Muhammed Alamgir, S.M. Tariqul Islam and J. A. Saju (Eds.)
ISBN: 978-984-35-4034-8

Full Paper of the WasteSafe 2023 –8th International Conference on
Integrated Solid Waste & Faecal Sludge Management
25-26 February 2023, Khulna, Bangladesh

STUDY ON PLASTIC WASTE RECYCLING IN CUMILLA DISTRICT

Nazmus Hussain Sakib[1], Md, Ashrafuddoula Dipu[2], Fahad Hasan[3] and Abdullah Ibn Faruk[4]

[1]Bangladesh University of Engineering & Technology
[2]Ahsanullah University of Science & Technology
[3]World University of Bangladesh
Corresponding author. +8801724622627, E-mail: dipu_fanofafridi@yahoo.com

ABSTRACT

Proper disposal of plastics and its derivatives is one of the biggest challenges all over the globe. Due to the improper management of plastic product environment is being polluted. Plastic waste generation and plastic waste-based pollution in Bangladesh is leaping at a high pace. The used plastic has become a threat for marine life and responsible for reduction of fertility of soil and ground water contamination. Plastic has become popular because of durability, lightweight and cheap rate. Comilla District is now officially known as Cumilla District. It is located in the south-eastern part of Bangladesh Latitude and longitude coordinates are: 23.450001, 91.199997, bordered by Brahmanbaria and Narayanganj districts to the north, Noakhali and Feni districts to the south, Tripura of India to the east and Munshiganj and Chandpur districts to the west. Comilla has a total area of 3146.30.17 square kilometres. Cumilla district has 17 Nos upazila.The amount of plastic waste has been increasing recent years in Cumilla district. Bottle, jars, bucket and plastic bags are the main form of waste plastic. Recycling can reduce the quantity of Plastic Waste. In this study the existing recycling process of plastic waste in Cumilla district is thoroughly observed. Total 32 Nos plastic waste recycling industry in cumilla district. From the filed investigation, it has been found that daily 24 tons and monthly 720 tons of plastic wastes are collected. Among those daily 23.28 tons and monthly 705.8 tons of plastic wastes are recycled and the amount of waste labels around daily 0.72 tons and monthly 14.4 tons were found to be disposed directly to natural environment. Traditional plastic recycling system was found in Cumilla district where the label of plastic bottles is not included in recycling process. Thus, improved plastic waste recycling system such as Mechanical recycling and Chemical recycling would increase the quality and efficiency of plastic waste management in Cumilla district.

Key words: Plastic, waste, Collection, Recycling, Environment

INTRODUCTION

Plastics are now the world's third-largest production material, second only to concrete and steel. Similarly, due to its widespread applications across the globe, plastic manufacturing may continue in the future. The manufacturing and use of plastic products on a global level have been on the rise since 1950. Approximately 8300 million tons of plastic were made, and 6300 million tons of plastic waste were thrown in landfills or dispersed into the environment. In addition, about 415 million tons of plastic are produced annually worldwide.

Plastic products become a part of our daily activities due to some of its special features like insolubility in water, resistance to corrosion and electricity, easiness of fabrication by heating and molding, long durability, light in weight. Plastics are generally made of carbon, hydrogen, oxygen, nitrogen, chlorine and sulfur. There are two types of plastic thermoplastic and thermosetting. Thermoplastics are linear or nearly cross-linked polymer. There is no chemical change in Thermoplastics when it is heated. And the thermosetting plastics are heavily cross linked. In the thermosetting process, a chemical reaction occurs that is irreversible (Klein, 2012). Thermosets can melt and take shape once; after they have solidified, they remain solid for rest longer time (Shimo, 2014). The idea of plastic first came at 1860 when Phelan and Celluloid, a US Pool and Billiard Company declared prize for the substitute of natural ivory and John Wesley Hyatt invented the first synthetic plastic in 1869. The first manmade plastic was created by Alexander Parkes who publicly demonstrated it at the 1862 Great International Exhibition in London (Bellis, 2017). The material,

called Parke sine, was an organic material derived from cellulose that once heated could be molded and retained its shape when cooled (Bellis, 2017). After that john Wesley Hyatt invented celluloid which is derived from cellulose and alcoholised camphor. In 1907 Leo Baekeland invented the first synthetic plastic named Bakelite. Plastic industries flourish commercially in the year 1960 and facing a transition from 1980 to 1986 due to the world economic instability and oil price hike.

