International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 7 Issue 04, April-2018

Review of Alternative Methods to Reduce the Generation and Improve the Disposal of Solid Wastes in India

Aman Sharma, Vaishnavi P Singh
UG Students, Dept. of Civil Engineering,
Cambridge Institute of Technology,
(affiliated to Visvesvaraya Technological University),
Basavanapura Main Road, Krishnarajapuram, Bengaluru - 560036

Vishnu S
Assistant Professor,
Dept. of Civil Engineering,
Cambridge Institute of Technology,

Abstract **- Many cities in India face serious problems in managing solid wastes. The annual waste generation increases in proportion with the rise in population and urbanization. Places with greater rural populations produce more organic wastes such as kitchen wastes and fewer recyclable items such as paper, metals and plastics. Improper management of solid waste is a threat to inhabitants and hazardous to the environment. Various studies reveal that about 90% of the solid waste is disposed of unscientifically in open dumps and landfills, creating problems to public health and the environment. Recycling is widely assumed to be environmentally beneficial, although the collection, sorting and processing of materials into new products also entails significant environmental impacts. There are different ways to recycle solid waste without causing any threat to the environment such as incineration (which can be adopted to some extent for recycling those wastes which on burning do not produce any harmful gases; further this heat can be converted into energy for other uses), by using the wastes (such as vegetable and fruit wastes, tea powder, etc) as manure, by transformation of the waste into other similar products (for instance, clothes can be modified into smaller garments and suitcases), etc. However, the focus should primarily be on trying to reduce the generation of wastes as much as possible. To achieve this, the most important step is to create awareness among people about the types of wastes and the ill-effects of not having them disposed of efficiently. This will help separating the various types of wastes and thus the disposal of the solid wastes in open places can be brought under control. Once the generation of wastes is reduced, recycling becomes easier, and solid wastes can be safely used again and again. Today, with the declination of space to store solid wastes the only remedy is to recycle those with a faster rate. This paper reviews about the literature on the issues concerning disposal of solid wastes, its impact on the environment and also the alternatives which can be implemented so as to minimize the generation of solid wastes.**

Keywords: Solid Waste, Recycling, India, Environment, Awareness

1.0 INTRODUCTION

Disposal of solid waste is one of the biggest challenges for any country. With rapid urbanization and industrialization, the challenge only gets bigger due to greater generation of solid wastes. Therefore, the demand for healthier and proper disposal of solid waste is justifiable and situation will be more difficult for developing countries to combat with this issue. One obvious way to tackle the situation is recycling.

Recycling is a key component of modern waste reduction and is the third component of "Reduce, Reuse and Recycle" waste hierarchy. Recycling is the process of converting waste materials into reusable objects to prevent waste of potentially useful materials, reduce the consumption of fresh raw materials, energy usage, air pollution (from incineration) and water pollution (from land filling) by decreasing the need for "conventional" waste disposal and lowering greenhouse gas emissions compared to plastic production. Materials to be recycled are brought to a collection centre or picked up from the curbside, then sorted, cleaned and reprocessed into new materials destined for manufacturing. There are several other methods of solid waste reduction; some of them are – purchasing items in bulk, buying items that are packed in recycled cartons, recycling items rather than sending them to the landfill, finding a way to reuse items rather than throwing them away, reuse items for a different purpose than originally intended, picking up only what you need, using rechargeable batteries rather than using disposable ones, teaching others about the benefits of reducing solid waste, etc. Waste management is the process of treating solid wastes and offers variety of solutions for recycling items that don't belong to trash. It is how garbage can be used as a valuable resource. Waste management disposes off the products and substances that you have used in a safe and efficient manner. It is something that each and every household and business owner in the world needs. This paper reviews the latest literature on the various alternative methods to collect, dispose and recycle solid wastes without causing any threat to the environment.

