International Journal of Advance Research in Science and Engineering
Volume No.07, Special Issue No.03, April 2018
www.ijarse.com
IJARSE
ISSN: 2319-8354

# SMART SOLID WASTE MANAGEMENT

**Rahul Hodage[1], Akshay Balwadkar[2], Ishwar Teli[3]**

*[1]Asst Professor Civil, GSMCOE Balewadi, Savitribai Phule Pune University, (India)*

*[2,3]UG Student Civil, GSMCOE Balewadi, Savitribai Phule Pune University, (India)*

**ABSTRACT**

*The Main aim of this paper is to study the current practices related to the various waste management initiatives taken in India for human wellbeing. The other purpose is to provide some suggestions and recommendations to improve the waste management practices in city. Population growth and rapid urbanization means bigger and denser cities and increased municipal solid waste generation. The segregation, handling, transport and disposal of waste are to be properly managed so as to minimize the risk to the health and safety of patients, the public and the environment .The economic value of waste is best realized when it is segregated . This project proposes to segregate the dry waste and wet waste at the household level. Similar to many imminent cities in India, Pune is also facing a major problem in management of MSW & its disposal. From various studies it is found that 90% of MSW is disposed off without treatment on land, out of this 60% waste is wet waste. The main focus of this study is to separate out wet waste from dry waste & to find the sustainable solution for the same by converting it into useful form of energy.*

***Keywords*: Municipal solid waste, CNG, Android App, dry and wet waste separation, Collection of waste**

## I.INTRODUCTION

### 1.1 GENERAL

Municipal Solid Waste contains unwanted and discarded materials, useless things, rubbish, garbage etc accumulated by various activities like household work, street sweeping, commercial operations, industrial processing and manufacturing etc. Haphazard growth in population, uncontrollable migrations from rural to urban regions, change in lifestyle, high living standards leads to more and more generation of solid waste.

Solid waste generation and management is became an issue of big concern in urban lifestyle. Developing countries like India are facing lots of problems regarding it due to many factors like social, educational and economical etc.

There are many traditional methods to manage as well as disposing the waste. Generally the Muincipal Solid Waste is collected from various sources like residential, commercial, Industrial, Hospitals etc. The most easy and economical method of disposing the garbage is ‘Landfill’; But this strategy does not only use valuable land,but also creates risk of dissemination of toxic substances in the environment. On the other hand, Waste recycling gives some temporary relaxation to the load coming on the SWM.

The most common problems related to SWM are Improper management which includes mixed waste i.e. dry waste and wet waste is not segregated; then it is not properly collected, It is not treated and finally it is directly dumped on the dump yards. This cycle is been repeating from many days ago till now and it's still going on now.

As mentioned earlier, the Municipal Solid Waste goes to landfill but one must notice that the cost of land is too high in urban areas. Also the landfill creates lots of problems for residing people like odour, nuaissance, mosquito breeding, animals like pig, dog etc. It creates unhealthy conditions and there are some cases of contaminatnation of ground water table due to lechate.

### 1.2 PROBLEM STATEMENT

There are many methods available for treating the solid waste and Pune Municipal Corporation has implemented huge treatment plants spending huge amount of money. But it seems to be inefficient because people are not aware of the importance of separating the dry and wet waste which creates lots of environmental problems. Solid Waste Management contains 60% wet & biodegradable waste. This can be decompose very easily by reduction of waste by using anaerobic digestor & providing purely segregated wet waste by using android software app by creating the awareness of importance of separation of dry and wet waste between the citizens to reduce the load on landfill & there by giving a sustainable solution with reduction in cost and effective solid management.

### 1.3 OBJECTIVES

1) To collect the segregated waste by using soft computing tools for a particular area
2) Creating awareness among the citizens about segregation of wet waste and dry waste
3) Wet waste collected in a particular area is treated in nearby place by converting it into compressed natural gas and organic manure as a by-product
4) To reduce the load on landfill & there by giving a sustainable solution

## II.LITERATURE REVIEW

### A. Background History

Pune city has population of 31,24,458 there are 8,00,000 houses and the basic calculations of waste is 350-450 gms per head per day. Total waste generation in Pune is approximately 1500-1700 TPD. Pune has total 15 wards PMC is responsible for collection, storage, seggregation, transportation and disposal of all solid waste generated in the city. There are SWM RULES 2000 set up by PMC; In that there is a record of construction of buildings before and after year 2010.This is to set up a compulsion for seggregation. PMC claims to be top in SWM. Currently the waste is collected by the Swatch from whole city.This collected waste is directly dumped at "Kachra Depot,Uruli Devachi" which is 20km away from the city. As the depot crossed the dumping limits of MPCB, PMC has to seriously work for the alternative.

