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A Study on Municipal Solid Waste Management

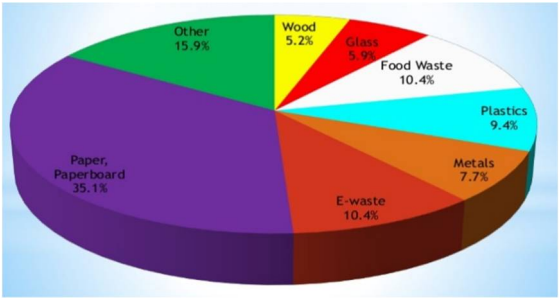
Prof. Snehal Mohite [1], Vishwajit Somwanshi [2], Gaurav Shinde [3], Shubham Kharate [4]
[1] *Assistant Professor,* [2, 3, 4] *Student, Department of Civil Engineering, JSPM's Imperial College of Engineering and research, Wagholi, Pune.*

Abstract: ***In India, the worst problem is population. In day-by-day it is increasing along with that construction sites or buildings also increase. This is affected to the free space. For doing the construction people cuts the trees and finishes the forest. People also occupy the place which is reserve for the waste management. So that we are doing the project on Solid waste management. There are various methods to manage the waste. In our project we use the technique called Pyrolysis. In pyrolysis process consist of both simultaneous and successive reactions when carbon rich organic material is heated in a non-reactive atmosphere. Pyrolysis is the thermal degradation of organic materials in the absence of oxygen.***
The main products obtained from pyrolysis of municipal wastes are a high calorific value gas (synthesis gas or syngas), a biofuel (bio-oil or pyrolysis oil) and a solid residue (char). Pyrolysis can be performed at relatively small-scale which may help in reducing transport costs and handling costs.
Keywords: Municipal Solid Waste, Recycling, Composting, Pyrolysis, Biomass.

I. INTRODUCTION

India is the second fastest growing economy and the second most populated country in the world. Here, about 852 million people live in rural areas and 325 million live in urban areas. The level of urbanization of the country has increased from 26.5% to 38% in the least 50-60 years and is expected to rise to 44% by the year 2026. Recently, single-use plastics have become a global threat which is considered harmful and non-biodegradable. In cities, the generation of excess plastic waste could lead to drainage choking during the monsoon that results in urban flooding, subsequently the micro-plastic intermixes with water polluting the rivers and oceans. Current studies have demonstrated that the presence of micro-plastic causes disturbances in the aqua life (primarily the food chain) and ultimately leading to global warming. Consequently, reported as the primary reason for the extinction of various indigenous species on the planet Earth. As per the report published in UNPD, the world produces around 300 million tonnes of plastic waste, only 9% of the generated plastic waste is recycled, ~14% collected for recycling while the rest reaches the ocean annually.

Municipal solid waste collected mainly from households consists of plastics, paper, metals, textiles, organic waste, leather, rubber, metals, glass, ceramics, soil materials and miscellaneous other materials. Typical household waste contains a wide range of materials that vary significantly in composition depending on the type of community and its consumer's incomes and lifestyles, and its degree of industrialisation, institutionalism and commercialism.



In general, the highest waste generation is correlated with the highest income. Moreover, even the season of year or the number of persons living in a household influence the amount and composition of waste. For example, more food waste and less paper are generated during summer. Additionally, the larger the community, the more garbage is produced per capita.

Pyrolysis is the heating of both organic and non-organic materials using very high temperature, in the absence of oxygen. Pyrolysis of organic materials produces three products: one liquid (bio-oil), one solid (bio-char) and one gaseous (syngas) while pyrolysis of non-organic materials also produces solid, liquid, and gaseous fuels. This means that the solid wastes of the city would not be dumped in dumpsites located in other local government units. It will be processed within the city in its pyrolysis facility. The products of the facility can be stored and used as recycled energy source

II. LITERATURE REVIEW

In [1] Akhilesh Kumar, Avlokita Agarwal (2020) "Recent Trends in Solid Waste Management Status, Challenges and Potential for the further Indian Cities". In this paper they study on the comprehensive review summarising the present SWM status identifying the associated challenges and deriving potential solutions for the MSWM in the Indian context. The unsorted solid waste at source, social taboo, citizen's attitude, poor assessment, inadequate potential strategies unorganised informal sector of waste, unplanned fiscal, and poor implementation government policies. The discussion in this review article concludes, there is an urgent need for adequate treatment and recycling strategies required to be adopted as per the Indian solid waste composition

In [2] Vandana Bharti, Jaspal Singh, A. P. Singh (2017) "A Review on Solid Waste Management methods and practices in India". In this paper the main focus is on municipal solid waste. Various methods have been described to manage the solid waste from organic compost making to energy generation. This paper deals with the solid waste management methods and practices in India. The solid waste management consists of various types of wastes like industrial, agricultural, transport, municipal etc.