2.0 RESULTS AND DISCUSSIONS

1. Nathan Curry and Pragasen Pillay (2012) in their paper titled "Biogas prediction and design of a food waste to energy system for the urban environment" has investigated the feasibility of urban anaerobic digestion through the presentation of four techniques for biogas estimation - ultimate analysis, yield from molecular formula analysis, a novel computer

(This work is licensed under a Creative Commons Attribution 4.0 International License.)

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 7 Issue 04, April-2018

simulation technique using Anaerobic Digestion Model #1 (ADM1), and a literature review of experimentally determined biogas yields. This paper argues for the use of small-scale anaerobic digestion in the urban buildings to deal with the organic waste produced on site as a way to save on transportation costs and reducing the amount of waste that is sent to and fills. Several techniques have been presented to estimate biogas production from food waste. A design technique for sizing an anaerobic digestion system has also been presented. A case study of system design has been presented for dealing with 165 tonnes of food waste in a building in downtown Montreal, Canada, including estimated energy consumption and production. This technology could be integrated into pre-standing urban buildings or designed and integrated into new buildings for a paradigm shift toward a more renewable, sustainable future.

2. Neha Gupta et al (2015) in their paper titled "The current status of municipal solid waste management in India" have presented an overview of current status of solid waste management in India which can help the competent authorities responsible for municipal solid waste management and researchers to prepare more efficient plans. Through the study of various research papers, it has been found that the changing pattern of waste composition emphasizes the importance of segregation for successful operation of waste management facilities. Municipal authorities should maintain the storage facilities in such a manner that they do not create unhygienic and unsanitary conditions. It has been recommended that a new survey should be carried out on the generation and characterization of MSW in India. Since the MSW is heterogeneous in nature, a large number of samples have to be collected and analyzed to obtain statistically reliable results.

3. Brijesh Kumar Pandey et al (2016) gave an overview of potential energy content of municipal solid waste in Bhopal city, India, so that energy can be derived from that waste as source of renewable energy. The main focus was on the analysis of generation and composition capacity of Municipal Solid Waste (MSW) to establish amount of energy that can be extracted from municipal solid waste in Bhopal. The composition of MSW at generation sources and collection points was determined on a wet weight basis and it consists mainly of a large organic fraction (40–60%), ash and fine earth (20–30%), paper (9–12%) plastic (12-15%), glass and metals (each less than 1%) (EPA, 2010; MOUD, 2005; CPCB, 2000ab). It was found that more than 92% of the MSW generated in country is directly disposed on open dumping in an unsecure and unplanned manner. In a crowded and congested place like India, special attention should be given to MSW management. Currently, there is no specific site for segregation of solid wastes in Bhopal. It is manually done by Rag pickers at the origin site of solid waste at very small level. There is no concept of transfer station in Bhopal city at present. In old practice of SWM in Bhopal, no data is properly maintained as required under the present system, so it is not possible to assess performance of the system. However, steps have been undertaken to improve the segregation and management of solid wastes. The collection efficiency was found to be about 65-70%, indicating the scope for improvement.

4. Vaibhav Srivastava et al (2014) have presented an overview of Urban Solid Waste Management in the developing world with emphasis on India. Disposal of MSW is one of the biggest challenges for Disposal of MSW is one of the biggest challenges for all countries. Rapid urbanization and industrialization is continuously going on in developing countries like India and China to attain developed status. This would result in more haphazard urban growth and solid waste generation globally. Therefore, demand for healthier and proper disposal of solid waste is justifiable and situation will be more difficult for developing countries to combat with this enormous amount of MSW in near future. Open dumping is a very common practice in developing countries posing risk to human health and environment. If MSW is managed in an appropriate manner then it not only mitigates the negative effects but it could help in meeting the demand of energy and employment. They suggest that wastes generated from one industry should be used as a by-product in other manufacturing industries.

