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Toxic Pollutants from Plastic Waste- A Review

Rinku Verma*, K. S. Vinoda, M. Papireddy, A.N.S Gowda

College of Sericulture, Chintamani, University of Agricultural Sciences, Bangalore, India

Abstract

Incineration of plastic waste in an open field is a major source of air pollution. Most of the times, the Municipal Solid Waste containing about 12% of plastics is burnt, releasing toxic gases like Dioxins, Furans, Mercury and Polychlorinated Biphenyls into the atmosphere. Further, burning of Poly Vinyl Chloride liberates hazardous halogens and pollutes air, the impact of which is climate change. The toxic substances thus released are posing a threat to vegetation, human and animal health and environment as a whole. Polystyrene is harmful to Central Nervous System. The hazardous brominated compounds act as carcinogens and mutagens. Dioxins settle on the crops and in our waterways where they eventually enter into our food and hence the body system. These Dioxins are the lethal persistent organic pollutants (POPs) and its worst component, 2,3,7,8 tetrachlorodibenzo-p-dioxin (TCDD), commonly known as agentorange is a toxic compound which causes cancer and neurological damage, disrupts reproductive thyroid and respiratory systems. Thus, burning of plastic wastes increase the risk of heart disease, aggravates respiratory ailments such as asthma and emphysema and cause rashes, nausea or headaches, and damages the nervous system. Hence, a sustainable step towards tomorrow's cleaner and healthier environment needs immediate attention of the environmentalists and scientists. This review presents the hazards of incineration; open burning of plastics and effects of plastic in water and also a possibility of working out strategies to develop alternate procedures of plastic waste management.

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Introduction

Plastic is made up of a wide range of synthetic or semi-synthetic organic substances that are soft and can be molded into solid objects of diverse shapes. Plastics are typically organic polymers of high molecular mass and they

* Corresponding author.
E-mail address: rinkuv@yahoo.com

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often contain other substances. They are usually synthetic, most commonly derived from petrochemicals and many are partially natural (LCPP 2011).

Plastic make up an estimated 10% of household waste, most of which is disposed in landfill (Barnes, 2009; Hopewell et al., 2009) However, 60—80 % of the waste found on beaches, floating on ocean or sealed is plastic (Derraik 2002, Barnes, 2005). 2.3 billion pieces were recovered from Southern California beach over 72 hours, which weighed 30,500 kg. The majority being foams such as polystyrene (71%) followed by miscellaneous fragments (14%) pre-production pellets 10% and whole items 1%. 81% of all plastics were between 1 and 4.75mm.

As per the estimate by Central Pollution Control Board (CPCB) the plastic consumption in India, is 8 million tons per annum and about 5.7 million tons of plastic is converted into waste annually (Rathi, 2006).The increase in production and consumption of plastic materials results in a constant plastic waste increase (UNEP, 2009). As a consequence in 2007, more than 250 million tons of plastic waste was produced (Jovanovic et al. 2009). Plastic materials are predominantly not biodegradable and having a low density makes them unfit for disposal in landfills (Aguado et al., 2007). Norway and Switzerland produced about 24.9 megatonnes of plastic waste (Mudgal *et al*., 2011). In 2009, around 230 million tonnes of plastic were produced and about 25% of these plastics were used in the European Union (EU) (Mudgal *et al*., 2011). This global figure has been increasing by an average rate of 9% since 1950 to a peak of 245 million tonnes in 2008. Polybags and other plastics items except PET in particular have been a focus, because it has contributed to host of problems in India such as choked sewers, animal death and clogged soils (PESD 2007)

Future application for plastic increases and its use continues to grow in developing and emerging economies (Global Industry Analysts, 2011). Without appropriate waste management, increased plastic waste, will add to the back log of plastic waste already in existence. There is no agreed figure on the time that plastic takes to degrade but it could be hundreds or thousands of years (Kershaw et al., 2011).

As per the EU studies, suggested, increased use and production of plastic in developing and emerging countries is a particular concern, as the sophistication of their waste management infrastructure may not be developed at an appropriate rate to deal with the increasing levels of plastic waste. Increase in temperature and environmental conditions may affect the degradation of plastic into secondary microplastics or the release of chemicals contained or transported on plastic waste. Secondary microplastics are those formed from breakdown of larger plastic materials (Arthur et al., 2009).

Plastic waste is a global problem, but with regional variability. One source of air pollution is burning of plastic waste in the open field and warming up of the surrounding air. This is also true for plastic waste in the marine environment in terms of water pollution and liberation of chemicals contained.

The property of plastic makes it so valuable and also its disposal becomes problematic, such as its durability, light weight and low cost. Most of the time, plastic is thrown away after usage; hence being durable they persist in the environment. Plastic has become ubiquitous and India is no exception. Most of the times, the Municipal Solid Waste (MSW) containing about 10-12% of plastic is burnt, releasing toxic gases into the environment which include substances like Dioxins, Furans, Mercury and Polychlorinated Biphenyls. Only few studies on the impact of such toxic gases have been performed in India. Landfills have contributed to nearly 20% of Green House Gases (GHG) followed by fossil fuels. Currently, landfills are overloaded with waste dumps and wastes being burnt along with plastic bags are posing health risks. An immediate measure to address them is the need.

Plastic waste has the ability to attract contaminants, such as persistent organic pollutants (POPs). This is so in the marine environment since many of these contaminants are hydrophobic, plastic could potentially act as a sink for contaminants, making them less available to wildlife, particularly if they are buried on the seafloor.

Biomass accumulation on the plastic or biofouling is likely to increase the density of plastic. Plastic contains chemicals or additives to give it certain properties. There is a wide range of additives, but probably the most relevant