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Study on Generation of Plastic Waste type and its Effect on Clogging of Drain for Successful Management

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ABSTRACT

A study was carried out in Guwahati, Assam, India on generation of different plastic waste type and its effect on clogging of drain for successful plastic waste management. Out of the 60 wards under the Guwahati Municipal Corporation 10 wards were considered for thorough study of household generation of plastic waste and differentiated its type as per the recycling potentiality. It was found that among the plastic waste 60% is recyclable plastic and 40% is non recyclable plastic. Distribution of NRP in drain is 89% and RP is 11% respectively. All the multilayered and laminated plastics are non recyclable and often mixed with the recyclable plastics and biodegradable solid waste and chiefly responsible for clogging of drain, artificial water logging, development of waste land etc. Therefore differentiation of plastic waste type into recyclable plastics (marked as RP) and non recyclable plastic (as NRP) would help for systematic segregation and management. For sustainable plastic waste management a special type of litter bin is developed for source collection and effort are also being taken for production of useable fuel from both RP and NRP through a simplified process. Once the plastic waste is segregated, the biodegradable solid waste in the land field will not create any problems rather it will act as soil conditioner.

Introduction

Plastic waste when mixed with the biodegradable solid waste blocks the normal process of microbial degradation and creates lot of problems like clogging of drain, artificial water logging, developing of waste land, loss of soil fertility and soil carrying capacity etc.
In Guwahati alone, generation of plastic waste worsen the situation with more than 5000 kg/day, among the plastic waste generation carry bag accounts for 15% only. Whereas plastic carry bag is considered as the major responsible for clogging of drain and artificial water logging due to the use and throw practices by the citizens. Accordingly, Government of Assam has banned use of plastic carry bag which is below 20 microns. But in reality all plastic carry bags even below 20 microns are also recyclable and collected by the rag pickers. Moreover citizens are selling most of the recyclable plastic to the waste pickers and usually they throw away the multi layered non recyclable plastic.

Key words: Plastic waste, RP, NRP, clogging of drain, artificial water logging, Guwahati.

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Even due to lack of knowledge people throw recyclable plastic like carry bag, pouch pack of vegetable oil, 'tata salt', bread etc. Therefore it is becoming necessary to study about the generation of plastic waste type as per the recycling potentiality.
Recycling is the best way of plastic waste management (Singhal and Pandey, 2001). Basically there are four different ways of recycling plastics:

1. Primary recycling: Conversion of waste plastics into products having similar performance level comparable to that of original products made from virgin plastics.
2. Secondary recycling: Conversion of waste plastics into products having less demanding performance requirements than the original material.
3. Tertiary recycling: The process of producing chemicals, fuels or similar products from waste plastics.
4. Quaternary recycling: The process of recovering energy from waste plastics by incineration.

In Guwahati, only primary and secondary plastic recycling industries are available with 10 nos. of plastic

Methodology

To determine the generation of total plastic waste, samples were collected from ten selective wards under the Guwahati Municipal Corporation and differentiated as recyclable plastic 'RP' and non-recyclable plastic 'NRP' on the basis of information collected from recycling industries. Random samples were collected as per the variation of waste generation. Wet samples were air dried to remove the water component. The weights of the segregated RP and NRP samples were taken on weighing scale of 1kg and 5kg respectively for accuracy of weight measurement. The waste characteristics from different sources are averaged and weighed against the number of population (Deshpande, 2008). These fractions are then represented as percent by weighed. To solve the problem of non-recyclable plastic waste experimentally produced fuel from both recyclable and non-recyclable plastic by applying heat through an electric heater.

Results

Differentiation of the plastic waste

On the basis of recycling practices in Guwahati, recyclable and non-recyclable plastics are systematically differentiated (Kashyap et al. 2006).

