Introduction
Plastic, the most versatile and wonder material, is the product of spectacular developments in the area of polymer science and technology. The penetration and acceptance of plastics into the social fabric is so high that it is now difficult to conceive a world without plastics. It is hard to trace out any area where plastics is not used, which ranges from variety of carry bags to day-to-day home utensils and appliances, varied industrial products including airplanes and artificial organs including artificial heart valve. Needless to say that plastics have reached such a stage that human survival cannot be ensured without their use. Plastic industry has grown rapidly and plastic materials are now unavoidable ingredients in every aspect of modern life.

Plastics come under the larger area of polymers, which are now considered one among the trinity of material systems: metals, ceramics and polymers. Although they are not as strong as metals and they cannot survive extreme temperatures, they outclass all other materials in their low density, strength to weight ratio, low corrosion rate and excellent barrier and surface properties. The ease with which they can be processed into a variety of products of intricate shapes and sizes place them at a high advantage over metal and ceramics. Especially, their low cost makes them highly competitive and gives them an enviable position in comparison to metals and ceramics. In terms of its usage, plastics has surpassed that of metals and ceramics and in many cases, replaced them. Plastics have become accepted in our every day life as a result of its wide use as packing material. Today, nearly 20% of packing is of plastic. The commonly used plastics in packing are polyethylene, poly propylene, polystyrene and polyvinyl chloride and to a limited extent polyethylene terphthalate. The total consumption of plastics in India is around 3 million tones and the waste produced is about one million tones.

The very factors that popularize plastics in our modern life are in fact a threat also to our very survival. The extreme durability of plastic defies the natural recycling process of the biosphere. Chemically, it is the most non-biodegradable material man has ever produced. Therefore, it is beyond any sort of biodegradation, though weathering and ultraviolet light can fragment large chunks. Although a plastic, as a finished product, is non-toxic, the production process involves many dangerous and toxic chemicals. Therefore, burning of plastics is considered very dangerous. It is also known that the break down products from plastics is
toxic contaminants. Though the advocates of plastics consider it as the most eco-friendly material saving natural resources such as timber, the growing mountains of plastic garbage is now assuming nightmarish proportions in many developed societies. In Kerala, the practice of burying, burning and dumping of solid wastes including plastics that we are mostly habituated is now growing into a serious crisis.

'Plastics as a threat to environment' arose mainly out of its use as packaging materials, particularly with the Introduction of the carry bags. Plastics at present account for about 21% of all (paper, glass, tin plate, etc.) packaging materials. They are increasingly replacing traditional materials such as paper, glass, aluminum, tin plate etc. because of a number of appealing characteristics, including cost. Packaging materials account for 25% of the total production of plastics In India, but in terms of consumption, they account for 52%. While the total consumption of plastics in India is about 4 million tones, the waste produced is around 2.0 million tonnes. Though plastics constitute only about 2.4 % (world average) of the total municipal solid waste, they are perceived as a major threat because of their long life and light weight. In India, plastic waste accounts for only 0.6% of municipal solid waste, whereas in urban areas of Kerala, it is as high as 4 – 6% almost at par with any developed economies with disposable life style contributing about 8 % of solid wastes.

**Plastics in soil**

These plastic discards, in general, are considered non biodegradable and do not decompose in a reasonable timescale as shown in the Table below. However, depending on the bondage and environment, the degradation time varies from a couple of days to several years. Generally, polyethylene and other commodity plastics remain in the soil for many years without any degradation whereas polycaprolactone degrade in a reasonable time.

<table>
<thead>
<tr>
<th>Material</th>
<th>Timescale</th>
<th>Material</th>
<th>Timescale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Styrofoam</td>
<td>Eternity</td>
<td>Leather shoe</td>
<td>40 – 50 years</td>
</tr>
<tr>
<td>Glass bottle</td>
<td>Unknown</td>
<td>Wood</td>
<td>10 – 15 years</td>
</tr>
<tr>
<td>Plastic jug</td>
<td>1 million years</td>
<td>Nylon socks</td>
<td>1 year</td>
</tr>
<tr>
<td>Disposable diaper</td>
<td>500 – 600 years</td>
<td>Cotton rag</td>
<td>5 months</td>
</tr>
<tr>
<td>Aluminium can</td>
<td>200 – 500 years</td>
<td>Paper bag</td>
<td>1 month</td>
</tr>
<tr>
<td>Tin can</td>
<td>80 – 100 years</td>
<td>Banana peel</td>
<td>3 – 4 weeks</td>
</tr>
</tbody>
</table>