With the increase of industrial advancement and population growth rate the amount of plastic waste is increasing. In 2015 the global production of plastics rose to 322 million tons, a 3.5% increase from the volume for 2014(Maris et al., 2018). The researcher found that currently about 1.7–1.9 billion metric tons/annum (BMTPA) waste is generated worldwide (Modak et al., 2010) and it will reach to 27 BMTPA within 2050 and almost one-third of this wastewill be contributed by the countries of Asia alone (Nations, 2010). Among this huge waste generation, about 50–70% is collected for disposal and uncontrolled landfilling is account for 15% of the collected waste (Modak et al., 2010); (Ramos et al., 2012) The environmental effect of this waste becoming intensifies with the presence of plastic litter which contributes almost 5% of the municipal solid wastes (Sharmin et al., 2016). The per capita consumption of plastic driven products is 100 and 20 kg bythe people from the North-America and Asia respectively (Gourmelon, 2015). The disposal of waste plastics has become a major worldwide problem due to its non-biodegradable property which makes safe and easy disposal complex. Indeed, large amounts of plastic waste have been introduced into the environment through its production and disposal, resulting in its accumulation in ecosystems across the globe, and especially in the ocean (Neufeld et al., 2016). (Jambeck et al., 2015) showed that 275 million metric tons (MT) of plastic waste was generated in 192 coastal countries in 2010, with 4.8 to 12.7 million MT entering the ocean. Using landfill sites for dumping of plastics is a non-sustainable and environmentally unfriendly option. Although plastic waste management is a global problem, different strategies have been developed in countries and/or continents. It is necessary the disposal or decomposition of plastic waste. The disposal methods Include land filling, mechanical recycling, biological recycling, thermal recycling, and chemical recycling (Cleetus et al., 2013). First plastic industry in Bangladesh started their journey in 1960's by making plastic toys, photo frame and plastic spare parts for the jute mills using handmade mold (Shimo, 2014). From the 2000's plastic recycling takes place through locally developed machines such as shredder, ex- truder and the companies started making plastic chairs, tables and water tank by rotation molding machine (Shimo, 2014). Day by day the plastic industry increases with the increase of the population along with the plastic waste increasing. From a study about the plastic consumption in the urban areas of Bangladesh, it was found that the per capita plastic consumption was 2.07 kg in the year 2005 and sharply increased to 3.5 kg in 2014(Waste Concern, 2015). Cumilla, is the 5th largest city of Bangladesh and 2nd largest in Chittagong division.With the increase of industrial, household and commercial activities, the amount of plastic waste is also increasing in Cumilla city. Here, the recycling industries use mechanical recycling process, but most of the steps of this process are manually assisted. The aim of this study is to observe the current status of plastic waste recycling.

METHODOLOGY

This study consists of finding out the location of plastic recycling Industry, filed investigation of that industry, observing the whole process of recycling, knowing about the selling practice of recycled plastic.

Selection of study area

Comilla District is now officially known as Cumilla District. It is located in the south-eastern part of Bangladesh Latitude and longitude coordinates are: **23.450001, 91.199997**, bordered by Brahmanbaria and Narayanganj districts to the north, Noakhali and Feni districts to the south, Tripura of India to the east and Munshiganj and Chandpur districts to the west. Comilla has a total area of 3146.30.17 square kilometres. Cumilla district has 17 Nos upazila. The names of the upazila are Chandina, Chauddagram, Cumilla Sadar, Debidwar, Daudkandi, Laksam, Lalmai, Muradnagor, Monohargonj, Burichang, Meghna, Sadarsouth, Homna, Nangalkot, Brahmanpara, Barura, Titas. The population of Cumilla districtis 62.1 million. Due to increase in residential, commercial and industrial activities the plastic waste is increasing day byday. Because of improper management the plastics waste cause harm for the environment. So, it has become a vital need for a proper management process of plastic waste.

