Plastic Waste, Health & Climate Change: Issues & Challenges of Odisha

Purna C. Mahapatra[1], Basanta K. Sahu[1], Amit K. Mohanty[2]

[1]Research Associate, [1]Sr. Scientist, [2]Sr. Research Fellow, Climate Change Cell, Forest and Environment Department, Kharavela Bhawan (Secretariat Building), Government of Odisha, Bhubaneswar, Odisha

Abstract

The population of Odisha is near about 41 million according to the 2011 census. The total area is 155.707 square kilometer which is the 4.8% of total area of India. Various activities such as construction, packaging, infrastructure, communication, mines, entertainment, agriculture and textiles uses plastics because for its low cost, best choices for packaging, durability and easy availability. Last few years, the consumption pattern and life style of people of Odisha has gone up due to change in socio-economic conditions. This, in return generates huge quantities of plastic waste. This quantum of plastic wastes become dangerous to environment (have adverse effects on health and climate) and need to be handled properly for its disposal.

Key words: *Plastic, Waste, Health, Climate,Environment*

Introduction

Plastic is the great creation of human being which changed the whole world and made the life smooth. Because of its high strength, lightweight and lesser cost, this man made material became a part in every sphere of human existence. Variety of the sectors (Industry) such as construction, infrastructure, automotive, communication, entertainment, agriculture, packaging and textiles uses it because for its better benefits. Generally, plastics are the polymers produced by the conversion process of natural products or by chemical reactions of the monomeric unit primarily synthesized from oil, natural gas or coal joined together by chemical bond to form a long chain of polymer of plastic [13]. Due to rapid growth of urbanization, population & industrialization, the consumption of Plastic increased day by day tremendously [9] and this plastic products now becomes very popular both in rural and urban areas globally.

Plastic Production and Trends

The rapid rate of development has led to increase in consumption of plastic products. Much of the growth in plastic production is driven by single use or disposable applications. Nearly 50 % of plastic used are single used products. The use of plastic in packaging both as rigid and flexible forms has been increasing. In India, the average per capita consumption of Plastic is about 11 kg, which are considerably one tenth uses of USA and one sixth of Europe [1]. Whereas average consumption is 28 Kg Globally (Fig 1). Having an estimation by the Ministry (Petroleum and Natural Gas), Government of India suggests that the per capita consumption of plastic in India would be doubled annually by 2022. Further World Economic Forum suggest that the consumption and production of plastic would increase drastically which leads generation of large amount of plastic waste and Green house gases which effects directly or indirectly to climate change.

Corresponding Author:
Purna. C. Mahapatra
E-mail: pcmbt007007@gmail.com

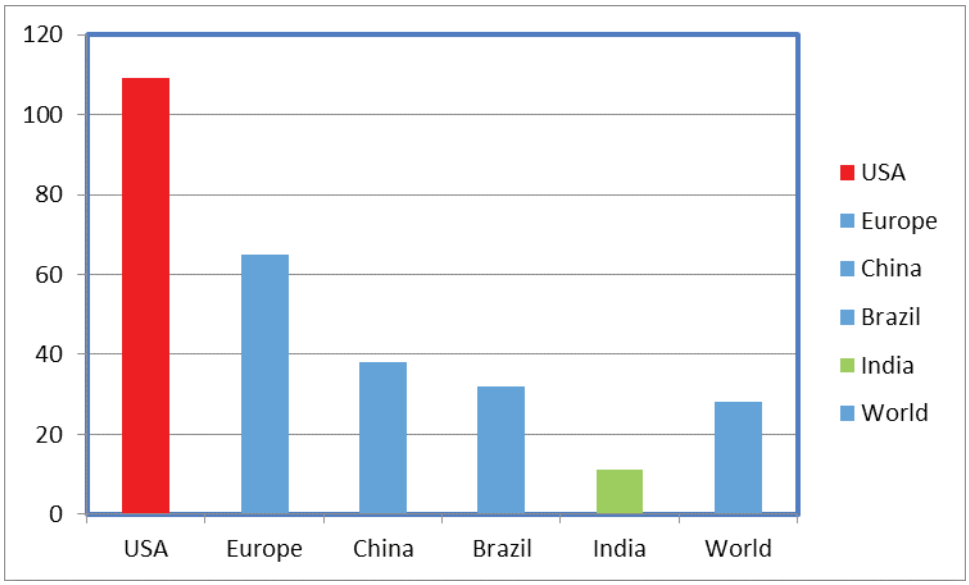

Fig 1 : Per capita consumption (Kg) of Plastics

Source: FICCI

Clasiffication Of Plastic

Basing upon the physical nature of plastic, it may be thermoplastic or thermosetting materials. Thermoplastic material can be softened or remolded by the application of heat where as thermosetting materials cannot be changed after their formation [6]. These are PET (Polyethylene terephthalate), HDPE (High-density polyethylene), PE (polyethylene), PVC (Polyvinyl Chloride), LDPE (Low Density Polyethylene), LLDPE (Linear Low Density Polyethylene), PP (Polypropylene), PS (Polystyrene) and PC (Polycarbonate).