Recyclable plastic (RP)

Plastic carry bags' made of LLDPE, HMHDPE, PP; 'plastic glasses' used for tea, coffee, water, ice cream etc. made of PS; 'plastic bottles' used for drinking water, cold drinks, fruit juice, medicine, cosmetics, shampoo and detergent, injectable saline, edible oil, automobile lubricants, mosquito repellent etc. made of PET or PVC; various single layered plastic 'pouch-pack' used for vegetable oil, salt, milk made of PE, PET, PP; PVC shoe; plastic sheet used for RCC construction and other damaged plastic sheet, plastic thread, damaged plastic pipes, damaged plastic bucket and mug, disposable syringe for injection and other plastic waste made of Polyester, PE, PET, PVC,PS, PP etc.

Non-recyclable plastic (NRP)

Multi layered plastic 'pouch pack' and plastic package used for potato chips, tea, coffee, biscuits, snakes, spices, noodles, chocolate, 'pan masala', shampoo, detergent, lubricants, fruit juice and others made of 'metallized PET', Polyester and PE; medicine blister strip made of PE and Aluminum foil; various plastic laminated on paper packs made of Paper, PET or PE; all the plastic laminated cover page of books, magazine and souvenir etc. laminated on paper through PET or PE; battery cases combination of plastic and paper; tooth paste tube and tooth brush, medicine tube, cosmetics tube, pen, comb etc. made of mixed PVC, Polyester, PET and others; aseptic packaging or all type of square boxes used for packaging of liquid substances like milk, vegetable oil, fruit juice and soft drink made up from complex layers of plastic, metal and paper etc.

recycling industries and recycling only 10% of total plastic waste. Therefore there is an urgent need to study about the generation of plastic waste type as per the present recycling scenario and develop technology for recycling of all the plastic waste.

Generation of household plastic waste

Out of the 60 wards under the Guwahati Municipal Corporation 10 wards were considered for thorough study of household generation of plastic waste and differentiated as per the recycling potentiality:

It is estimated that out of the total plastic generated from household 60% is recyclable plastic and 40% is non-recyclable plastic.

Proportion study of RP and NRP in roadside drains

To study the proportion of RP and NRP in roadside drains, single samples were collected from different drains of studied wards respectively. Standard weight of five kilogram plastic waste samples was collected for analysis and weighted the proportion of RP and NRP. It was observed that proportion of NRP in drain accounts 89% and RP was 11% respectively. We found mean weight of 0.55 kg in case of RP that of NRP was found 4.45 kg among the samples, where as the proportion of the NRP was found highly significant ($p=0.0008<0.05$) as compared to that of RP ($p=0.29>0.05$).

Discussion

In Guwahati all the plastics i.e. both recyclable and non recyclable are being dumped together at different places. Among the total plastic type, recyclable plastic is 60% and non recyclable plastic is 40%.

Distribution of NRP in drain is 89 % and RP is 11%. Therefore, non recyclable plastics are the major responsible for clogging of drains and artificial water logging in Guwahati.

All the multilayered and laminated plastic waste are non recyclable and often mixed with the recyclable plastic waste. Today's major problem of plastic recycling is that some plastics are often made up of more than one kind of polymer and added some sort of fiber to give added strength which is a composite form of plastic. There is no recycling potentiality of mixed or layered plastic as these cannot be melted for a new form of plastic.

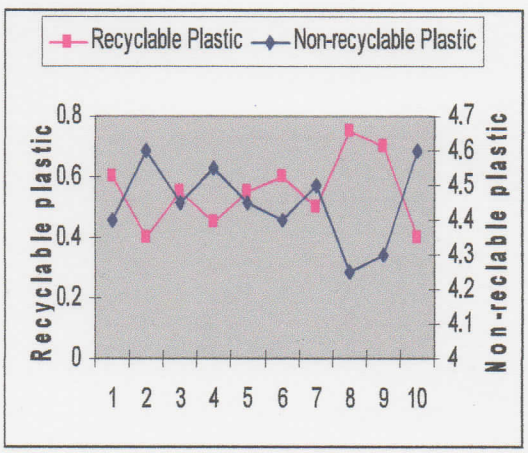

Figure-1: The proportion of RP and NRP in the roadside drain.

