Plastics – Boon or Bane?

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Introduction

During the last few years, the world has witnessed many anti-plastic movements by activists/environmentalists vigorously asking people to stop using plastics that this movement today has degenerated into a 'hate plastics' crusade. World media patronage providing ample adverse publicity to a false cause makes people with insufficient knowledge about technology believe that plastic in all forms is bad for public well-being and environment. The Government of India's pledge on the World Environmental Day (2018) to 'Beat Plastic Pollution' and win global acclaim by eliminating virtually all sort of single use plastics (viz., carry bags, cups, plates, cutlery, straws, etc.) by 2022, makes it all the more unrealistic and counterproductive in the long run. Launching a full-fledged anti-plastics campaign without making a distinction between various plastic types and its application only contributes to a wrong impression emotionally controlling people to reject all plastics forms and simultaneously branding plastic manufacturers and users as polluters.

Plastics and its varied use

Polyethylene terephthalate (PET), high density polypropylene (HDPE), low density polypropylene (LDPE), polypropylene (PP), polycarbonate (PC), polyvinyl chloride (PVC), polystyrene (PS), polyacetal (PA), etc., are the plastic types popular around the world for different application's viz., construction materials (pipes, fittings, etc.), agriculture, fishing nets, medical diagnostics, packaging, electronics and telecommunications equipment's, etc. Today, plastics play an integral indispensable part in many industrial processes plus product economies and perhaps with some exceptions it is impossible for modern people to live practically a normal life without them. Despite propagation of their poor image, plastic demand continues to rise worldwide and so avoiding plastics is neither technologically probable nor economically viable, for humans a fact that anti-plastic activists/environmentalists must recognize soon.

Plastics pollution and disturbing trends

Plastics are non-biodegradable albeit a positive aspect in several applications even though anti-plastic activists/environmentalists propagate it as a negative facet stating its presence in elephant dungs, in the stomach of cows, floating waste dumps in oceans and reservoirs, plastics exuding out of ruptured dead fish belly, electronic waste and packaging materials dumped and leaking everywhere. Rightly, a plastic product does remain in same shape and size for a thousand years hence without degrading in landfills and release carcinogenic vapors on incineration but this fact only adds to the clutter. No doubt, plastics as waste material is an issue, however the question we need an answer is for an equally efficient and convenient plastic substitute and an effective alternative mechanism to prevent dumping or burning plastic wastes.

Search for alternatives

Several researches in the quest to develop and produce plastic substitutes like polylactic acid biopolymers, starch blended polymers, etc., are progressing around the world, however they are still in the evolutionary developmental stages not commercially available or adequate to totally replace conventional plastic items. Furthermore, to effectively equal the efficiency and utility aspect of plastics at a reasonable cost of production are challenges scientists are grappling through until date.

Condemning the use of single use plastics by putting in place a regulatory charter without any concrete alternative plan or availability of substitute products, is most likely to meet practical problems soon, forcing the entire anti-plastics campaign to temper reform and eventually fizzle out. Currently the demands of single use plastics are so high that replacing them with paper, jute or cotton is near impossible due to their own limited availability. Ironically, nylon, polyester staple fiber, polyester filament yarn, etc., that are cotton and jute substitutes in India are non-biodegradable in nature giving a feeling that the authorities are carrying out the entire strategy to ban plastics in empty space.

