

Plastic Commodities and Associated Risks in the Households of AMC (Asansol Municipal Corporation), West Bengal, India



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Abstract

In the present study we have made a survey in the Asansol Municipal Corporation regarding the pattern of use of plastic consumables With respect to the types and their impact on the society. (strikeout rest of the part) In our study we could find that the awareness about the categorization of plastic was nil but fortunately the proportion of plastics which are in use in most households, are the category-5 and 1. These two categories of plastics are relatively safer. However, the reuse of these plastics in this area is a general practice which might affect the health of the society. Most of the plastic waste in total solid waste per house was found to be LDPE and HDPE carry bags, biscuit and cookies trays, category-1 water bottles etc. These plastics are collected by the municipality garbage collection service and disposed in the outskirts of the city. Total solid waste per house hold is about 1150g/day of which 5-6% by weight and 10-12% by volume consists of plastic wastes. The net inference which we could draw from this study is that, people of AMC need to be made aware of the plastic categories and their composition because each of them have dangerous consequences on human life. Reuse of the category = 5 plastic is relatively better, but they have to minimize the use of category-1 plastic as far as possible. It's an awareness to the authorities of such cities to disseminate these ideas and develop proper separation system for collecting plastic wastes for recycling or for immobilizing them in construction works.

Keywords: Resin Identification Code, Health Risk, Carcinogenic, Solid Waste

Introduction

One of the most versatile and useful material to be invented in the 20th century is plastic. Plastic is a synthetic polymer, recyclable but non-biodegradable. The name plastic (Edgar and Edgar) was given by the Belgian chemist, Leo Baekeland (ACSNHCL, 2015), who first invented plastic in the form of 'bakelite'. Bakelite found its use in making electronic devices. Since then, plastic has occupied almost all aspects of human life starting from hair pins to spacecrafts. The world is in fact now flooded with plastics.

The environmental and health concern regarding plastic became evident when it was realized that plastics are non-decomposable or rather decompose very slowly and also the fact that they leach out carcinogenic ingredients in the food contained within them.

Plastic manufacturers often add various types of additives to give them the characteristics they are looking for, viz., flexibility, durability and reduced cost. These chemicals include, phthalate (Meeker et al. 2009), bisphenol A (BPA) (Kang et al. 2003; Brede et al. 2003), polybrominated diphenyl ethers (PBDE) (ATSDR 2004; Webster et al. 2005; Allen et al. 2007; Lorber 2008) and tetrabromobisphenol A (TBBPA) etc. These chemicals are endocrine-disrupting compounds (EDCs) and each of them affect different elements of hormone function (NRC 1999). Their disruptive activities include, estrogen activity, thyroid hormone homeostasis disruption (Richter et al. 2007; Wetherill et al. 2007), anti-androgens and others (Hagmar et al. 2001; Julander et al. 2005). Some of these polymers leach out carcinogenic monomers in the liquid content while others leach out toxic metals.

Plastics have integrated so intricately in our lives that it is almost impossible to curb their use. But, if they are used cautiously after understanding their composition and the hazardous effect they cause, it might be possible to minimize the harmful effect of these plastics. For the betterment of understanding by general public, The Society of Plastic Industries (<http://www.plasticsindustry.org/>) have introduced a classification called, the **Resin Identification Code** to all types of plastics in use. According to this code, there are seven types of plastics available for human

daily consumption designated by a triangular symbol containing numbers, 01 to 07 within it (<http://www.virtualweberbullet.com/plastics.html>) (Table-1). All containers and packages made of plastics should be marked with these indications. This categorization helps us to understand the chemical composition of the plastic concerned, the risk factor associated to them if they are used for keeping foods or heating in the microwave and so on. A brief idea about each of the class of plastic is given here in the table – 1.

Plastic categories, their uses and health risks

Plastic categories	Chemical composition	Use	Health Risk
	Polyethylene terephthalate (PET)/PETE	To hold water, soft drinks, juices, beer, mouthwash, ketchup etc.	Leaches antimony at high temperature above 60-80 °C, It can cause, diarrhoea, vomiting and stomach ulcer (Meeker et al. 2009).
	High density polyethylene (HDPE)	Use to bottle milk, water, juice, cosmetics, shampoo, dish and laundry detergents and household cleaners. Bags of groceries are also made of HDPE	It is considered low hazard plastic. But a 2011 study points out that it also releases chemicals having estrogenic activity (EA) (Yang et al. 2011).
	Poly vinyl chloride (PVC)	Commonly used for making blister packs, clamshells (for storing pills), shrink wraps, meat wraps. In India, its mostly used to make pipes and electric cables.	This is considered as bad plastic. Not suitable for keeping foods and beverages. It releases hazardous toxic substances. Phthalate which is used as softener in PVC plastics dissolves in fat and may enter human body through food chain (Meeker et al. 2009).
	Low density Polyethylene (LDPE)	Used to make bags for dry cleaning, for keeping household garbage. They are also used to make container lids, toys and squeeze balls etc.	It is considered as low hazard plastic. This group of plastics are mostly discarded as waste and they have tremendous effect as far as terrestrial and aquatic ecosystem is concerned.
	Polypropylene (PP)	Used to make durable water bottles, baby feeding bottles, bottle caps and closures, bottles for ketchup and syrup etc. Microwave proof plastics are also made of PP.	PP is most safe plastic. However, reports are there that they release chemicals similar in structure to BHT (Butylated hydroxytoluene) and BHA (Butylated hydroxyanisole). These elements are added as antioxidants during polypropylene preparation. However, the toxicity of these chemicals are yet to be analysed properly (Reingruber et al. 2010).
	Polystyrene (PS)	Also called Styrofoam. It is commonly used for making cups, plates, bowls, cutlery, meat and poultry trays, chocolate trays, rigid food containers (eg., yoghurt) etc.	This is one of the hazardous plastic, considered unsafe. They can leach styrene, a carcinogenic agent. Styrene is also a neurotoxin (EPA, US,1999;ATSDR, 2004; WHO,2008) (http://www.epa.gov/ttn/atw/hlthef/styrene.html) (http://www.inchem.org/documents/ehc/ehc/ehc26.htm)
	Others (Made of resins other than the above six types). They are either combinations of above materials or made of PC (Polycarbonate)	Used to make large volume reusable water bottles, some citrus juice and ketchup bottles. Also used to make oven baking bags, barrier layers and custom packaging. Some baby feeding bottles are made of PC.	Category seven is risky. Most significant issue with this class of plastics is the hormone-disrupting substance, bisphenol A (BPA). The polycarbonate plastics leach BPA in the liquid kept there in particularly on heating (Calafat et al. 2005). (http://www.ehponline.org/members/2004/7534/7534.html)