Plastic and Environment

In spite of heavy demand, plastics are non-biodegradable and cause threat to the ecological system as they reduce the fertility of soil and thereby hamper the growth of plants, choke drains and sewer resulting in overflowing gutters and if swallowed by cattle, they may cause death by obstructing their intestine. The color pigments contaminate food products wrapped in them and cause health hazards and some of it are even carcinogenic. The plastic bags when discarded can get filled with rainwater offering ideal breeding ground for vector borne diseases like malaria and burning of plastics also releases most carcinogenic and toxic substances like dioxins, furans and hydrogen cyanide, which pollute air as well as cause severe and chronic health problems. Plastic products take hundreds of years for degradation [14], as they are not biodegradable like paper bags, they also block the rainwater infiltrating into the soil hindering recharge of ground water. In last decade, due to the widespread littering of plastics, which badly affects the quality of the environment by generating huge amount of waste on the land, has attracted attention of whole world [2].

Plastic and Its Adverse Effects on Human Health

It is estimated that, about 54 % of the world plastic production is Polyethylene and polypropylene [11], which is not only widely used for packaging but also for protecting, serving and disposing all kinds of consumers goods due to its non-biodegradable nature. There are several toxic materials are being secreted by the plastics and their additives. Among them, Bisphenol A (BPA) is most important. BPA has been associated with a number of health problems such as ovarian chromosomal damage, decreased sperm production, rapid puberty, rapid changes in immune system, type-2 diabetes, cardiovascular disorder, obesity etc. Some studies have also claimed that BPA increases the risk of breast cancer, prostate cancer, pains, metabolic disorders, etc. BPA in women and impaired health, including obesity, endometrial hyperplasia, recur-rent miscarriages, sterility, and polycystic ovarian syndrome [12 & 15]. Similarly PVC Causes Cancer, Birth Defects, Chronic Bronchitis, Ulcers, Skin diseases, Vision failure, Liver dysfunction. Polystyrene causes Eye, Nose and Throat

irritation, Lymphatic & Hematopoietic cancer for workers. Polyurethane Foam causes Bronchitis, Coughing, Skin & Eye Problem. Polyester causes acute Skin rashes, Eye & Respiratory tract infection and many more. The adverse effects of Plastics are enumerated in Fig (2).