5. Aminatha Kirama and Aloyce W. Mayo (2015) in their paper titled "Challenges and prospects of private sector participation in solid waste management in Dar es Salaam City, Tanzania" evaluated effectiveness of private sector participation in solid waste collection and transportation in Dar es Salaam City. The study covered 20 private service providers in municipalities of Kinondoni, Temeke and Ilala. Information was collected through questionnaires, interview guides, physical observation and field studies. Data were sought from 5 private companies, 15 Community Based Organizations, Dar es Salaam City Council, Waste Departments of Municipal authorities and local governments of ward and streets. It was found that private sector service providers contribute to the general cleanness of the city through collection and transportation of 9% of the generated solid wastes. They also provide employment to over 350 people. However, a number of factors undermine the performance of private service providers including inefficient system of refuse fee collection, the absence of planned wastes recycling systems, inaccessible roads, inappropriate contract durations and low awareness of the communities on issues of solid waste management. The success of the system will depend on accountability of municipal authority by raising the awareness of the communities, enforcing municipal by-laws, promote environmentally friendly waste

(This work is licensed under a Creative Commons Attribution 4.0 International License.)

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 7 Issue 04, April-2018

management practices and plan and provide wastes transfer stations and collection routes.

6. Marina Ili and Magdalena Nikoli (2015) through a case study evaluated recent trends of MWM via several indicators to evidence differences between municipalities in Serbia.
   Fifteen Serbian municipalities were selected in order to assess a variety of different waste management practices and verify the usability of the benchmarking method. This research suggests that municipalities should turn their attention and put their efforts into the key issues particularly the provision of reliable data on waste volume in line with the National Waste Management Strategy and the Law on Waste Management. It is difficult to make performance comparison among municipalities when it is obvious that current situation in municipalities is characterized by rather unreliable and incomplete data on municipal waste generation, support to the benchmark based research on costs and cost structures, i.e. the economic side of waste collection and management, preparation of the technical documentation for Regional Waste Management Centres and construction of Regional Waste Management Centres with regional landfills as well, organization of financially sustainable waste management scheme through the principle of full costs recovery for the services of collection, treatment and disposal of waste, as well as the introduction of stimulation instruments for re-use and recycling of waste.

7. Md. Mohib-Ul-Haque Khan et al (2015) in their work "Development of a decision model for the techno-economic assessment of municipal solid waste utilization pathways" have developed a framework and conducted a site selection by spatial analysis of waste availability and considering environmental parameters. In addition, a decision-making model based on economic, environmental, and other parameters to select optimal waste disposal has been developed and the transportation cost using a real road networks incorporating GIS and other attributes (road speed limits, direction of traffic, etc.) has been calculated. In the economical comparison of the nine waste management scenarios it was found that waste conversion scenarios become more economical with an increase in the capacity; land filling becomes expensive as the capacity increases due to the higher post-closure and operating costs; and land filling and integrated waste conversion scenarios are more sensitive to capital investment than the standalone scenarios.

8. Khaiwal Ravindra et al (2014) have investigated the existing waste management practices in Chandigarh including waste generation, collection, transportation, treatment and disposal to recognize factors that are responsible for inefficient management. The paper also reports the carbon credit potential of the MSW generated in the city. Further, in response to the existing situation, a model or waste management cycle has been proposed that would help in improving the existing management practices. The study has confirmed that waste fraction of the city is dominated by the organics and no attention is given to this major fraction due to lack of weak frameworks. System analysis of waste indicators shows that various indicators (RDF production, common collection points), may be effective for general waste management, but the most effective indicators (organic fraction of waste, livelihood and health concerns of waste handlers) are not systematically included in the policies framed in the city.