In [3] Arti Pamnani, Meka Srinivasarao (2014) "Municipal Solid Waste Management In India: A Review And Some New Results". In this paper gives current scenario of India with respect to municipal solid waste quantity, quality and its management. We have presented a brief overview of MSWM in Major cities medium scale towns and small-scale towns. We have also presented some interesting results on MSWM of small-scale towns and their surrounding villages.

In [4] Abhishek Nandan, Bikarama Prasad Yadav, Soumyadeep Baksi, Debajyoti Bose (2017) "Recent Scenario of Solid Waste Management in India". In This paper they studied on Public involvement in management of solid waste is of significant importance. Authorities must protect fundamental right of citizens by implementing best practices and citizens must perform fundamental duties by their contribution to those practices

In [5] Sunil Kumar, Stephen R. Smith, Geoff Fowler, Costas Velis, S. Jyoti Kumar, Shashi Arya, Rena, Rakesh Kumar and Christopher Cheeseman (2017). "Challenges and opportunities associated with waste management in India". In this paper they studied on Public involvement in management of solid waste is of significant importance. Authorities must protect fundamental right of citizens by implementing best practices and citizens must perform fundamental duties by their contribution to those practices.

In [6] P Vijay, Saraswati Rao M, Sivasubraminiyan G (2019). "Solid Waste Research in India during 2008-2017: A Bibliometric Analysis". This paper presents a bibliometric overview of Indian researchers' publications published on "Solid Waste" in the Web of Science database from 2008 to 2017. Several aspects have been analysed in the study; such as the growth and distribution of solid waste research in India, the most productive organization/institution in India, authorship pattern.

III. METHODOLOGY

Pyrolysis process consists of both simultaneous and successive reactions when carbon-rich organic material is heated in a non-reactive atmosphere. Simply speaking, pyrolysis is the thermal degradation of organic materials in the absence of oxygen. Thermal decomposition of organic components in the waste stream starts at 350°C–550°C and goes up to 700°C–800°C in the absence of air/oxygen.

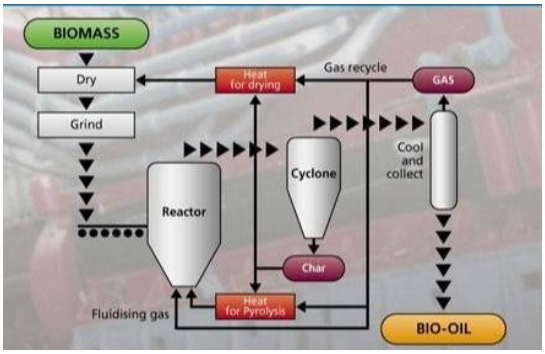


Fig. Pyrolysis

Pyrolysis of municipal wastes begins with mechanical preparation and separation of glass, metals and inert materials prior to processing the remaining waste in a pyrolysis reactor. The commonly used pyrolysis reactors are rotary kilns, rotary hearth furnaces, and fluidized bed furnaces. The process requires an external heat source to maintain the high temperature required.

Pyrolysis can be performed at relatively small-scale which may help in reducing transport and handling costs. In pyrolysis of MSW, heat transfer is a critical area as the process is endothermic and sufficient heat transfer surface has to be provided to meet process heat requirements.

The main products obtained from pyrolysis of municipal wastes are a high calorific value gas (synthesis gas or syngas), a biofuel (bio-oil or pyrolysis oil) and a solid residue (char). Depending on the final temperature, MSW pyrolysis will yield mainly solid residues at low temperatures, less than 450^0C, when the heating rate is quite slow, and mainly gases at high temperatures, greater than 800^0C, with rapid heating rates. At an intermediate temperature and under relatively high heating rates, the main product is a liquid fuel popularly known as bio-oil.

A. Wide Range of Products

Bio oil is a dark brown liquid and can be upgraded to either engine fuel or through gasification processes to a syngas and then biodiesel. Pyrolysis oil may also be used as liquid fuel for diesel engines and gas turbines to generate electricity. Bio oil is particularly attractive for co-firing because it can be relatively easy to handle and burn than solid fuel and is cheaper to transport and store. In addition, bio-oil is also a vital source for a wide range of organic compounds and specialty chemicals.

Syngas is a mixture of energy-rich gases (combustible constituents include carbon monoxide, hydrogen, methane and a broad range of other VOCs). The net calorific value (NCV) of syngas is between 10 and 20MJ/Nm^3. Syngas is cleaned to remove particulates, hydrocarbons, and soluble matter, and then combusted to generate electricity. Diesel engines, gas turbines, steam turbines and boilers can be used directly to generate electricity and heat in CHP systems using syngas and pyrolysis oil. Syngas may also be used as a basic chemical in petrochemical and refining industries.

The solid residue from MSW pyrolysis, called char, is a combination of non-combustible materials and carbon. Char is almost pure carbon and can be used in the manufacture of activated carbon filtration media (for water treatment applications) or as an agricultural soil amendment.

