently 1.3 billion tonnes of Waste annually & by 2025 world could generate 2.2 billion tonnes of waste per year. Moreover, it projected to reach 9.5 billion by 2050. (FAO, 2009)[2,3].

Waste starts out as a complex mixture of food waste, glass, metals, yard trimmings, woody waste materials, non-recyclable paper and plastic, construction and demolition waste, rags, and sludge from wastewater treatment.[4]

Plastic products such as surgical wraps, drapes, gowns and blister packs are widely used .India generated 56,898 tonnes of Covid-19 bio-medical waste from June 20 to June 21.Biomedical waste (BMW) is a substantial pollutant generated in the healthcare sector. Waste management is a huge problem not only in urban cities of India but in most of the nations in the globe. There is a requirement to evolve an effective system that will resolve this issue or decrease it to some level [6,7].

Waste to energy conversion system comprises of Storage Pit, Crane, furnace or Combustion chamber, heat recovery system (Steam), ash-handling system and Air pollution control system [5].

The internet of things described as a physical object networking with the use of embedded software and electronic sensors that permits the devices to receive and send information from each other. The internet of things carries out collection of data, sensing, storing data and processing by linking physical devices to internet [12].

Waste to Energy conversion is an automated system delineated to improve the effectiveness and exactness of an action by automatically controlling the waste conversion process. The system moreover encompasses with client server technique.

I.1 What is Hospital Waste?

Waste containing infectious or potentially infectious materials.

Biomedical waste is generated from biological and medical sources and activities, such as the diagnosis, prevention, or treatment of diseases.

1.2. Types

1.Infectious: Discarded blood, sharps, unwanted microbiological cultures and stocks

2.Hazardous: Expired or Discarded Medicines: Pharmaceutical waste like antibiotics, cytotoxic drugs including all items contaminated with cytotoxic drugs along with glass or plastic ampoules, vials etc

3. Radioactive: Nuclear medicine as a hyperthyroidism, thyroid cancer

4. General: syringes and needles, used swabs, plasters and bandages.

Plastic products such as surgical wraps, drapes, gowns and blister packs are widely used [1].

FIGURE 1 USE OF PLASTIC PRODUCTS IN HOSPITALS

1.3 Biomedical Waste- Management

Color-coded bins for proper disposal of Bio medical waste recommended by The Central Pollution Control Board.

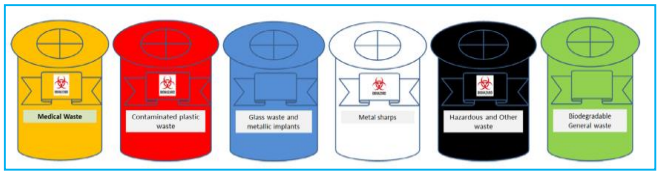


FIGURE 2 BIOMEDICAL WASTE MANAGEMENT IN CLINIC

1.4. Segregation

Basic separation of different categories of waste generated at source and thereby reducing the risks as well as cost of handling and disposal [15].

1.5. Labelling and Collection

The bins and bags should carry the biohazard symbol indicating the nature of waste to the patients and public.

Collection of biomedical waste involves use of different types of container from various sources of biomedical wastes like Operation Theatre, laboratory, wards, kitchen, corridor etc.

Once collection occurs then biomedical waste is stored in a proper place. Segregated wastes of different categories need to be collected in identifiable containers.

II. Material and Methodology

A thermochemical process where polymeric plastic waste degraded during high temperature heating without oxygen using which exhibits release of oil and gas fraction.

In all of Experiment about 1000 g added in pyrolysis reactor. Heating in the reactor heated from room temperature to targeted temperature. The feedstock stock melted and pyrolysis temperature at 500,550 and 600^{o}C[10].

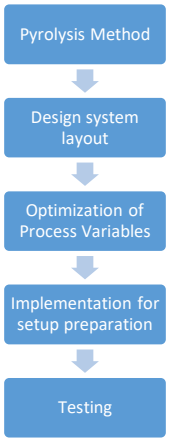


FIGURE 3 METHODOLOGY FOR WTE

III. Flow Diagram

Hospital waste collected at common location and transported in the vehicle using Van as there is infections material like contact with blood and cells so it pretreated as per guideline of CPCB.

The collected sample were crushed in 1 cm^2 is fed in the reactor.

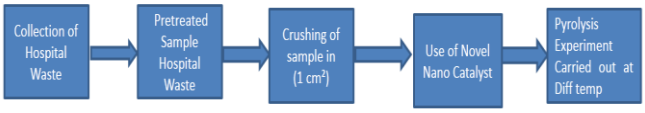
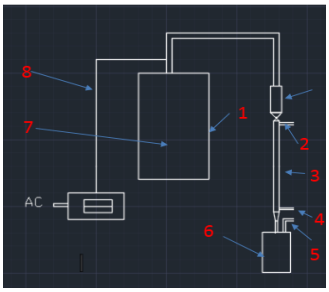


FIGURE 4 FLOWDIAGRAM WTE

IV. EXPERIMENTAL SETUP

Batch reactor made of Stainless steel and cover with Electrical heater and inner diameter 120 mm, height is 550 mm with K- Type Thermocouple, and heater for condensing output of reactor double pipe condenser is used. A schematic diagram of setup is available in figure 5.



1 = pyrolysis reactor
2 = water outlet
3 = condenser
4 = water inlet
5 = gas outlet
6 = oil tank
7 = electrical heater
8 = thermocouple wire

FIGURE 5 APPARATUS FOR EXPERIMENT

V. OVERVIEW OF DEVLOPED MODEL

We have ensured the development process of our proposed solution. In the development process, we have first developed IoT microcontroller based multiple modules for pyrolysis base smart TWE system the Arduino microcontroller has different modules include a K-type thermocouple, GPS shield, real time clock and blue tooth module along with the android application. Then we have established a dashboard in webserver to ensure real-time data monitoring over the internet. Our system could measure reactor temperature up to 1200 ^oC.