Survey procedure

ISBN: 978-984-35-4034-8

In Comilla district the recycling is done by individual recycling industries. It was observed that recycling industries are situated in every upazila of the district. A questionnaire survey has done to know about the present recycling system of plastic waste. Total number of recycling industries in Comilla district has been determined. In figure-1 the location of Cumilla district upzila are shown.

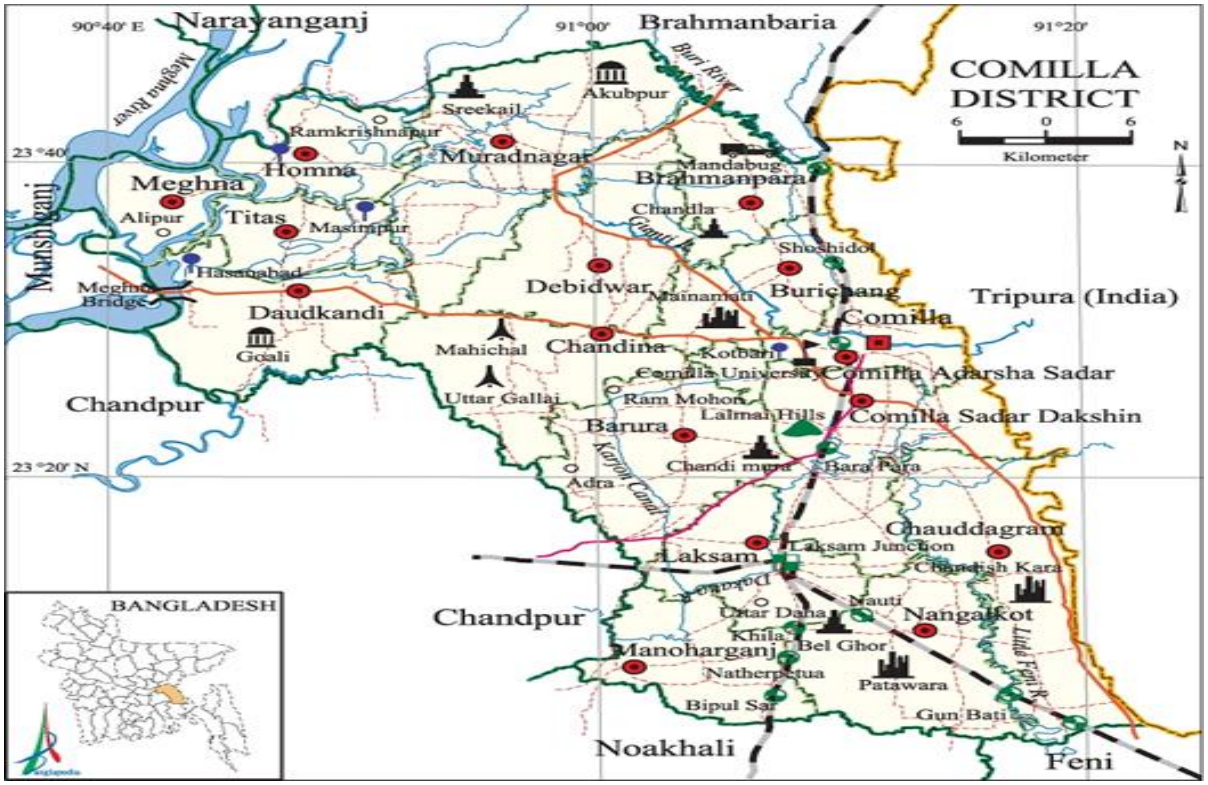

Figure1 Map of Comilla district

RESULTS AND DESCISION

In Cumilla district there is one type of plastic recycling industry. Making shredded plastic, after packing shredded plastic sent to the plastic industries within the country. The flow diagram for various steps of plastic recycling industry in Cumilla district are shown in figure-2 & figure-3.

