

CURRENT SCIENCE

Volume 121 Number 7

10 October 2021

GUEST EDITORIAL

Plastics – don't ban, but plan

The Industrial Revolution during the Anthropocene has resulted in total change in the pattern of living in the world. Industrial growth promoted urban development all over the world. Deforestation set in, while cultivated lands started being converted into housing and industrial plots. Urbanization resulted in the growth of concrete jungles around the industries. Growth of industries as well as infrastructure increased the demand for wood, glass, iron, cement and ceramics, which all led to increased exploitation of natural resources. Due to the growth of construction industry, the use of river sand increased manifold. Mining and processing became intense; easily winnable mineral resources became scarce. These modern developments have created environmental problems like global warming, pollution of air, water, land, sea and even space. There are 8.4 million species living on earth. Humans are just one of them. Each species finds its own space for living in nature. Some live in the forests, some in the mountains, some others in the rivers or seas, and their living conditions are related to their place of living. Modern development has interfered in their way of living due to change in environmental conditions. The plant kingdom which supplies food also maintains the temperature, and brings rain; and today plant biodiversity is getting disturbed. The living conditions of sea animals and marine plants are disturbed due to pollution of the sea. Everywhere the contributor is the human species. While the sapiens rule the world, many other species are becoming extinct. Man has only been exploiting nature and indiscriminately utilizing the natural resources. He thinks that science has an answer to everything, and he can deal with anything. However, the present circumstance has deflated this human arrogance.

Against this background, the emergence of plastics is being seen as yet another major polluter. However, use of plastics in the post-World War era may be considered as an attempt at safeguarding the natural resources. Use of plastics in various fields of engineering, packaging, healthcare, aerospace, automobiles, etc. can be gleaned as a revolution that has led to saving of our forests and mineral wealth. Application of plastics in the post-World War era as an engineering material led to the substitution of wood, metal, glass and ceramics, etc. which were all dependent on natural metallic and non-metallic mineral raw materials. Plastics in the packaging industry substituted/

replaced materials like paper, paper boards, wood containers, etc. and helped reduce deforestation. Plastic packaging also helped in better preservation of food, increasing the shelf-life of many materials. Plastic furniture to a significant extent replaced wooden furniture. Plastic bonders have found wide application as desired adhesives. Plastics are the poor man's need and the common man's friend. The role of plastic in electrical and electronic industry speaks volumes about its importance. At this point, it should be appreciated that plastics may be considered as an environment-saver, not as a pollutant. Even in the present COVID-19 pandemic, plastics have proved important; they are used in personal protective equipment, masks and other gadgets. It is necessary to understand that the emergence of plastics has made human life better and is helping safeguard natural resources. To me it appears that plastic is like a gift of God.

Today, we also see that the same plastics are responsible for various problems like water clogging in canals, pollution of air and water because burning and dispersal of microplastics are affecting living conditions. This problem is observed more in the case of single-use plastics (SUPs) – the throw-away plastics, throughout the world. The whole world is considering a ban on SUPs to solve the plastic problem, although it may affect thousands of industries and way of living of common man. The Governments are taking various steps in this regard and our own Swachh Bharat Mission has become very handy in this respect. In the meantime, successful attempts have been made to find use for waste plastics which may add value to them, resulting in the reduction of throw-away plastics.

Waste plastics are useful as a structural material and can be utilized as a binder for laying roads, making of blocks, table-tops, etc. These products have shown the potential for recycling or reuse of waste plastics to reduce pollution. The school of Research at the Thyagarajar College of Engineering (TCE), Madurai, has developed a novel technology to use waste plastics for road construction, and for developing different structural materials. Waste plastic-coated stone aggregate is mixed with bitumen and used for road construction. The plastic material used for this process includes carry bags, chocolate covers, biscuit covers, food packing material – both single and multi-layer (size 2–4 mm and thickness less than 80 μm). The shredded plastic is added over hot stone (heated to

170°C) where it melts with no gas expulsion (which occurs when plastic is decomposed) and is coated over the stone. This is mixed with bitumen (at 160°C) and the mixture is used for road-laying. Here, plastic is added to an amount of not less than 10% of the weight of bitumen. Thus equivalent amount of bitumen is saved. For example, a 20 mm thick, 1 km, single-lane tar road can utilize 1 tonne of waste plastic (which is approximately equivalent to 1,000,000 carry bags) and 9 tonnes of bitumen. Roads with the above asphalt and molten plastic mixture are doubly strong (Marshall Stability Value – 17 KN) and do not develop potholes even after 10 years; so there is no maintenance expenditure for at least a decade. India has about 4.6 million km long multi-lane roads. To convert them into plastic tar roads, we need not less than 10 million tonnes of SUPs/waste plastic. According to the data provided by the Central Pollution Control Board, in India we generate around 1 million tonnes of waste plastic annually. On the one hand the technology is useful and on the other the entire waste plastic can be used.