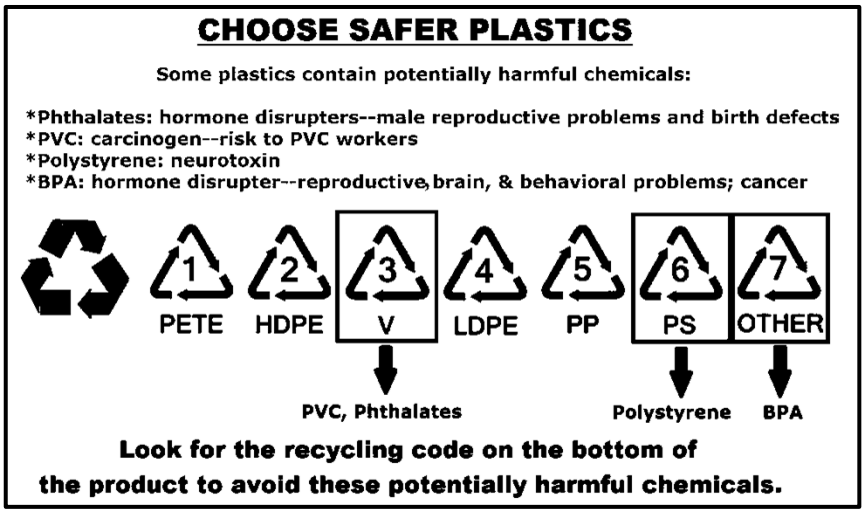
Recycling and reuse

The fundamental concern with plastics is not its specific first use, but our inherent inability to recycle and reuse after its utility is complete. The world is yet to launch a pragmatic massive campaign to recycle plastics even though isolated small capacity unit efforts are on. Surprisingly the world is currently recycling just 12% of all plastic wastes for reuse, with the remaining either incinerated or sent to landfill dumps – a valuable resource lost forever. In fact, if the current 2016 plastics demand of 260 metric tons continues to rise as of today then, in 2030 the demand will be of 460 metric tons, taking the even now serious global plastics waste volume problem to a high new level.

All materials flowing in this universe follow either a biological or a technical cycle. In the biological cycle, waste from one is food for the other next and in a technical cycle, keeping items at its highest value by recovery and restoration of products components and materials by reuse through repair is the norm. Recycling in this case is the available last preference. Incineration and landfills dumps should be the last option for disposing waste plastics (a valuable resource) in India, as we need land to grow food for our ever-enlarging population. Circular or cyclic plastics economies with minimization or elimination of waste preventing pollution and regenerating natural systems by involving all stakeholders is imperative to control plastics waste. Frugality is deep-rooted in Indian beliefs and philosophy that makes it all the simpler for the Government authorities to create consumer awareness on plastic reuse. Laterally we should also clearly emphasize the creation of infrastructure facilities to collect, reprocess and reuse waste plastics minus unjust draconian rules and regulations.

Mechanical and chemical recycling

Waste collectors, aggregators and recyclers the key functionaries in waste plastics processing are all responsible for success in mechanical and chemical recycling that could curtail annoying



environmental waste plastic leakages and without doubt, all would require liberal financial support to succeed. Mechanical recycling technologies currently are sizeable businesses; however, they are nowhere in scale on comparison to the conventional plastic industry. Moreover, it primarily focuses only on PET; HDPE & PP. Mechanical recycling of PVC, LDPE and PS is only miniscule due to several technical challenges and waste collection difficulties. Some typical mechanical recycling technologies include conversion of used PET bottles into flakes further depolymerized and trans-esterified to an upgraded polybutylene terephthalate polyester for automotive applications and the successful use of plastics wastes in road construction projects.

We classify chemical recycling efforts into two specific categories viz., monomer recycling (i.e., of condensation polymers like PET & polyamides) that could also forestall the need to build capital-intensive monomer plants and reprocessing of plastic wastes to liquid hydrocarbons through pyrolysis that can effectively dislodge naphtha or natural gas liquid demand, be more resilient to crude-oil price fluctuations also be profitable. The biggest advantage of cracking technology is its ability to handle mixed plastic wastes that have already exhausted their potential for mechanical recycling.

India can benefit

India one of the most populous countries in the world is also one of the leading plastic waste creators. The demand for plastics and the quantum of plastic wastes will only grow as our country's living standards improve over the years. Exploiting the plastic recycling technologies will therefore certainly prove beneficial, reaping substantial potential profits.