9. Surindra Suthar and Pavitra Singh (2014) through a case study analyzed household solid waste generation and composition in different family size and socio-economic groups. This work studies about the solid waste generated from households of the Dehradun city of Uttarakhand, India. Results clearly suggest that the biodegradable stuff was the major component in Household Waste (HW); mainly comprised of vegetable/food waste and paper waste. The fraction of reusable/recyclable items in HW was comparatively lower than MSW composition of other metro/small cities of India. It could be attributed due to in-house screening of recyclable/reusable waste articles from HWs.
10. Sie Ting Tan et al (2015) in their paper titled "Energy, economic and environmental (3E) analysis of Waste-To-Energy (WTE) strategies for municipal solid waste (MSW) management in Malaysia" have aimed to evaluate the 3E impact change from the baseline study in Malaysia represented by existing landfills that would result from the implementation of advanced WTE technologies, including Land Fill Gas Recovery System (LFGRS), incineration, Anaerobic Digestion (AD), and gasification. The four waste treatment alternatives are selected because they are considered by the Malaysia Government to be the best available technologies for WTE. In this study, the energy potential of MSW is in the form of electricity and heat. The economic assessment considers both the cost (capital cost, operation cost, and transportation cost), and profit (selling of energy, carbon credit through carbon avoidance, and additional profit from selling the by-products). It was found that incinerator could provide the best results for solid waste management in terms of economic and environmental impact (GHG mitigation) considering both electricity and heat production; however, if heat production was not preferred, AD becomes the most sustainable option for Malaysian scenario.

11. Vijay Kumar Garlapati (2015) in his paper titled "E-waste in India and developed countries: Management, recycling, business and biotechnological initiatives" has given an overview about global e-waste stats, health concerns of e-waste components along with the waste management, recycling, legislative polices and

(This work is licensed under a Creative Commons Attribution 4.0 International License.)

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 7 Issue 04, April-2018

recommendations related to e-waste. Innovative technologies in electronic equipment development results in a rapid obsolescence which results in massive generation of e-waste. To develop an economical and environmentally friendly recycling system for e-waste, classification and quantification of valuable and hazardous components is a pre-requisite. Several tools including e-waste management and recycling tools such as Extended Producer Responsibility (EPR) and Producer Responsibility Organization (PRO) approaches, legislative polices coupled with recommendations for e-waste management could ultimately ameliorate most e-waste problems.

12. Dorina Grazhdani (2015) has given an overview about the factors that affect recycling rates in Prespa Park villages by utilizing a set of panel observations of recycling and waste management policies, along with income and demographic variables. The research problem addressed in his paper is to explore empirical data in Prespa Park at the village level and examine whether waste generation volume can be decoupled from population growth. His paper also examines the effect of policy, socioeconomic and housing structure variables on the rate of solid waste generation and recycling in Prespa Park, which may promote waste reduction. The study has used two empirical analyses. The first empirical analysis connects waste statistics with factors affecting the solid waste generation and recycling in Prespa Park at the village level to examine whether waste volume can be decoupled from urban population growth. The second empirical analysis identifies the factors that have the potential to promote waste reduction and that waste management planners should focus on.

13. Alperen Tozlu et al (2015) in their paper titled "Waste to energy technologies for municipal solid waste management in Gaziantep" gave an overview on recent technologies and methods applied to MSW management in the world. Current research studies accessed on the literature on MSW are outlined. Moreover, recent MSW management in Gaziantep metropolitan city is displayed with the existing method which produces Landfill Gas (LFG) for power production. The systematic MSW disposal has been improved in Gaziantep city during the past years.

    Alternatively to sanitary landfill, it is suggested that an incineration plant be installed due to rapidly increasing volume of MSW with respect to population growth and awareness of public be raised about MSW segregation due to being very costly process.