IV. RESULT

Public Private Partnership (PPP) is good, but needs enough safeguard measures for sustainable and stable operation. There should be proper clause and provision for fine and also against breach of contract. The contract with NGOs and private players should be clear. Corporations or local pantemunicis are spending huge amount on keeping the city clean. There is huge cost attached with the collection and conversion of waste. The whole process is cumbersome and needs effective handling at each and every step. It is unfortunate to see litter all around in a promising city such as Pune. Everyone likes cleanliness. Commitment from citizen, Government and the corporation is essential to keep city garbage free.

V. CONCLUSION

The rapid increase in the quantities of MSW and the inability to provide day-to-day solid waste collection services may cause an irritation and health hazard. Segregation of waste is essential component of solid waste management which is comparatively very poor. The decentralized biogas plants based on solid waste will be the ideal solution.

The ethos and working culture of the MSWM staff at all levels is conducive to up-gradation of the existing treatment and disposal options. The 2043 horizon will require management of about 6000 TPD waste with state-of-the-art reduction technologies for resource & energy recovery. Higher degree of mechanization and enhanced monitoring techniques will need to be employed. Emphasis will also shift to full consumption of treated waste products within the city limits. Emphasis will also be on reduction of residues to go into landfill.

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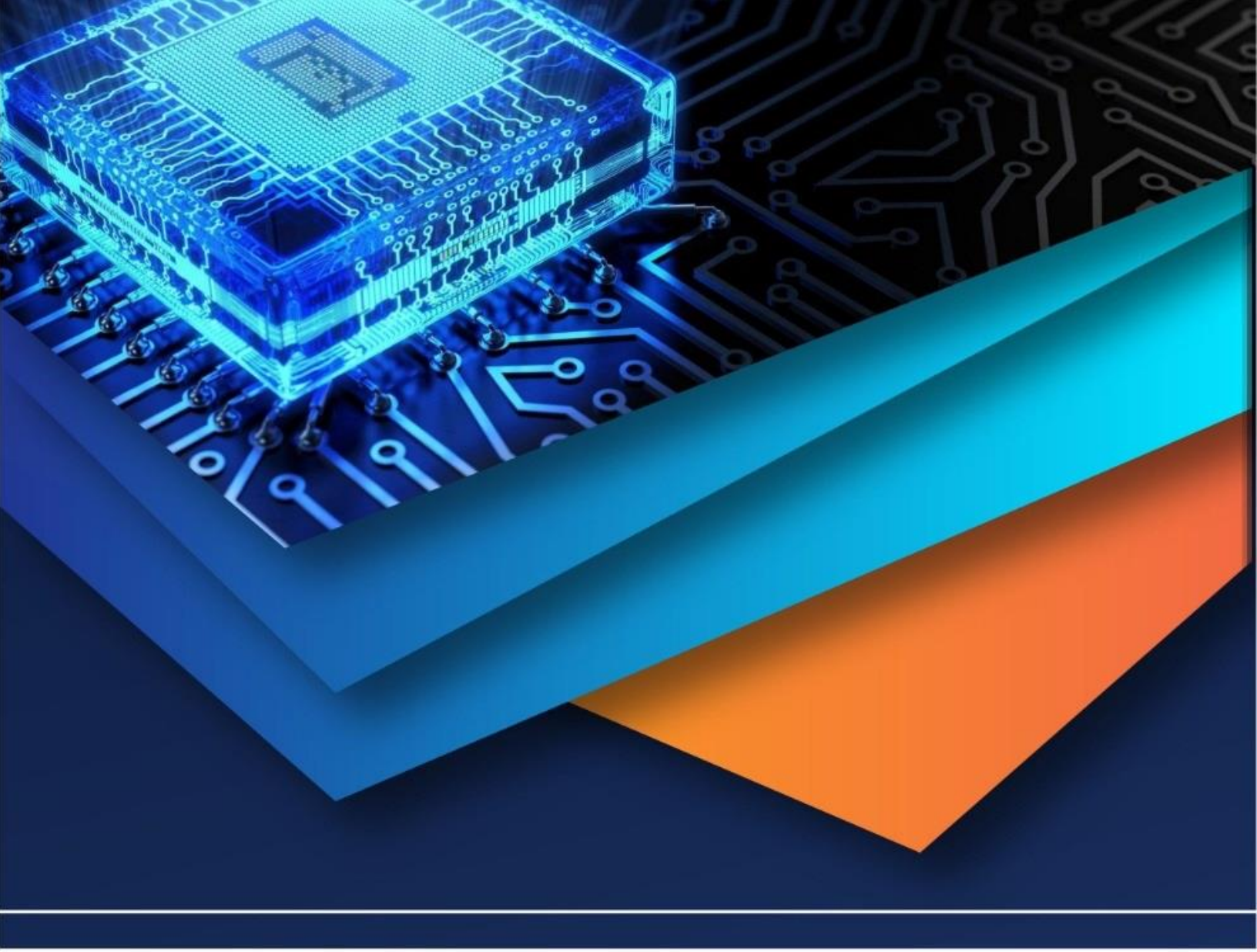

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