The plastic discards that we throw indiscriminately is poisoning our soils, smothering our water sources, littering every pathway and road, clogging the drainage systems, dirtying the beaches and floating over our coastal waters. The littering of plastics in soil leads to scattering of non biodegradable materials over the soil and within the soil. In plastic saturated soils the
natural gradients of physico chemical conditions get completely disrupted and the natural process of evolution of soil gets arrested. This, in turn, upset the temperature gradient, air circulation and water percolation through different soil strata ultimately leading to the death of soil ecosystem. A study from Simla shows that plastics over a period of time has accumulated in the soils in six layers of polymers and if this continues, the soil will be sterilized to such an extent that they will not be able to support any life. Many of our food items including milk is sold in plastic sachets which uses polyvinyl chloride (PVC) which is a known carcinogen. These materials in landfills slowly decompose and releases toxic chemicals contaminating soil and groundwater. The burial of red and yellow plastics, which usually contain cadmium as a pigment, may lead to groundwater contamination. PVC uses many heavy metals as stabilizers, including lead salts and certain phthalates which are hazardous.

**Burning of plastics**

Though burning of wastes including plastics is not an environmental friendly activity, it is being practiced indiscriminately all over the world. When plastic is melted down, its chemical structure changes and release gases causing cancer. For example, burning of polyurethrene foam releases about 57 cancer causing chemicals which include extremely toxic toluene diso cyanate. The PVC gives off vinyl chloride gas, even the trace quantities of which cause liver cancer. Generally, higher concentration of vinyl chloride is detected around the rubbish dumps. Often they are set fire or they catch fire emitting smoke containing hydrogen fluoride, which is not only very poisonous but also contributes to acid rain. When PVC is processed in a poorly ventilated area formed in the absence of sufficient oxygen and at a temperature more than 300°C, carbon monoxide is produced. During incineration, PVC evolves dioxin, which is also highly toxic.

**Plastics in sea**

The oceans and waters of the world have been used as a receptacle for unwanted waste products from boats, ships and land also. Over the years the waste stream has changed drastically and products that do not sink or decompose in the waters, such as plastic, increases trash and garbage in the marine environment. These new floatable causes serious harm to wildlife and sea faring vessels alike, besides, the obvious aesthetic degradation of the coastal waters and coastlines. Small pellets of polyethylene, polypropylene and polystyrene are floating every where in the oceans. These are virtually indestructible and are very buoyant. They remain a constant threat to all life forms.
Larger plastic debris mostly primary and secondary packaging materials generated by the shipping industry occur in great abundance in the ocean. An estimated 1.1-1.26 kg/person/day is generated on board the ships as waste plastic and thrown overboard. The containers for lavatory and household cleansers made of polyethylene form a major portion of the stranded plastic. The polyvinyl chloride mineral water containers which many people even in developing countries are beginning to use as part of the new hygienic sense is going to pose a most serious threat in future to marine life. It is estimated that merchant ships alone dump about 5,00,000 plastic containers each day in international waters. A clean-up operation of 157 miles of Texas shoreline, made a collection of 31,773 Plastic bags, 30,295 Plastic bottles, 15,631 Plastic six-pack rings, 28,540 Plastic lids, 1,914 Disposable diapers, 1,040 Tampon applicators and 17,460 Plastic milk jugs indicating the magnitude of garbage dump.

Plastic is now considered to be the most far-reaching man-made threat facing many marine species. It kills or maims tens of thousands of sea turtles, seabirds, sea lions and hundreds of whales, dolphins and porpoises. The dangers of an oil spill or a toxic chemical spill are usually restricted to one place, but plastics are like individual lethal floating mines floating around the oceans waiting for victims. The sea turtles, especially hatchlings, which spend their early lives at sea surviving near the surface waters is indiscriminately harmed when it consumes transparent plastic materials which often look like a jelly fish or the larval stage of a crab. These indigestible materials blocks faecal matter and prevent assimilation of nutrients, in turn, make the turtle too buoyant to dive for food. Carnivorous birds like great skuas also ingest plastic along with their food. The migrating red phalarope also found to ingest plastic pellets which often impair their feeding. It is estimated that about one million seabirds and one lakh cetaceans (whales, porpoises and dolphins) die every year because of plastic pollution.