Right policy intervention and active participation of stakeholder's viz., producers, converters and consumers, it is probable to recycle and reuse plastic waste by either means to as much as up to 50% of the total production within a decade reducing not only new oil demand for petrochemical production but also make way for a cleaner environment. This brings us back to our title question, "Are plastics boon or bane?" All will agree that using plastics in its various forms is indeed a boon for us, although its disposal has become an agonizing bane. Pending apt alternative stratagems or policy measures and without any tangible development of biodegradable plastic substitutes, the anti-plastic campaigns will only linger as a sensational topic both for the media and the so-called activists and environmentalists to milk out some more intermittently consistent undue profile-raising publicity.

CLASSIFICATION OF PLASTICS FOR CONSUMER ITEMS

Symbol - Code Name	Description	General Properties	Common Uses
1 **Polyethylene Terephthalate PETE**	Commonly recycled. It sometimes absorbs food odours and flavours from foods and drinks stored in them.	Good gas & moisture barrier properties, high heat resistance, clear, hard, tough, microwave transparency, solvent resistant.	Household items like soft drink beverage bottles, medicine jars, ropes, clothing and carpet fibre, pre-prepared food trays, roasting bags, boil in the bag food pouches. Some shampoo and mouthwash bottles.
2 **High-Density Polyethylene HDPE**	Safe and not known to transmit any chemicals into foods or drinks. Commonly recycled. NEVER safe to reuse an HDPE bottle as a food or drink container if it did not originally contain food or drink.	Excellent moisture barrier properties and chemical resistance, hard to semi-flexible and strong, soft waxy surface permeable to gas, HDPE films crinkle to the touch, pigmented bottles, stress resistant.	Milk containers, motor oil, shampoos and conditioners, soap bottles, detergents and bleaches, etc.
3 **Polyvinyl Chloride PVC**	Sometimes recycled. PVC should not encounter food items, as it can be harmful if ingested.	Excellent transparency, hard, rigid (flexible when plasticised), good chemical resistance, long-term stability, good weathering ability, stable electrical properties, low gas permeability.	Credit cards, Carpet backing and other floor covering, window and door frames, guttering, pipes and fittings, wire and cable sheathing, synthetic leather products, etc.
4 **Low-Density Polyethylene LDPE**	Sometimes recycled. A very healthy plastic tends to be both durable and flexible.	Tough and flexible, waxy surface, soft – scratches easily, good transparency, low melting point, stable electrical properties, good moisture barrier properties.	Films, fertiliser bags, refuse sacks, packaging films, bubble wrap, flexible bottles, irrigation pipes, thick shopping bags, wire and cable applications, some bottle tops/caps.
5 **Polypropylene PP**	Occasionally recycled. PP is strong and can usually withstand higher temperatures.	Excellent chemical resistance, high melting point, hard but flexible, waxy surface, translucent, strong.	Most bottle caps, ketchup and syrup bottles, yoghurt containers, potato crisp and biscuit wrappers, crates, plant pots, straws, lunch boxes, refrigerated containers, fabric/carpet fibres, heavy-duty bags/tarpaulins.
6 **Polystyrene PS**	Recycled (difficult).	Clear to opaque, glassy surface rigid or foamed, hard brittle high clarity, affected by fats and solvents.	Yoghurt containers, egg boxes, fast food boxes and trays, video cases, vending cups and disposable cutlery, seed trays, coat hangers, low cost brittle toys, packing foam, etc.
7 **OTHERS**	Difficult to recycle. Miscellaneous types of plastics not defined by the other six codes. Polycarbonate (PC) finds use in baby bottles, compact discs and medical storage containers.	Many OTHER polymers exist that have a wide range of uses, in engineering sectors. They have the number 7 and OTHERS (or a triangle with numbers from 7 to 19).	Nylon (PA), Acrylonitrile butadiene styrene (ABS), Polycarbonate (PC), Layered or multi-material mixed polymers, etc.