

Degradable plastics: can it reduce plastic waste?

During the last several decades' plastics products have invaded almost every sphere of human activity, and indeed have become an indispensable commodity in our lives. Plastics have slowly & surely substituted conventional materials such as wood, rubber, leather, and metals, and have contributed in some measure in conserving the fast depleting forests and ore deposits.

Experts have estimated that 6,000 tonnes of plastic furniture saves 14,000 cubic meters of wood that is available from 32,000 hectares of forests. In many cases plastics have outperformed certain other materials in terms of durability and energy consumption. For example PVC pipes last longer as compared to metallic ones and consume less energy to produce. This wonder material can be seen in the form of polythene carry bags, toys, pipes, furniture, electronic and automobile accessories, communication and even in the medical field.

The downside of this mass scale use is the alarming increase of plastic waste accumulating in the environment. Plastic products are petroleum-based and composed of long polymeric molecules, which are too tightly bonded to be easily broken down by natural decomposing organisms such as bacteria and other microorganisms.

In other words, traditional plastics are non-degradable and thus accumulate in waste collections. In addition to this, some plastics generate toxic gases when incinerated or burned, thus adding to environmental pollution.

This is particularly acute in the case of chlorinated plastics such as PVC, (in cling films), PVDC (Saran) in packaging material, etc.

Several action plans have been put in place in different countries to mitigate this problem; the most widely practiced being recycling of plastic wastes. This could solve the problem to some extent, since most plastics can be recycled into useful products. However we know that in Sri Lanka, plastics are still a very visible contributor to environmental pollution. What then is the solution? Although there is no magic answer to this, research efforts are now focused on finding suitable substitutes for traditional plastics, which are degradable and hence will not contribute towards the waste build up.

Degradable plastics have been in existence for some time. However, due to several reasons, some of which are given below, they have not replaced traditional plastics in the mass market.

At this point it is perhaps pertinent to draw a distinction between degradable and biodegradable, as they are often used synonymously.

Degradable plastics is the general term used for those plastics which can be broken down to simpler substances by some means, and therefore unlikely to persist in the environment, while biodegradable plastics are specifically those plastics which are broken down by the action of living organisms.

The latter are usually made from renewable plant and animal material such as starch, cellulose, collagen, casein, plant proteins, polyesters and triglycerides. Recently some manufacturers have claimed that they have developed completely synthetic plastics materials, which are eventually biodegradable.

Degradable plastics can be of three types. The first type is based on organic material such as starch and they need water and microorganisms to initiate their breakdown and are known

as 'hydro - bio degradable'. The second type which was more recently introduced are those, which do not need water to degrade and are 'oxo - bio degradable' plastics. The third type can degrade even in the absence of microorganisms. The degradation of plastics can be triggered by one or several factors such as microorganisms like soil bacteria, heat, air or oxygen, ultraviolet light (from sun light) or even mechanical stress.

One of the major forms of plastic wastes in Sri Lanka are the ubiquitous plastic or 'sili-sili' bags, and other packaging material, which are also responsible for blockage of drains, death of animals through ingestion, and constitute an environmental eyesore. With a view to mitigating this problem to some extent, some companies in Sri Lanka have already commenced the manufacture of degradable plastic bags.

While they should be lauded for their initiative, some thought should also be given to certain questions, which could arise, and these questions should be tackled. For instance, in the case of bags, how does one ensure that the bag does not start degrading before the contents of the

bag are disposed of? Particularly in packaging, where the packaging material is expected to protect the contents, it is imperative, that the outer covering only degrades once the contents are used up or removed. The 'sili-sili' bag must degrade only after it reaches the drain or garbage dump. So can the time and conditions for degradation be controlled? Yes, to some extent as the disintegration speed and intensity will depend on the additives incorporated into the plastic during manufacture.

However, the necessary conditions such as heat, sunlight, or microorganisms must also be present and this constitutes a practical problem, since these factors are not under our control.

Manufacturers cannot predict the lifetime of the bag, and also the approximate weight it could carry, since the usage conditions like exposure to sunlight, heat and time under mechanical stress are beyond their control. Another problem could be that during the process of degradation, which could take several weeks, the harmful effect on animals, drain blockage and flooding could still occur.

On the negative side

again comes the release of gases such as methane, in the case of degradable polythene, which is a greenhouse gas and contributes towards global warming and is thus environmentally harmful.

In this context another problem that could arise assuming that degradable plastics are used in large scale, is what would it do to our rapidly growing plastics recycling industry? If degradable plastics get into the mainstream of recycled plastics, what would the fate of products made out of recycled plastics? Invariably we could expect the products to degrade but we will not know when this will happen. We might find bottle lids or plastics hangers or crates (made out of such recycled material) slowly disintegrating while in use.

Some manufacturers in the West claim that they have already come up with a solution whereby, if the degradable plastic finds its way to a recycling plant, then the degradation step is arrested.

Such claims need to be examined thoroughly before such degradable plastics are introduced into the country.

But while all this strikes a note of pessimism, this does not mean that degradable

plastics are not usable.

On the contrary, for certain specific applications they would be ideal. One such application is in garbage disposal bags and agricultural films and pots where the product could be programmed to self-destruct under controlled conditions.

What more could we do to reduce the plastic waste accumulating in our environment? Simplistically, polythene bags, which are commonly used to day, could be made thicker and more expensive, so that reuse is encouraged. Some countries have also specified the minimum thickness of polythene that could be manufactured, to reduce the number of bags that could be made.

Thinner the film, easier it is to be disposed, and also more difficult to reuse. In the last Cabinet paper put up by the previous Minister of Environment, Sri Lanka too had plans to ban polythene below 20 microns in thickness. But this legislation never saw the light of day. But it is imperative that a national policy be implemented for plastic waste disposal.

The Municipal Council in Colombo has already set in place a collection meth-

odology whereby each household is provided with different bags for the collection of plastic, paper and food wastes. These are sent to central collection centres.

Recycling plants for plastics have already been set up in different locations by several organizations. These activities should be extended countrywide.

Cannot these degradable plastics then solve our immediate environmental problem? Together with other programs outlined above, combined with a nationwide awareness campaign to educate the public on the environmental hazards caused by waste plastic materials and backed by a strong national policy and action plan, yes, it can certainly mitigate it in some measure. But what we should understand is that degradable plastics, at present, are neither a quick and easy solution to the environmental problems nor a substitute for the traditional plastics. The solution is more difficult, but it must be addressed bearing in mind that the polluter is not the plastic but the people that dispose the plastics and other waste indiscriminately. The 'onus' is 'on us'!

(Industrial Technology Institute)