**Environmental management of plastics discards**
Considering the widespread use of various types of plastic articles in our social fabric and the public attitude towards plastics developed over the years, it is difficult to curb the use of plastics altogether. Instead, a policy of reduce, reuse and recycle has become the code word for management of plastics. The management will involve identification and selection of an appropriate technology for recycling. Some of the techniques include:

- Processing with virgin resin.
- Blending and compaction
- Pyrolysis to obtain chemicals and fuels.
- Chemical decomposition to obtain monomers, fuels and other chemicals.
• Conversion into useful products through chemical reactions.
• Isolation of plastic through solutions.
• Use of shredder residue as filler.
• Collection, separation and recovery systems for post consumer plastic waste.

Further, it is necessary for the public to adopt the following control measures to check the menace of plastics.
• Do not litter and casually dispose off plastic waste in your surroundings particularly in water bodies.
• Sort the garbage and keep the plastic material apart which may be collected by recyclers who make a living out of it simultaneously. It may also become necessary to engage a community volunteer for plastic waste collection system.
• Strictly avoid burning of plastic waste
• Take the initiative and avoid the plastic stuff which is avoidable and not specifically beneficial.
• Avoid buying short life plastic shopping bags if a non-plastic substitute can effectively perform the same function such as a jute or cloth shopping bag.
• Exert your choice and prefer a shop sticking to paper bags rather than plastic packages.
• Avoid excessive packaging particularly of plastic coated stuff.
• Express your disfavour to the manufacturing company in a letter.
• Start such letter writing campaigns against industries using plastic packaging indiscriminately.
• Wherever possible reuse plastic material such as shopping bags, plastic bottles, containers etc by making it a culture of austerity and thrift with all material that we use.
• Learn more about the impact of plastic on your health and on your surroundings.
• Raise your voice for governmental legislation to prevent undesirable plastic products.
• Demand effective measures for recycling.
• Exert pressure on municipalities and local bodies for a more scientific and efficient waste sorting collection and disposals system.

The role of plastic in present day lifestyle is an example of the total lack of concern for the surroundings and for tomorrow. Less than 1 percent of the plastic we use in India is recycled. There are over 2000 small plastic recycling units countrywide whose output is over 3, 00,000 tonnes of finished goods every year. In our country recycling technology is almost standardized though crude and it is incredibly pollutive and hazardous to the workers the environment and often to the users of the recycled material. Therefore, stringent control
measures have to be enforced.

**Enforcement measures on plastics**
Many countries have banned hazardous plastics. In Italy, over 200 local communities have banned use of plastic bags. Denmark banned plastic bottles altogether. Many other European nations have also imposed severe restrictions on the use of plastic. Use of plastic bags has been banned recently in Pakistan. Plastic mats used in the construction of bunds and plastic pipes is banned or restricted in countries like U.S.A.

Some of the Indian states curbed the use of certain plastic articles by various laws, but the effective implementation of such laws in isolation is often questioned. Himachal Pradesh was the first state to impose a ban on dumping plastics carry bags under Non-biodegradable Garbage (Control) Act 1995. The states like Haryana and Sikkim also imposed ban on plastic carry bags under the Garbage Control Bill. In 1999, the Government of India imposed ban on plastic carry bags with thickness less than 20 microns and enforced different control measures. The Government of Kerala imposed ban on the use of plastic carry bags with thickness less than 30 microns in 2003. In order to control the increase in non biodegradable wastes and prevent the misuse of plastics, the government is now contemplating an act for banning the production, transportation, selling and use of certain plastic articles.

**Conclusion**
The use of plastic today is widespread and to some extent, it minimizes the use of wood, metals etc., thus reducing the stress on natural resources. If plastics are not used with discretion, it causes considerable environmental problems leading to pollution and impacts on health and aesthetics. The management of plastic waste is difficult but an achievable possibility provided we streamline the collection and separation of plastics from other waste materials and subject it to recycling as far as possible. Along with this, considerable awareness has to be created to reuse the plastic materials as far as possible, reduce its use wherever feasible and replace it with alternative materials such as clothes, jutes, paper etc.