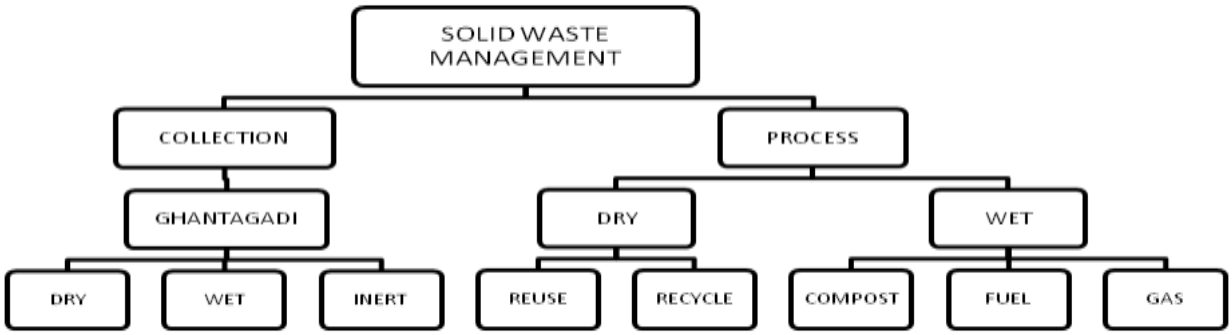


Fig.1 Flow Chart of Solid Waste Management by PMC

**Prof.V.D.Jaysingpure (2016)** Pune Municipal Corporation(PMC) disposes municipal solid waste at Urali Devachi Depot which is 20 km away from Pune city.Due to unscientific disposal of MSW huge heaps are produced at the disposal site.Solid waste is heterogeneous in nature such as mixture of vegetables,food items,paper,plastics,glass etc.If solid waste is disposed of on land in open areas,then it causes a negative impact on the environment, ground water and on health.The anaerobic decomposition brings about degradation of most of the solid waste. This result in the emission of carbon dioxide(CO2),methane(CH4) and other trace gases which constitute about 60% in a solid waste. Open dumping is the problem of water pollution.Due to continuous pressure of this disposal it results into squeezing of contaminated liquid called lechate.

**Rajendra Jagtap and Prof. Dr.Mahesh V Shitole 2015** Due to low priorities given by the politicians to passed a required amount of budget,PMC's waste management initiatives pedestal on the following four premises were endured much.1)Integrating informal sector for MSWM 2)Refuse into resource through decentralized WSM 3)Waste to energy 4)Data collection for Management Information System(MIS) using Mobile SMS. An open dumping is a land disposal site at which solid wastes are disposed of in a manner that does not protect the environment, are susceptible to open burning and are exposed to the elements, vectors and scavengers .open dumping can include solid waste disposal facilities or practices that pose a reasonable probability of adverse effects on health or the environment.

## B. Other Relevant Literature

**A M.K. Pushpa [1]** describes paper about microcontroller based automatic waste segregator. The proposed system uses an inductive proximity sensor to detect metal waste and blower mechanism to segregate between wet and dry wastes. A simple 8051 microcontroller forms the heart of the system. It controls the working and timing of the entire subsections.

**Subhasini Dwivedi [2]** proposes a solid waste treatment plant for separating plastic, glass bottles and metal cans from solid waste material. The system uses different capacitive, proximity sensors to detect each object which is moving on a conveyer belt and segregate into different bins with the help of hydraulic cylinder flaps. The entire system is controlled by a programmable logic controller.

**S.M.Dudhal [3]** describes paper deals with waste segregation using programmable logic controller.The system is developed for separating out metal from waste materials. The system consists of an automatic feed system trough which waste fed into a conveyor belt, sensors and a robotic arm to which an electromagnet is attached will extract the metal from the waste and will deposit it into a bin.

## III.METHODOLOGY

The purpose of this paper is to segregate the waste at house hold level as well as commercial complex in the area for this classification of waste material is necessary which is given below.