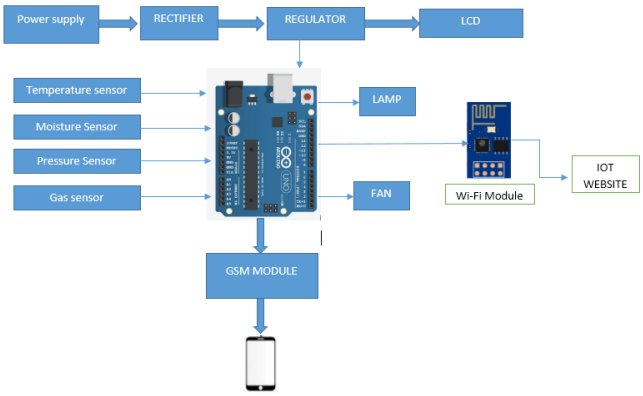


FIGURE 6 BLOCK DIAGRAM OF SYSTEM

Arduino mega is connected to which is a main controller is connected with Wi-Fi for internet connectivity, A barometer sensor for temperature and pressure, measurement based WTE system. a humidity sensor for sensing the humidity and a gas sensor which detects the smoke and harmful gases[12].

CONCLUSIONS:

Hospital plastic waste investigated using thermal pyrolysis and result shows about Iot enabled system which measure highest liquid fraction at 550 ^oC.We have design low cost ,low power Wi-Fi based Industrial Monitoring system that control and monitor WTE system using a web application.

Nowadays we need everything computerized. Earlier we can only monitor the situations with the help of cameras. In industries to reduce manual overhead we have implemented Internet of Things (IoT) in Industry to monitor as well as to inform the responsible person to take appropriate measures, but this will partially fulfill our requirement. As sometimes, it will be late in this process and it will harm to property as well as life. For this purpose we are developing a system for Industrial Automation using IoT with the help of Artificial Intelligence to make system automated that will take intelligent decisions.

REFERENCES

[1] Andrea Tabasová, Jirí Kropá, Vít Kermes, "Waste-to-energy technologies: Impact on environment," Energy 2012; 44:146-155.

[2] Victor Arruda Ferraz de Campos, Valter Bruno Silva, "A review of waste management in Brazil and Portugal: Waste-to energy as pathway for sustainable development,"2021; 178:802-820.

[3] MA Karim, John Taylor Wetterhan, "A comparative study of solid waste management in the United States Europe and Asia," 2020; 3-11.

[4] Raj Kumar, C.Ganesa Moorthy, "Energy Source: Plastic Waste into Fuel,"2019; 16:29-34.

[5] Olaide Monsor Aderoju, Aliyu B. Oke, Ganiy Ishola Agbaje, António Guerner Dias, "Plastic waste for electrical power generation: a case study in Nigeria,".2019; 538-553.

[6] Selvakumar Dharmaraj, Veeramuthu Ashokkumar, Rajesh Pandiyan, "Pyrolysis: An effective technique for degradation of COVID-19 medical Wastes Chemosphere," 275(2021).

[7] Khodadad Mostakim, Md Arman Arefin, "Harnessing energy from the waste produced in Bangladesh: evaluating potential technologies," Heliyon, October 2021.

[8] Rashid Miandad, Mohammad Rehan, Mohammad, "Catalytic Pyrolysis of Plastic Waste: in Energy research," Vol.7,Nos24 ;1-27.

[9] Ioannis Kalargaris, Guohong Tian, Sai Gu,"The utilization of oils produced from plastic waste at different pyrolysis temperatures in a DI diesel engine," 131 (2017) 179-185.

[10] Mochamad Syamsiro, Dwi Yanto Mathias, "Pyrolysis of Compact Disc (CD) Case Wastes to Produce Liquid Fuel as a Renewable Source of Electricity Generation, "Energy Procedia 2018; 145:484-489.

[11] Sathish Paulraj Gundupalli, Subrata Hait, Atul Thakur, "A review on automated sorting of source-separated municipal solid waste for recycling Waste Management," 60(2017) 56-74.

[12] Kellow Pardini, Joel J. P. C. Rodrigues, Sergei A. Kozlov, Neeraj Kumar and Vasco Furtado, "IoT-Based Solid Waste Management Solutions: A Survey,"J. Sens. Actuator Netw. 2019, 8, 5.

[13] Naman Sharma et.al, ''IoT based garbage monitoring system,''International Journal of Advance Research, Ideas and Innovations in Technology, Page 1850-1853.

[14] M. Vikram Reddy,''Municipal solid waste – waste to energy conversion in India: an overview," Int. J. Environmental Technology and Management, Vol. 17, Nos. 2/3/4, 2014.

[15] Urso Campos, Hamed Zamenian, Dan D. Koo, David W. Goodman "Waste-to-Energy (WTE) Technology Applications for Municipal Solid Waste (MSW) Treatment in the Urban Environment,", Volume 5, Issue 2, February 2015), IJETAE.

AUTHOR INFORMATION

Barot Kaushal, Asst.Professor, Department of Mechatronics Engineering, Parul University, Vadodara has more than 15 years of Experience in teaching and 5 years of Industrial Experience. He has also guided three M.Tech students.

Dr.SSPM Sharma, Asst.Professor, Department of Mechatronics Engineering, Parul University, Vadodara has more than 10 years of Experience in teaching and 3 years of research Experience.in IoT and Automation.