The present study gives an account of the plastic categories that are in regular use in the households of Asansol city. The study also includes the amount of plastic waste present in the daily solid waste that are generated in the households and the proportion of plastic waste that finds its way to the waste disposal site. The study also suggests some changes in the use of plastic materials in daily life by the people of AMC.

Materials and Methods

Description of the Place of Study

The present study has been made with respect to Asansol Municipal Corporation (AMC), Geographically, it is situated at 87 °E longitude and 23°40' N latitude. Asansol is an industrial town of Burdwan district of West Bengal, India, covering an area of 127.237 km². AMC consists of 50 wards and 95,293 household with an average of five members per house with a total population of 4,86,304 as per 2011 census. Asansol resembles all typical characteristics of a metropolitan city and is considered second most important industrial and commercial city in West Bengal after Kolkata. The literacy rate of Asansol is 72.57%. Asansol Municipal Corporation generates 120 Matric tons of domestic solid waste everyday (Ghosh, M. K., Dikshit, A. K., and S. K. Sharma. A GIS based transportation model for solid waste disposal – A case study on Asansol municipality).

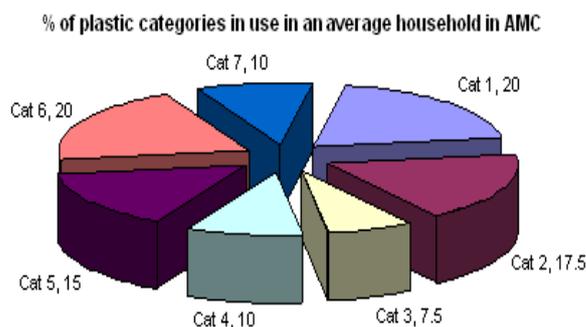
Data Sampling

Fifty students were selected to survey ten houses each and collect data. This data not only includes the types of plastics mostly in use but also includes, how much of solid waste is generated in an average in each household of AMC and how much of this waste is occupied by plastic waste. The proportion of plastic waste was determined with respect to weight as well as volume. This ratio of plastic to other organic wastes was also determined at the site of disposal. The categories of plastics used and finally disposed were also noticed.

Result and Discussion

An Account of Plastic Categories and their Uses in the Households of AMC

The data presented here in the figure – 1 in the form of pie chart is an average of 250 households most of which are of middle class standard. It is evident from the pie chart that the 20% of the plastic categories in use are of type – 1. This is good as far as their harmful effect is concerned (table -1). However, the major concern is the use of category – 6 and category – 7 plastic which together occupy 30% of the total use. As these plastics are tremendously hazardous, their excess use needs to be controlled. People of AMC are absolutely unaware of such categorization of plastics and social awareness is also a purpose of this sort of study. As far as category – 5 is concerned, it occupies 15% of the total consumption which is good sign as it is the safest plastic to be used and best for reuse purpose. Category – 1 is not good for keeping foods for longer period and also for reuse, but this plastic was found to be in random use for repeated number of times in households as well as in snacks corners.



The Ultimate Fate of Plastics after Use

Out of total solid waste that is generated (Table – 2), 5-6% by weight comprises of plastics of different categories. A considerable proportion of the waste plastic is occupied by the plastic bags, plastic trays, wrappers, water bottles of category-1 etc. This means that plastics of categories- 1, 2, 5 and 7 are mostly reused. Among them also category-1 and category-5 are reused as water bottles and category – 2 and 7 find their way to the bottle collectors which come time to time to collect them for recycling. As far as the SWM (Solid Waste Management) of the city is concerned, the authorities have still not developed any separation system neither at the source level nor at the sink (waste disposal site) level. So, whatever plastic finds its way in the waste carrying vehicles, they end up at the disposal site and become buried within the debris.

Plastics discarded openly or being dumped in the landfill also contaminate a wide range of natural terrestrial, fresh water and marine habitats (Thompson et al. 2005). Data on the accumulation of plastic debris in natural terrestrial and freshwater are extremely lacking. Environmental auditing with respect to plastics in every city, town and village is need of the time and has been felt worldwide (Barnes et al. 2009; Zubris and Richards 2005; Brinton 2005). This study endeavours to initiate large scale data sampling and finding the impact of rampant use of plastic in our society.

Parameters	Values
Amount of solid waste generated/ household	1150g/day (avg.)
Percentage (in terms of weight) of plastic waste of total solid waste	5-6%
Percentage (in terms of volume) of plastic waste of total solid waste	10-12%
Categories of plastic finding its way in the waste	Cat. 4>6>1>2>3>7>5
Plastic Categories in reuse	Cat. 5 and Cat.1
Awareness level	Nil

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