**Classification of waste**

There may be different types of waste such as Domestic waste, Factory waste, Waste from oil factory, E-waste, Construction waste,

Agricultural waste, Food processing waste, Bio-medical waste, Slaughter house waste etc. We can classify waste as follows:

• Solid waste- vegetable waste, kitchen waste, household waste etc.

• E-waste- discarded electronic devices such as computer, TV, music systems etc.

• Liquid waste- water used for different industries, tanneries, distilleries, thermal power plants

• Plastic waste- plastic bags, bottles, bucket, etc.

• Metal waste- unused metal sheet, metal scraps etc.

Further we can group all these types of waste into wet waste (Biodegradable) and dry waste (Non Biodegradable).

**Wet waste (Biodegradable) includes the following:**

• Kitchen waste including food waste of all kinds, cooked and
uncooked, including eggshells and bones

• Flower and fruit waste including juice peels and house-plant waste

• Garden sweeping or yard waste consisting of green/dry leaves

• Sanitary wastes

• Green waste from vegetable & fruit vendors/shops

• Waste from food & tea stalls/shops etc.

**Dry waste (Non-biodegradable) includes the following:**

• Paper and plastic, all kinds

• Cardboard and cartons

• Containers of all kinds excluding those containing hazardous material

• Packaging of all kinds

• Glass of all kinds
• Metals of all kinds
• Rags, rubber
• House sweeping (dust etc.)
• Ashes
• Foils, wrappings, pouches, sachets and tetra packs (rinsed)
• Discarded electronic items from offices, colonies viz. cassettes, computer diskettes, printer cartridges and electronic parts.
• Discarded clothing, furniture and equipment

From this classification the people are aware about the importance of segregation of waste at their level. The main aim of the paper is to reduce the waste generation and maximum waste is recycle or reuse.

**Basic principles of Solid Waste Management**

Basically remember 4R s: Refuse, Reduce, Reuse & Recycle

• Refuse: Do not buy anything which we do not really need.
• Reduce - Reduce the amount of garbage generated. Alter our lifestyle so that minimum garbage is generated.
• Reuse - Reuse everything to its maximum after properly cleaning it. Make secondary use of different articles.
• Recycle – Keep things which can be recycled to be given to rag pickers or waste pickers.Convert the recyclable garbage into manures or other useful products.

In this system the Green Android is introduced which is user friendly and gives the information about every house holder which is recorded automatically. The Green App records the data of the waste collected on daily basis in kilograms the dry waste and wet waste is collected separately at the time of collection by strict observation. Every house holder, society, shops etc is provided with QR Code for scanning every time PMC sweeper will came at individual house and scan the code the waste is weighed on machine and recorded in the their account. The dry waste is send to Kachra Depo ie for land fill where this waste is decomposed for long time. The wet waste which is biodegradable can be used for producing the CNG gas (Compressed Natural Gas) and organic manure for agriculture purpose, which highly reduces the density of waste material that is send to kachra depo. In pune very few companies have their tie ups with the private hotels from there they collecting the wet waste for the CNG production. Since they have limited scope to collect the waste, the system fail to collect the wet waste from residency or society's etc for this purpose this App helps to collect the wet waste from every house holder effectively. Through this app we can provide information to people and make aware about the use of two different buckets provided by PMC for segregation of dry and wet waste.

## IV.DESIGN AND DEVELOPMENT

Project aims to study the existing system of SWM and to improve the process part like segregation by providing effective door to door. Collection system and to improve the collection system by creating centralized APP and to also monitor the litter on the road and open space. To utilize the wet waste to generate BIO-CNG and utilize it to run LOCAL BUS TRANSPORT OF GOV. Therefore we are created the android APP To achieve 100%

segregation for the disposal of waste we have designed an Android app called My Clean City which stores the data about the waste collected from houses, shops, hotels, hospitals, schools and colleges. As a case study we will take Balewadi city waste collection details. Balewadi city consists of 8142 flats, houses and Bunglows 263 shops, 31 major hotels, 12 schools and colleges and 8 major business hubs. The waste collection details will help in the analysis of segregated data accordingly.With the help of this analysis we get an exact idea of the amount of waste to be recycled. The wet waste is recycled to produce CNG in biodiagester at cng station. After the process of recyclation 2 types of output is produced. One is the CNG gas and the remaining waste can be used as compost to use as fertilizer for farmers. The CNG gas would be used for buses and the remaining compost as fertilizers, after the sale of these the amount collected as a profit margin could be used to benefit for the people in various schemes or offers. This will motivate the people for the waste segregation and would help in keeping the society clean and green.