14. Rohit Kumar Singh and Biswajit Ruj (2016) in their paper titled "Time and temperature depended fuel gas generation from pyrolysis of real world municipal plastic waste" have studied about the pyrolysis process in which thermo-chemical degradation reaction is operated at high temperature ranging from 400–900 degree Celsius in an inert atmosphere. On heating above degradation temperature, the high-molecular chains are lysed to stabile low-molecular products and solid residue. Products like gas, oil/wax, and char were obtained as a result of the process whose composition and yield depends on plastic type, reactor type, and process condition particularly reaction temperature and heating rate. It was concluded that the residence time of volatiles plays a vital role in formation of lighter hydrocarbons whereas the increase in operating temperature enhances the production of hydrogen gas. In a large scale setup plant the amount of gas generated was enormous having high heating value and have a great potential in terms of energy and product recovery as the gases obtained can be utilized for electricity generation by utilizing in steam turbines or can be used in the process itself to cut down the energy inputs for the process and providing a sustainable process with permissible or no pollution.

15. Surajit Bag et al (2015) in their study have assessed the current status of solid waste management practices in India. Understanding the benefits of integrated waste management which facilitates efficient utilization of different components of waste management and selection of suitable developers or agencies for collection, transportation, processing & disposal of waste is imperative. Selection of appropriate site and all necessary clearances (such as EIA, Consent to Establish etc) should be ensured. Evaluation of different W to E technologies based on the patterns of energy consumption, production, and different levels of material recovery and on the cost benefit analysis is necessary to arrive at a suitable technology that will be economically viable and energetically efficient.

16. Biplob Nandy et al (2015) in their paper titled "Recovery of consumer waste in India – A mass flow analysis for paper, plastic and glass and the contribution of households and the informal sector" have analyzed the efforts taken towards resource conservation and recycling by studying various factors involved, and a quantitative estimation of the amount of materials recovered at various stages. Both the informal sectors and the households in India, play a vital role in recovering consumer waste. The study shows that consumer waste is far more efficiently recovered in India than what has been reported in literature until now. Despite the fact that the disposal of biodegradable waste and items with no recycling value is currently poorly managed, the current system very efficiently recovers a major fraction of the recyclable matter from the waste stream. The culture of reusing and recycling contributes significantly towards mitigating the environmental footprint of economic growth, reducing the carbon intensity of the economy through conservation of raw materials, and through improved energy and resource efficiency.

(This work is licensed under a Creative Commons Attribution 4.0 International License.)

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 7 Issue 04, April-2018

17. Chaitanya Nidhi and Nekram Rawal (2015) gave an overview about the usefulness of the Rapid Impact Assessment Matrix (RIAM) tool which is a quick method of Environmental Impact Assessment (EIA), to provide a method that would systematically and quantitatively evaluate the social and economic factors and the environmental components for the suitability of the new site. RIAM is a very powerful tool to use in an EIA.

    It is transparent, able to test different options easily, and still able to obtain an overview of the solutions. It is easy to visualize the results of different options, which makes the tool useful for decision makers.

18. Jenna R. Jambeck et al (2015) in their paper titled "Plastic waste inputs from land into the ocean" gave an overview about waste management by burying or burning waste which was sufficient for inert or biodegradable waste, but the rapid growth of synthetic plastics in the waste stream requires a paradigm shift. It has been predicted that long-term solutions will likely include waste reduction and "downstream" waste management strategies such as expanded recovery systems and extended producer responsibility. Improving waste management infrastructure in developing countries is paramount and will require substantial resources and time. While such infrastructure is being developed, industrialized countries can take immediate action by reducing waste and curbing the growth of single-use plastics.

19. N. Ramesh et al (2015) in their paper titled "Energy production through organic fraction of municipal solid waste—A multiple regression modeling approach" have tried to develop a model through multiple line regression analysis with Chemical Oxygen Demand (COD) as dependent variable and various parameters like Hydraulic Retention Time (HRT), Organic Loading Rate (OLR), Sludge Loading Rate (SLR), influent, effluent, Volatile Suspended Solid (VSS/TS) ratio, influent COD, effluent COD, etc as independent variables and to analyze the impact of these parameters on COD. The regression results have assisted the researchers in analyzing the variables that affect COD removal in two aspects: prediction and explanation. In terms of prediction, the regression models all achieve high levels of predictive accuracy. In terms of explanation, the estimated model reveals that COD removal is strongly influenced by three variables, viz. Methane content, Inf. and Infl.COD.