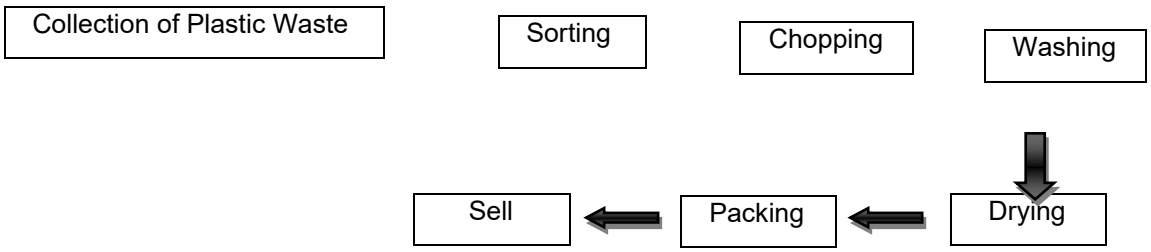

Figure-2 Typical flow diagram of recycling process in recycling industry in Cumilla district.

Collection of Plastic Waste

Sorting

Chopping

Washing

Drying

Packing

Figure 3 Various steps of plastic recycling industries in Cumilla district.

ISBN: 978-984-35-4034-8

Collection and storage of plastic waste

Plastics are collected by tokai and feriwala in Cumilla district. They sell these wastes to the primary dealer and the primary dealer sell these wastes to the secondary dealer. The secondary dealer sells them to the recycling industry. Industry stores them a place.

Sorting

Sorting is done by manual method. The level of plastic bottles is separated from bottle. They are not used in recycling. This sorting is done by eye inception. Separation of plastic bottles has been done based on their colour. More efficiency of this step increases the profit of the recycling.

Shredding

Shredding is done by machine. This machine consists of a motor, a cutter, a conical shape basket. Through the basket the plastics are supplied to the machine

Washing

After shredding the plastics are put in house of water mixed with caustic soda, salt and washed by manual method. Most of the industry use this process.

Drying

After washing shredded plastics are dried in drying machine or under sunlight. Most of the industry use the sunlight for drying the shredded plastic. But in the rainy season they use electric fan for drying the washed shredded plastics.

Packaging and selling practice for shredded plastics

After drying the shredded plastics are packaged in bag. After packaging the owners of industry Sell them to the Plastic factory for making new products. They also Those also export those shredded plastic to India and China.

Disposal practice for waste label

The labels are collected in basket during the sorting and after sorting worker throw them in nearest canal, drain or nearest dustbin. In figure-4 disposal practice of waste label shown.

Figure 4 Disposal practice of waste label.

As Cumilla district has 17 Nos upazila. Total 32 Nos plastic recycling industries has been found in this study. In table-1, total plastic waste, recycled plastic waste and waste level has been shown.

Table 1 Collected plastic waste, recycled plastic waste and waste level in recycling process in Cumilla district.

SL No	Name of Upazila	No of Plastic recycling Industry	Total Plastic waste collected Kg/month	Recycled Plastic waste Kg/month	Waste level Kg/month
1	Chandina	3	71100	69678	1422
2	Chauddagram	3	63900	62622	1278
3	Cumilla Sadar	2	52050	51009	1041
4	Debidwar	2	42000	41160	840
5	Daudkandi	3	81000	79380	1620
6	Laksam	2	36000	35280	720
7	Lalmai	1	20100	19698	402
8	Muradnagor	2	49800	48804	996
9	Monohargonj	1	27000	26460	540
10	Burichang	2	36000	35280	720
11	Meghna	2	41400	40572	828
12	Sadarsouth	1	28800	28224	576
13	Homna	3	54000	52920	1080
14	Nangalkot	2	46200	45276	924
15	Brahmanpara	1	23150	22687	463
16	Barura	1	23400	22932	468
17	Titas	1	24100	23618	482

From the table it was found that 720 ton per month waste has been collected and 705.6 ton per month plastic waste has been recycled. 14.4 ton per month waste label has been wasted and throw them in nearest canal, drain or nearest dustbin. In Cumilla district the primary collector of waste plastic is Tokai and Feriwala. They sell them to the local Plastic waste dealer in cheap rate. The price varies from 15 to 27 taka per Kg. They local dealer sell them to the recycling industry. The price varies from 26 to 38 taka per Kg. After collecting the waste plastic fron the dealer, the plastic waste recycling industry sorting them according to their colour and type. After chopping, washing and drying they sell those shredded plastic. The price varies from 41 to 76 taka per Kg. From this study it was found the plastic waste not only coming from Cumilla district, but also coming from another district also. About 2 percent of plastic waste has been wasted.