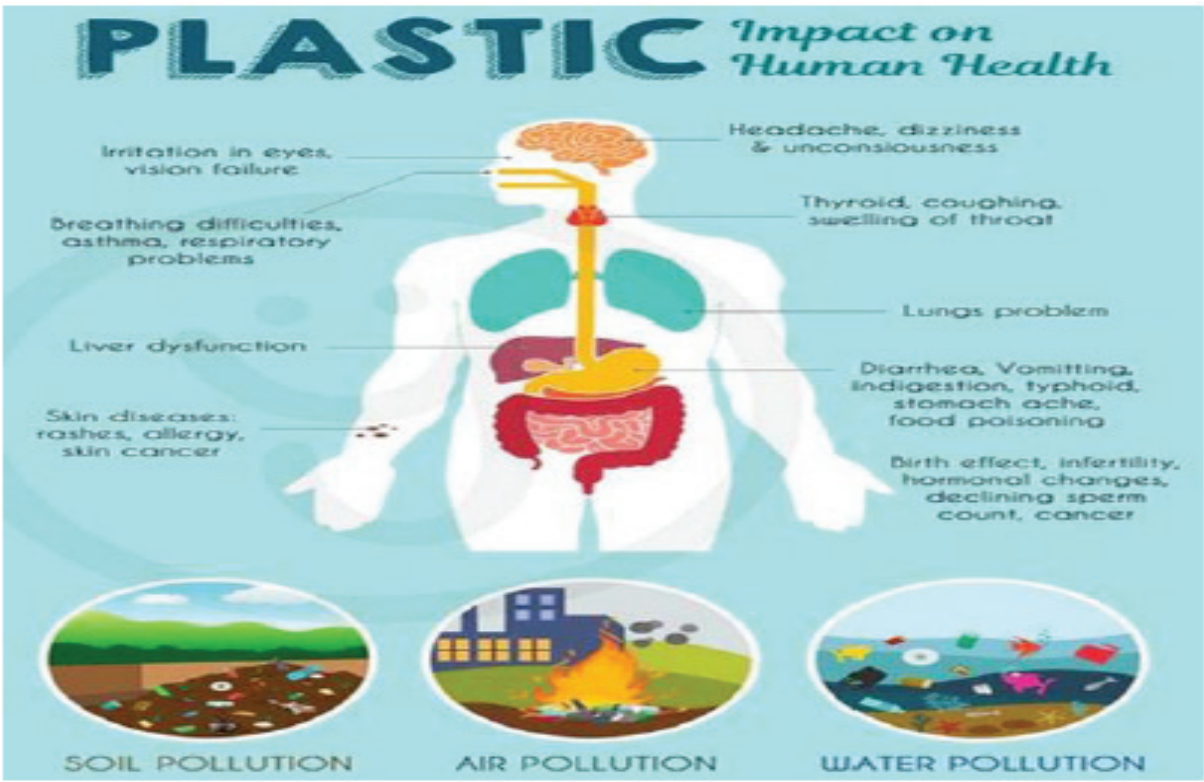

Fig 2: Impact of Plastics on Human Health

Plastic and Climate Change

Plastic when exposed directly to sunlight produces Green House Gases (GHGs) in to the atmosphere. Large volumes of plastic accumulating in Environment contribute to Change in Climate. In every stage of Plastic Life Cycle i.e. from manufacturing to decompose/ its management, emitting GHGs. Potential sources of GHGs from plastic to the environment are sludge of sewage treatment plants, waste water, leakage from plastic landfills, incineration fumes and global transport of chemicals from plastic. In addition to this, Methane is also emitted from waste dump and landfills, contributes largely for global warming [3]. Gradually the earth's and oceans atmosphere are getting warmer day by day. This warming makes worsen the climate variability. A report by the Tear Fund (2019) states that global plastic production emits 400Mt of greenhouse gases each year – more than the UK's entire carbon footprint. If the growth of plastic production continues at its current rate, by 2050 the plastic industry could account for 20% of the world's total oil consumptions which will indirectly/ directly contributes on Climate Change.

Climate Change Adaptation and Mitigation

Complete ban on plastic and its product is not going to solve the problem; efforts are required to get rid of the load already created in our environment. For this purpose, we can use the plastic waste in such a way which not only reduce the plastic waste load but also improve in quality of our environment. In this context, the plastic waste can be used for road construction, waste to oil, co- processing in cement kilns. The concept of 5'R principle i.e. Reduce, Reuse, Recover, Recycle and Refuse for plastic must have to be adopted in every sphere of our life- whether in home or in work place.

Management of Plastic Waste

Earth being the Home of thousands of living Organism, large amount of Plastic waste has increased the toxicity of the Environment which in turn leads to the death of Organisms. It is felt necessary that certain stringent steps are needed not only with regard to

regulating the use of polythene but also prohibiting the use of thermocol and similar plastic products in order to save the planet. Ministry of Environment, Forest and Climate Change, Government of India have enacted the Plastic Waste Management Rules, 2016 under the Environment (Protection) Act, 1986 (29 of 1986) restricting the use of certain plastic carry bags and containers and its management. The State Government, Odisha also having considered all the pros and cons of the issues have also restricted the indiscriminate use of certain types of plastic products in all municipal limits of the state. All Gram Panchayats in the state have adopted the "Bye Law on solid waste management in Gram Panchayats of Odisha 2019" which also includes management of plastic waste. It is a good sign that the State Government of Odisha has taken a proactive step to prohibit the use of single use plastics such as PET/PETE bottles, water pouch, and other single use disposable items in the premises of all the Departments.

Plastic Waste Management Rule, 2016

Government of India has noticed Plastic waste Management Rules, 2016 for effective management of Plastic waste in the country. The salient features are

i) Plastic waste, which can be recycled, shall be channelized to registered plastic waste recycler.

ii) Local bodies shall encourage the use of plastic waste (which cannot be further recycled) for road construction as per Indian Road Congress guidelines or energy recovery or waste to oil etc.

iii) Thermoset plastic waste shall be processed and disposed off as per guidelines issued from time to time by Central Pollution Control Board, New Delhi.