20. Sanjeeb Kumar Das (2015) have gathered information on unconventional methods of waste management followed; collected data about agencies involved in waste management activity; studied the attitude and perceptions of the individual concerning solid waste problems; and have found out the interest of the people to extend support to location-specific management program. Quality of life, educational level, level of awareness and economic background are the major parameters that have been reported to be important aspects in studying the attitude of people in municipal solid waste management. People's participation in solid waste management depends on factors like including their interest in participation, economic and social objectives of participation and the importance and degrees of participation.

3.0 CONCLUSION

The above discussion focused on the latest trends in the generation, collection, recycling and re-use of solid wastes. As discussed earlier, the urbanization, industrialization and the generation of e-wastes has complicated the solid waste management process globally. Firstly, segregation for efficient waste management should be properly planned. Increase in generation of solid wastes due to population explosion demand for good storage facilities without compromising on hygiene and sanitation. Future studies should focus on the generation and characterization of MSW. The studies should survey as large a population as possible and statistically reliable results need to be presented. Secondly, the problem related to disposal needs to be addressed. Most of the MSW in India is directly dumped in open in an unsecure and unplanned manner. The collaboration of both the public and private sectors is imperative to the efficient solid waste disposal. Selection of appropriate sites for disposal is important because the location should not negatively affect the environment. Thirdly, recycling is widely assumed to be environmentally beneficial in solid waste management. Being an important component of the waste hierarchy, recycling can be done in many ways. The energy derived from the solid wastes can be re-used as another form of energy. Wastes generated from one industry can be used as a by-product for processing in another industry. Pyrolysis of plastic waste results in the generation of hydrocarbons that can be utilized for energy generation (mostly in steam turbines) with permissible or no pollution. Thus, the use of WTE technology for solid waste management is crucial and should be widely adopted. Combining the three approaches discussed requires good infrastructure along with effective planning. Attitude and perceptions of individuals concerning solid waste problems, the quality of life, educational level, level of awareness and economic background are key components to ensure total participation. The Government needs to frame efficient policies to include most efficient indicators like organic fraction of waste, livelihood and health concerns of waste handlers. A system needs to be developed to monitor the progress, which can be done by benchmarking. That is, based on the performance of developed countries, a benchmarking standard needs to be established. Then, the current performance of solid waste management needs to be compared to the best practices. To reduce the performance gap, a strategy for efficient solid waste management needs to be planned, developed and implemented. Finally, a feedback loop should be set up for continuous improvement in order to realize the benchmark established.

(This work is licensed under a Creative Commons Attribution 4.0 International License.)

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 7 Issue 04, April-2018

4.0 REFERENCES

[1] Nathan Curry and Pragasen Pillay (2012). Biogas prediction and design of a food waste to energy system for the urban environment - Renewable Energy 41 (2012) 200-209

[2] Neha Gupta, Krishna Kumar Yadav, Vinit Kumar (2015). A review on current status of municipal solid waste management in India - Journal of Environmental Sciences 37 (2015) 206–217

[3] Brijesh Kumar Pandey, Savita Vyas, Mukesh Pandey and Anurag Gaur (2016). Characterisation of municipal solid waste generated from Bhopal, India - Current Science Perspectives 2(3) (2016) 52-56

[4] Vaibhav Srivastava, Sultan Ahmed Ismail, Pooja Singh, Rajeev Pratap Singh (2014). Urban solid waste management in the developing world with emphasis on India: challenges and opportunities - Rev Environ Sci Biotechnol (2015) 14:317–337

[5] Aminatha Kirama, Aloyce W. Mayo (2015). Challenges and prospects of private sector participation in solid waste management in Dar es Salaam City, Tanzania - Habitat International 53 (2016) 195-205