The procedure of how the collected waste details are stored in Mobile Application "My Clean City"App. The Features of App shown in the snap shot shown below.

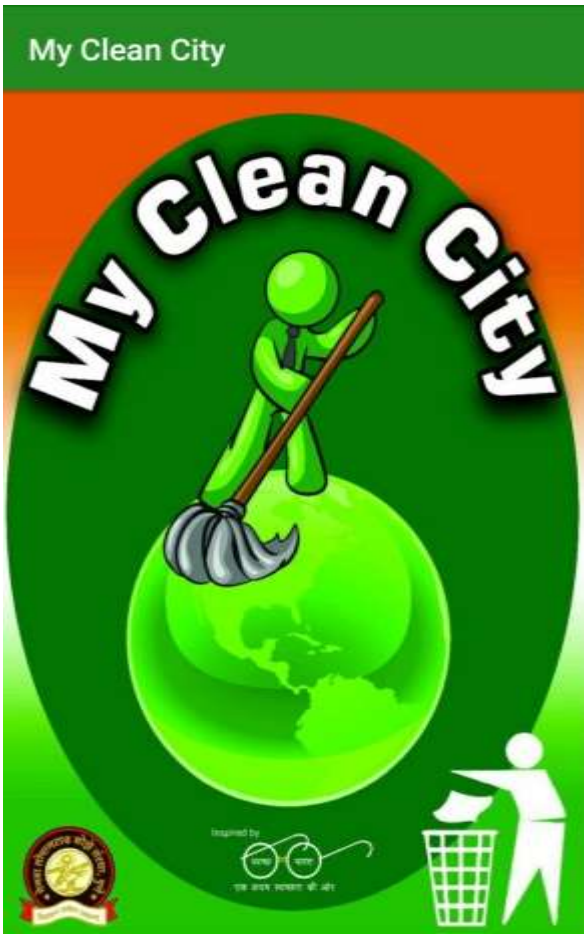


Fig 1: Front screen of Android APP


Fig 2: Second screen shows Guidelines for users


Fig 3: Third screen to operate and view the data


Fig 3: Fourth screen to Scan the QR Code

Fig 4: To add new house ant to view the data


Fig 5: To view the data by option


Fig 6: Login for the PMC worker to add the data

## V.EXPECTED RESULT & DISCUSSION

| *BIOGAS OF 50 TONS* | |
|---|---|
| *PERCENTAGE PRODUCTION RANGE (%)* | *GAS PRODUCED FOR 21 TONS OF WET WASTE* |
| *5* | *1.05 TON* |
| *10* | *2.1 TON* |
| *20* | *4.2 TON* |
| *30* | *6.3 TON* |
| *60* | *12.6 TON* |

## CNG GAS PRODUCTION

The above amount of biogas is expected depending upon the digestion by bacteria.The minimum of 5 % is expected as the output.The gas is used to run the PMPML on route of Balewadi to corporation (km)

**THE REPORT ON BALEWADI DEPOT**:

| *BALEWADI BUS DEPOT* | | |
|---|---|---|
| *AREA* | *15 ACRES* | |
| *BUSES* | *25* | |
| | *CNG* | *20* |
| | *DIESEL* | *5* |
| *CNG TANK* | *100 KG* | |
| *BALEWADI TO CORPORATION* | *8 TO 10 BUS DAILY (ALTERNATE FUELING)* | |
| *TRIPS/ FLIGHT BY EACH BUS* | *MORNING* | *4 (BACK &FORTH)* |
| | *AFTERNOON* | *2* |
| | *EVENING* | *4* |
| | *NIGHT* | *1* |
| *DISTANCE* | *11 KM* | |
| *DAILY REQUIREMENT* | *1000 KG TO 1400 KG ALL ROUTES* | |
| *FOR CORPORATION BUSES* | *500 KG TO 800 KG FOR 5 BUSES* | |
| *FILL UP POINT* | *NA.TA.WADI CNG PUMP* | |

**PMPML DEPOT (***BALEWADI)*

Hence the amount of CNG required is fulfilled by the biogas plant of 50 tons capacity.We have covered the bio CNG and its effectiveness in the above chapters.