Role of various stakeholders in management of plastic waste in odisha

i) State Pollution Control Board, Odisha (SPCB, Odisha)

Ø Enforce of provisions of the said rule relating to registration, manufacture of plastic products, processing and disposal of Plastic wastes.

ii) State Government

Ø Creating awareness among all stake holders about their responsibilities.

Ø Discouraging to use of single use plastic among citizen of the state by sensitization / awareness campaigns programmes.

Ø Promoting the use of Plastic alternative materials such as jute & compostable bags.

iii) Associate Government Departments

Ø Ensuring segregation, collection, storage, transportation, processing and disposal of plastic waste.

Ø Ensuring channelization of recyclable plastic waste to registered recycler.

Ø Ensuring processing and disposal of non-recyclable plastic waste.

Ø Ensuring no open burning of plastic waste.

Ø Framing of bye-laws incorporating the provision of rules

Ø Setting up system, oprationalise and coordinate for waste management in the rural areas by ensuring segregation, collection, storage and transportation of plastic waste.

iv) Producer and Brand owner

Ø Ensure collection of used multi layered plastic sachets/ pouches/packaging material either through their own channel or concerned local body.

Ø Phase out manufacture and use of non recyclable plastic.

v) Waste Generators

Ø Minimize generation of plastic waste.

Ø Ensure segregation of plastic waste at source

Ø Hand over segregated waste to appropriate agencies.

vi) Non- Government Organizations

Organizing mass awareness campaigns in electronic media & print media.

Current status of management of plastic waste

The State of Odisha generates approximately 90138.98 (estimated by SPCB, Odisha for the year 2018-19) tons per annum (TPA) of plastic waste. Details, district wise plastic waste generation as for the year 2018-19 are enumerated in the Fig (3).

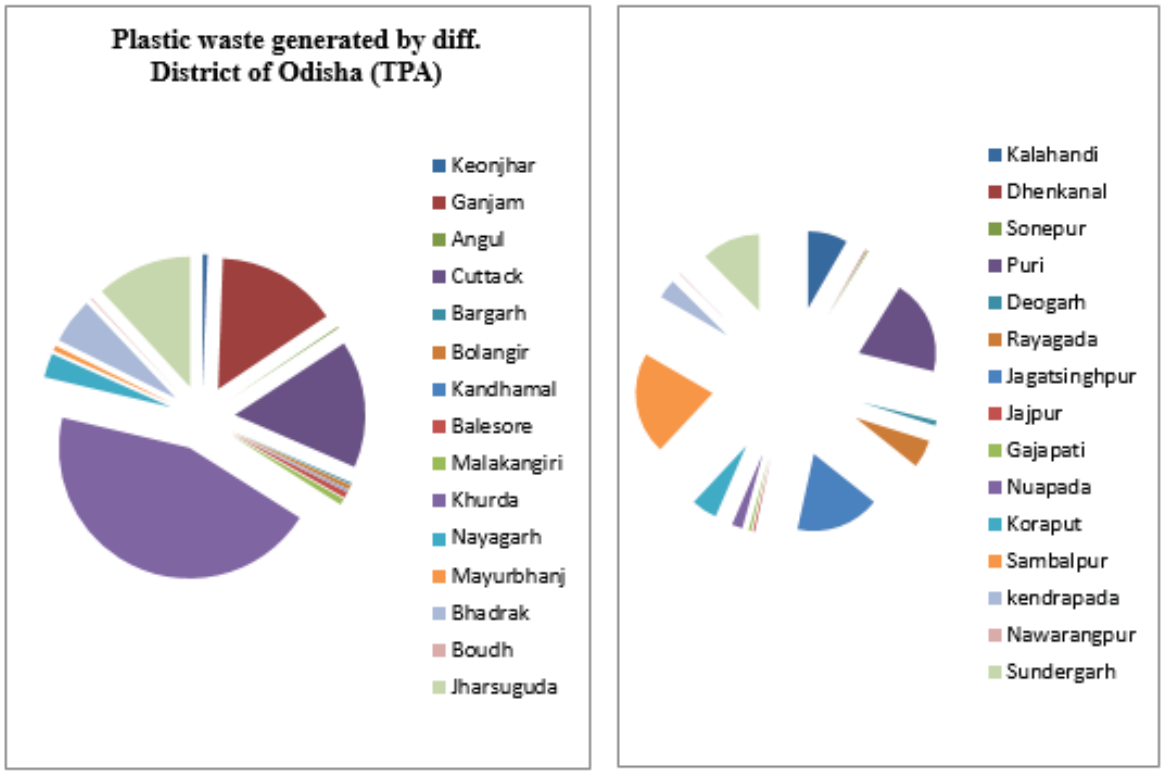

Fig 3 : District wise waste collection of the year 2018-19

Source: SPCB, Odisha

The status of registration of different category of plastic units is as under follows.