The plastic tar road technology has been recognized by the Indian Roads Congress and given coding (SP 19 – 2013) for laying the roads in the country. TCE has been recognized as a resource partner of the Ministry of Environment Forest and Climate Change (MOEF, C&C), Government of India (GoI) for plastic waste management under the ENVIS scheme. Now the Government has declared that it will be laying plastic roads on highways and rural roads to the tune of a million kilometres. Almost all the states of the country have started implementing the technology and Kerala, Tamil Nadu, Madhya Pradesh and Meghalaya have taken the lead. This reuse of waste plastic has revolutionized the road technology. There is demand for this technology from overseas as well. In India, more than 1.5 lakh km roads have been laid by Pradhan Mantri Gram Sadak Yojana (PMGSY) and MOEF, C&C, GoI. Even border roads are using this technology.

Another technology developed in TCE is the innovation of a structural material called plastone (a synthetic granite). This has been developed using waste plastic and solid waste like granite stone, ceramics, limestone, concrete debris and other industrial solid wastes. Plastone can be shaped as tiles, table-tops, hollow blocks, etc. A 1' × 1' × 1" block needs not less than half a kilogram of waste plastic (about 15 PET bottles). It can be used as pavement blocks in lawns, for canal lining, as portable speed breakers and so on. Using these tiles, toilets can be constructed in just 2 h at a low cost of about Rs 12,000. This year's central budget includes the construction of two crore toilets and if plastone is used, we need 1 crore tonnes of waste plastic/SUP for plastone products.

Waste plastics are also used to make corrosion-resistant iron rods, leak-proof roofing sheets, e-waste modified bitumen, etc. Hence, reuse technologies have been well-established.

Indian roads need 100 lakh tonnes of waste plastic and plastone toilets need another 100 lakh tonnes. Thus, all the

waste plastics available and newly produced SUPs can be used.

Plastic materials find various uses in all walks of life, and waste plastics have become a great resource for road construction and for structural materials. However, the problem lies with the way we manage solid waste, including used plastics. The public should consciously learn to use double-bin system and dispose waste plastic separately. School students can be educated by creating awareness about future problems that might arise from waste plastics. They will spread the culture of segregating plastics at home before disposal. Similarly, hotels and community halls should properly segregate plastics while disposing garbage. The industries which manufacture plastic materials have the responsibility to collect waste and help the administration. The administrators and the Government officials should effectively enforce orders relating to proper waste disposal. Industries should be compelled to work under the norms of extended producer responsibilities. They must be made to realize that it is their bounden duty to collect and use waste plastics and help in reuse and contribute to keeping the environment clean. The civic bodies should sincerely consider developing a proper system for the collection of waste and deposit it at the reuse/recycle centres. The Government can use unemployed graduates, NGOs, and other groups to make the system effective. Self-help groups (women) can get involved in this, as has been done for example in Tamil Nadu. They may be given financial support to set up centres for collecting waste plastics and supply the shredded plastics to the reuse centres.

Properly used plastic is a great friend and not a foe. Plastic is not bad; it is our poor garbage disposal culture that is creating the problem. If we think positively and use the plastic waste, we can make the environment better. Let us educate ourselves on circular economy.

While we develop clean habits of plastic waste disposal, we should also do more research to develop bio-decomposable polymers, use non-toxic additives and plasticizers, and multi-packet systems instead of multilayer plastics. Together with the right focus, the problem can be solved.

Let us re-educate ourselves. Expansion of mind is the way of life. Let us accept the reality and work together for the betterment of the environment. We must understand the importance of plastics. Our watchword should be 'not to ban, but to plan'. Banning plastics is not the solution. By developing a proper system of reuse and by proper planning, we can solve the problem of plastic pollution.

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