Proposal for recycling of waste labels

The labels of plastic bottles are considered as useless wastes and not included in the recycling process. Although plastic is a non-biodegradable material but after long time it may become a vital problem for the environment. The waste plastic labels can't be used as a single recyclable material but would be a mixer element in low quality products like plastic pot, toilet vessel, bicycle pedals, etc.

CONCLUSION

Plastic is an unavoidable part of our lives, and its demand is increasing. Humans have massively deteriorated Earth's natural ecosystems. Recycling is an important method for handling plastic waste. The most effective plastic treatment method is to convert plastic waste into high-value-added components. About 98 percent waste plastic has been recycled in Cumilla district and 2 percent of waste label has been wasted. The recycling industries are entirely managed by private sector. Due to poor waste management practices, the current usage of plastic is unsustainable. Society faces a serious threat of plastic waste pollution that is being underestimated. We must decrease the amount of plastic waste dispersed on roads and rivers; construction materials established from recycled

plastic waste are more durable and cost-effective. Appropriate handling of plastic waste provides a platform for creating wealth. Contact with toxic chemicals utilized during plastic production and improper waste control can pose serious problems to humans and the environment. Therefore, governments, regulatory bodies, and health administrations worldwide must take action, and consider the sustainable manufacturing, applications, and disposal of plastic waste.

REFERENCES

Bellis, M. (2017). A brief history of the invention of plastics. Retrieved September 10, 2018, from https://www.thoughtco.com/history-of-plastics-1992322

Waste Concern. (2015). Environmental Challenges of Plastics Waste in Bangladesh.

Ahmed, M. A., & Moniruzzaman, S. M. (2018). A study on plastic waste recycling process in Khulna city, (Iccesd), 1–10. Retrieved from www.iccesd.com/proc_2018/Papers/r_p4227.pdf

Halden, R. U. (2010). Plastics and Health Risks. Annual Review of Public Health, 31(1), 179–194. https://doi.org/10.1146/annurev.publhealth.012809.103714

British Plastics Federation. (2014). A History of Plastics. Retrieved September 10, 2018, from http://www.bpf.co.uk/plastipedia/plastics_history/Default.aspx

Knight, L. (2014). A brief history of plastics, natural and synthetic - BBC News. Retrieved September 10, 2018, from http://www.bbc.com/news/magazine-27442625

Shimo, M. H. U. (2014). Plastic Recycling in Bangladesh, What Needs To Be Done? Arcada – University of Applied Sciences Degree. Retrieved from https://www.theseus.fi/bitstream/handle/10024/87021/Plastic Recycling Thesis.pdf?sequence=1

Leeuwen, A. Van. (2013). Plastic Bag Bans and Third World Countries. Retrieved September 10, 2018, from https://fightttheplasticbagban.com/2013/05/20/plastic-bag-bans-and-third-worldnations/

Islam, M. N. … Beg, M. R. A. (2004). The fuel properties of pyrolysis liquid derived from urban solid wastes in Bangladesh. Bioresource Technology, 92(2), 181–186. https://doi.org/10.1016/j.biortech.2003.08.009

Ahmed, A. M. … Rafizul, I. M. (2017). Prediction of Solid Waste Generation Rate and Determination of Future Waste Characteristics at South-Western Region of Bangladesh Using Artificial Neural Network. *Waste Safe*, 24–25.

Mourshed, M. … Joardder, M. U. H. (2017). Towards the effective plastic waste management in Bangladesh: a review. Environmental Science and Pollution Research, 24(35), 27021–27046. https://doi.org/10.1007/s11356-017-0429-9