i) Recyclers

The SPCB, Odisha has issued registration under the Rule to one (1) number of plastic recycler as on 31st December, 2018.

ii) Producers / Manufacturer

The SPCB, Odisha has issued registration under the Rule to Seven (7) nos. of plastic product manufacturing units.

iii) Brand Owners

The SPCB, Odisha has issued registration under the Rule to Four (4) nos. of brand owners.

Status of utilization of plastic waste in odisha

48 Urban Local Bodies (ULBs), 132 Material recycling facilities (MRFs) have been set up in which plastic wastes are segregated and sent out for recycling.

A) In recycling –Plastic wastes are utilized daily by recycling process.

B) Road Construction-- 4.6 MT of Plastic waste has been used for construction of 9.6 K.M of road in Deogarh & Sambalpur districts of Odisha under Pradhan Mantri Gram Sadak Yojana by Rural Development Dept.

C) Waste to oil-- Consent to establish has been granted to M/s Hindalco Industries for establishment of polycrack converts of 0.5 MT/Day plastic to oil.

D) Co-processing of Plastic Waste in Cement Kilns–

Four cement plants have been identified for the purpose of co-processing and ULBs are advised to send the non-recyclable plastic waste to these cement plants. The quantity of plastics waste used by different cement plants is illustrated in Fig (4) in yearwise manner.

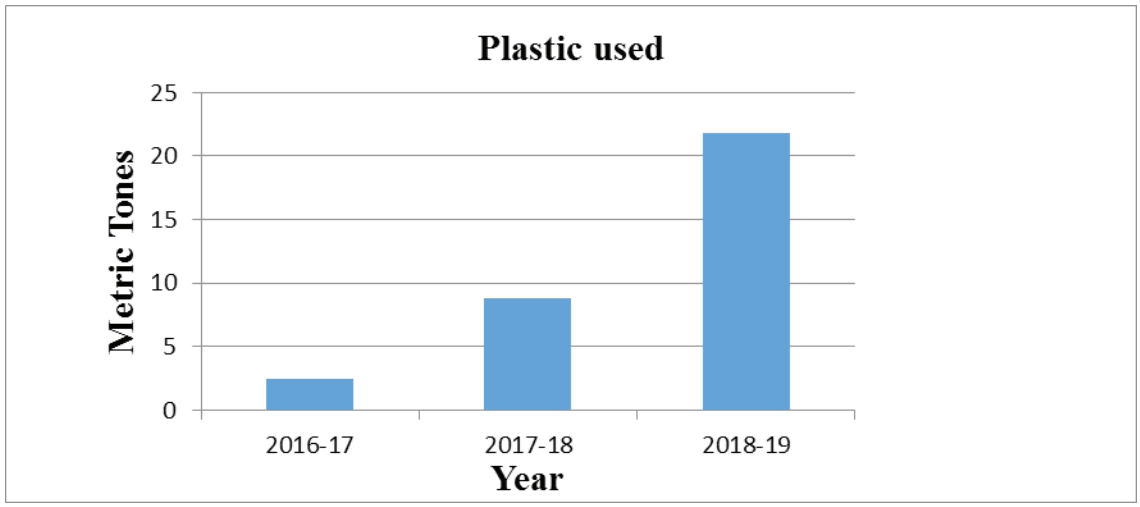

Fig 4: Year wise plastic used in cement plants in Odisha

Source: SPCB, Odisha

Discussion

Single use Plastics also often referred to as disposable plastics (use and throw items), are commonly used for packaging and include items intended to be used only once, before they are thrown away or recycled. Plastic bottles, jars, and container find their way into the reusing and recycling economy through informal chain of rag pickers and kabbadi wallahs or scrap dealers. But single use plastics such as bags, candy wrappers, tobacco and pan masala sachets, soap wrappers and shampoo sachets are either too difficult or not lucrative enough to collect. These plastic items then find their way into landfills, unauthorized garbage dumps or simply remain uncollected on road berms. Eventually, these single use plastic items clog rivers; pollute ground water and other water bodies [8]. They when consumed by animals find their way into our food systems.