| **SEGREGATION** | **COLLECTION** |
|---|---|
| *100 % segregation is achieved* | *100% collection of segregated waste* |
| *Proof is available* | *100% coverage of city.* |
| *Fee is paid* | *Due to collection point, no need for time table* |
| *Proper hierarchy of work* | *No wastage of fuel & time* |
| *Bit by bit city is cleared* | *Increase in trips from 5-6 to 10-12* |
| *No waste is thrown in open* | *Due to gg on rent taskforce is increased* |
| *Proper collection in plastic* | *Due to smart packing other transport vehicles also available* |
| *Informs by message* | *Proper routes are maintained* |
| *Weighs, so pattern is designed* | *Tracking of gg is possible by gps* |
| *Perfect amount of waste is calculated* | *Payment is done as per scanning codes and transfer.* |
| *Designs the process route as per capacity of plants.* | *Covering of whole city is possible with future increament.* |

## VI.CONCLUSION

Solid Waste Management Green App has been successfully implemented for the segregation of waste into inert, dry and wet waste at a house hold level. Though in this system segregation of waste is done by mandatory, the green app provides information about the waste collected from every house holder and create awareness among the people. This system proves to be best management practice of collecting the wet waste, it was observed there is increase in quantity of wet waste collection which is used for the CNG production and organic manure. Ultimately the land fill load goes on decreasing which saves the land and production of lechate effluent is highly reduced which causes contamination to the nearby ground water table. Problem of wet waste which comprises of 60% of MSW of Pune, would be solved by utilizing it as CNG for PMPML. “Wealth from Waste” will be obtained. Also the problem of segregation, collection, and litter free city will be solved with the help of software technology.

## REFERENCES

[1] Central Pollution Control Board of India (CPCB) (1998), “Status of solid waste management in metro cities”, CPCB.

[2] Gibbs and Soell (2010). “Sense and Sustainability Among Consumers and Fortune 1000 Executives, Gibbs and Soell, Inc.

[3] Municipal Solid Waste (Management and Handling) Rules 2000, Ministry of Environment and Forests, Government of India, issues on 25 September 2000

[4] Mane T.T, Hingane Hemlata. "Existing Situation of Solid Waste Management in Pune City, India" Journal of Environmental Research

[5] Mane T.T and Hingane Hemlata "Analytical Study of Solid Waste Management In Pune, India " Journal of Environmental Research and Development Vol. 9 No.04, April-June 2015

[6] M.K.Pushpa, Aayushi Gupta, Shariq Mohammed Shaikh, Stuti Jha, Suchitra V, "Microcontroller based Automatic Waste Segregator", IJIREEICE, Volume 3, Issue 5, May 2015

[7] Pavithra, "Smart Trash System: An Application using ZigBee", IJISET, Volume 1, Issue 8, October 2014

[8] Rajendra Jagtap and Prof. Dr. Mahesh V Shitole "Pune Solid Waste Management" ISSN: 2319-7943

[9] R. Jaysingpure "Solid Waste Management, A Case Study of Pune City" http://www.inderscience.com

[10] Ren C. Luo, "Sensor Technologies and Microsensor Issues for Mechatronics Systems", IEEE/ASME Transactions on Mechatronics, Volume 1, No. 1, March 1996

[11] Ruveena Singh, Dr. Balwinder Singh, "Design and Development of Smart Waste Sorting System", IJRECE, Volume 3, Issue 4, October-December 2015

[12] S.M .Dudhal, B.S. Jonwal, Prof. H.P.Chaudhari,"WASTE SEGREGATION USING PROGRAMMABLE LOGIC CONTROLLER", IJTRE, Volume 1, Issue 8, April 2014

[13] Subhasini Dwivedi, Michael Fernandes, Rohit D'souza, "A Review on PLC based Automatic Waste Segregator", IJARCET, Volume 5, Issue 2, February 2016

**WEBLINK**

**[1] http://www.inderscience.com/info/inarticle.php?artid=39466**

**[2] http://www.inderscience.com/info/inarticle.php?artid=39477**

**[3] http://www.iswa.org/media/publications/waste-management-research/**

**[4] http://www.iswa.org/media/publications/waste-management-world/**

[5] **http://www.omicsonline.com/open-access/international-journal-waste-resources.php**