[6] Marina Ili, Magdalena Nikoli (2015). Waste management benchmarking: A case study of Serbia - Habitat International 53 (2016) 453-460

[7] Md. Mohib-Ul-Haque Khan, Siddharth Jain, Mahdi Vaezi, Amit Kumar (2015). Development of a decision model for the techno-economic assessment of municipal solid waste utilization pathways - Waste Management 48 (2016) 548–564

[8] Khaiwal Ravindra, Kamalpreet Kaur, Suman Mor (2014). System analysis of municipal solid waste management in Chandigarh and minimization practices for cleaner emissions – Journal of cleaner production 89 (2015) 251-256

[9] Surindra Suthar, Pavitra Singh (2014). Household solid waste generation and composition in different family size and socio-economic groups: A case study - Sustainable Cities and Society 14 (2015) 56–63

[10] Sie Ting Tan, Wai Shin Ho, Haslenda Hashim, Chew Tin Lee, Mohd Rozainee Taib, Chin Siong Ho (2015). Energy, economic and environmental (3E) analysis of waste-to-energy (WTE) strategies for municipal solid waste (MSW) management in Malaysia - Energy Conversion and Management 102 (2015) 111–120

[11] Vijay Kumar Garlapati (2015). E-waste in India and developed countries: Management, recycling, business and biotechnological initiatives - renewable and sustainable energy reviews 54(2016) 874-881

[12] Dorina Grazhdani (2015). Assessing the variables affecting on the rate of solid waste generation and recycling: An empirical analysis in Prespa Park - Waste Management 48(2016) 3-13

[13] AlperenTozlu , EmrahÖzahi, Ayşegül Abuşoğlu (2015). Waste to energy technologies for municipal solid waste management in Gaziantep – Renewable and Sustainable Energy Reviews 54 (2016) 809–815

[14] Rohit Kumar Singh and Biswajit Ruj (2016). Time and temperature depended fuel gas generation from pyrolysis of real world municipal plastic waste - Fuel (2016). http://dx.doi.org/10.1016/j.fuel.2016.01.049

[15] Surajit Bag (2015). Solid Waste to Energy Status in India: A Short Review - The International Daily journal ISSN 2278 – 5469

[16] Biplob Nandy, Gaurav Sharma, Saryu Garg, Shweta Kumari, Tess George, Yengkhom Sunanda, Bärbel Sinha (2015). Recovery of consumer waste in India – A mass flow analysis for paper, plastic and glass and the contribution of households and the informal sector - Resources, Conservation and Recycling 101 (2015) 167–181

[17] Chaitanya Nidhi and Nekram Rawal (2015). Selection of new disposal site for solid waste using rapid impact assessment matrix (RIAM) technique: a case study in Allahabad, India - The International Daily journal ISSN 2278 – 5469 EISSN 2278 – 5450

[18] Jenna R. Jambeck, Roland Geyer, Chris Wilcox, Theodore R. Siegler, Miriam Perryman, Anthony Andrady, Ramani Narayan, Kara Lavender Law (2015). Plastic waste inputs from land into the ocean – sciencemag.org vol 347 issue 6223

[19] N. Ramesh, S. Ramesh, G. Vennila, J. Abdul Bari, P Magesh Kumar (2015). Energy production through organic fraction of municipal solid waste - A multiple regression modeling approach - Ecotoxicol. Environ. Saf. (2015), http://dx.doi.org/10.1016/j.ecoenv.2015.08.027i

[20] Sanjeeb Kumar Das (2015). Attitudinal Study on Municipal Waste Disposal Management: A Case Study in Bhubaneswar City - International Journal of Energy, Sustainability and Environmental Engineering Vol. 2 (1), September 2015, pp. 37-38

(This work is licensed under a Creative Commons Attribution 4.0 International License.)