It is well appreciated that while plastic is a much used material for a variety of products, it is the littered plastic waste that goes uncollected leading to an environmental hazard [5]. As we aware, these plastic wastes can be segregated and shredded to less than 4mm size and can be used for the construction of road with bitumen [7]. These roads have better resistance towards rain water and making road more durable. While on the other hand this will help to reduce plastic waste and reduce the use of bitumen 8 % resulting in major environmental benefits. Plastic waste can also be used in cement factories for co-processing as alternate fuel. So the option of utilizing plastic waste as alternate fuel may be explored.

Conclusion

The scientific way of management of plastic waste is highly essential to save our mother earth; otherwise its unscientific waste management practices would bring an unwarranted result to the environment. It is important that everyone should follow the mantra of 5 R's i.e. Refuse Reduce, Reuse, Recover and Recycle and in addition to this, should remember 6th R that is responsibility. Without understanding the term responsibility, effective plastic waste management is difficult to achieve.

Conflict of Interest: The authors have no conflict of interest to declare.

Ethical Clearance: In this research no cell-lines/ animals are used. So it's not applicable for ethical clearance.

Source of Funding: This is a part of climate change research and is being funded by DST, GOI.

References

1. Anonymous(2018):https://https://www.downtoearth.org.in/news/waste/an-indian-consumes-11-kg-plastic-every-year-and-an-average-american-109-kg-60745. Assessed, 4th Nov 2019.
2. Bhattacharya RR, Chandrasekhar K, Deepthi MV, Roy P, Khan A. Challenges and opportunities:

plastic waste management in India. Teri. 2016; 1-18.

3. Chandegara VK, Cholera SP, Nandasana JN, Kumpavar MT, Patel KC. Plastic packaging waste impact on climate change and its mitigation. Research gate, Book chapater.2015; 46: 404-15.
4. Anonymous(2019)http://www.cpcb.nic.in/waste/municipalwasteAssessed on 6thNov 2019
5. Gutberlet J, Uddin SMN. Household waste and health risks affecting waste pickers and the environment in low- and middle-income countries. International journal of occupational and environmental health. 2017;23(4):299-310. Epub 2018/06/21.doi: 10.1080/10773525.2018.1484996
6. Gwada1 B, Ogendi G, Makindi SM, Trott S. Composition of plastic waste discarded by households and its management approaches, Global Journal of Environ. Sci.and Management. 2019; 5(1): 83-94. DOI: 10.22034/gjesm.2019.01.07.
7. Jethwani S, Jha SA, Sangtiani D. Utilization & Specification of Plastic Waste in Bituminous Roads. International Journal of Engineering Research.2017; 6 (2): 91-94.
8. Kataoka T, Nihei Y, Kudou K, Hinata H. Assessment of the sources and inflow processes of microplastics in the river environments of Japan. Environ Pollut. 2019; 244: 958-65. Epub 2018/11/25 ,https://doi.org/10.1016/j.envpol.2018.10.111.
9. Mukhtar EM, Williams ID, Shaw PJ, Ongondo FO. A Tale of Two Cities: The emergence of Urban waste systems in a developed and a developing City. Recycling, 2016; 1: 254–270. doi:10.3390/recycling1020254.
10. http://ospcboard.org (Assessed on 5th. Nov. 2019)
11. Plastics Europe MRG (Marker Research Group). Business Data and Carts 2007, Status September 2008.
12. Proshad R, Kormoker T, Islam Md S, Haque MA, Rahman Md M, Mithu Md MR. Toxic effects of plastic on human health and environment: A consequences of health risk assessment in Bangladesh. International Journal of Health, 2018; 6 (1): 1-5. doi: 10.14419/ijh.v6i1.8655
13. Sangawar VS, Deshmukh SS. A short overview on development of the Plastic waste management: Environmental issues and challenges. Scientific Reviews and Chemical Communication. 2012; 2(3): 349-354.
14. Urbanek AK, Rymowicz W, Mironczuk AM. Degradation of plastics and plastic-degrading bacteria in cold marine habitats. Applied microbiology and biotechnology. 2018;102(18):7669-78. Epub 2018/07/12. doi: 10.1007/s00253-018-9195-y.
15. Verma SS. Roads from plastic waste.The Indian Concrete Journal, 2008: 43-44.