Table-1: Generation of plastic waste type in study area

Sl. No.	Ward No.	No. of Household	Population	Total Plastic (kg)	Recyclable Plastic (kg)	Non-recyclable Plastic(kg)
1.	51	7036	33006	148.52	89.40	59.11
2.	52	1672	8242	32.14	19.00	13.41
3.	53	2227	10932	36.08	21.35	14.73
4.	54	3870	19491	76.00	45.00	31.00
5.	55	3299	14967	44.90	27.54	17.36
6.	56	5062	24997	112.48	67.40	44.59
7.	57	4375	20502	61.50	36.99	24.51
8.	58	6058	28881	86.64	52.26	34.37
9.	59	5108	23641	70.92	42.50	28.41
10.	60	5712	25979	77.94	46.81	31.12
Total Weight (Kg)				**747.12**	**448.25**	**298.61**

Distribution study of RP and NRP in roadside drains

To study the distribution of RP and NRP in roadside drains, samples were collected fromdifferent drains one from each ward of the study areas:

Ward No.	Sample No.	Sample Weight(kg)	RP (kg)	NRP (kg)	RP (%)	NRP (%)
51	1.	5.00	0.60	4.40	12	88
52	2.	5.00	0.40	4.60	8	92
53	3.	5.00	0.55	4.45	11	89
54	4.	5.00	0.45	4.55	9	91
55	5.	5.00	0.55	4.45	11	89
56	6.	5.00	0.60	4.40	12	88
57	7.	5.00	0.50	4.50	10	90
58	8.	5.00	0.75	4.25	15	85
59	9.	5.00	0.70	4.30	14	86
60	10.	5.00	0.40	4.60	8	92

It is observed that distribution of NRP in drain is 89% and RP is 11% respectively.

For plastic recycling each type of plastic must be segregated so that plastic types must not be mixed for recycling. Because a small amount of the wrong type of plastic can ruin the melt. Non recyclable plastics can be recycled only after de-lamination process.

It is observed that instead of plastic carry bag (Anonymous, 2008) which is the recyclable plastic, non recyclable plastics are the major responsible for clogging of drains and is creating a major problem in Solid Waste Management.

Therefore plastic waste management is becoming very much essential to block the flow of plastic waste towards-drains, low-lying areas, road side, markets, open public places and other 'land fields' for successful solid waste management.
For systematic differentiation of recyclable and non-recyclable plastic type, marking code 'RP' for recyclable plastic and 'NRP' for non recyclable plastic has been used.

Design of a litter bin is worked out after lots of R & D for source collection of plastic waste. For this purpose a model litter bin of 10 inches diameter and 14 inches height is designed, made up of local bamboo.

The bin also contains a bamboo net to keep the plastic compressed. Plastic waste like carry bags are very difficult to keep inside the residences as it takes large volume and space. So people prefer to throw it. This little liter bin is capable to store a large quantity of plastic waste, i.e. nearly 1.5kg. The name of the litter bin is named as "Money Earning Litterbin" as one can earn money out of it.

Recycling of only some types of plastic materials is not enough where as recycling of all type of plastic waste is essential for a successful management (Gupta, 2004). With this back ground the plastic wastes generated within the greater Guwahati area was tried to be managed through the production of useable fuel by a very simplified method. In this process of conversion of waste plastics into fuels, random de-polymerization is carried out in an air tight iron made chamber with an elongated pipe instead of using specially designed reactor and any special catalyst except plastic waste (Bondopadhyay and Sharma, 2004). The reaction temperature was given through an electric heater and the reaction process was started after 15 minutes and completed within 2 hours. In this process all types of plastic including multilayered NRP waste was used where, 720 ml liquid fuel was derived from 1 kg of plastic waste.

This liquid fuel is the best substitute of diesel and was even tried for running a scooter. Where as gaseous part can also be utilized as fuel.

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