IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

POLYMER: A THREAT TO ENVIRONMENT AS POLLUTANT AND ALTERNATE GREEN SUBSTITUTES

[1]Neena Srivastava , [2]Vanshika Dixit, [3]Pragya,

[1]Associate Professor , [2]Student, [3]Assistant Professor

[1] Department of Chemistry,

[1]M.V.D. College, Lucknow ,India

Abstract: Water and air the two essential components which serve as the soul of all life forms; have become global garbage cans. Synthetic polymers are vital to many branches of industries for example in packaging industry, Manufacturing industry, Automobile industry etc. Though they are essential element in the cycle, but the fact that Plastic are harmful cannot be denied, especially because of its non-biodegradable nature. When we litter it on soil it makes the soil less fertile, it also harms the sea life , burning of plastics leads to environmental pollution owing to release of poisonous chemicals. Growth is persistent , so is the need of polymers, increasing day by day therefore unlike synthetic polymers that are derived from petroleum oil a better, optimized and efficient substitute would be bio-plastics produced from renewable biomass sources such as plant residue and extracts, agricultural by-products organic minerals to decrease the burden of pollution. This paper discusses cause and affect relations of synthetic polymers on human race as well on marine life further a brief on bio-plastics as an efficient alternate.

Index Terms **- synthetic polymers, biodegradable polymer degradation**

I.INTRODUCTION

Giant molecules called polymers are made up by the linkage of simpler molecules (monomers) by a polymerization reaction into essentially endless chain structures. Polymers occur naturally, but the majority which are used commercially are manufactured from simple monomers.

The most well known natural polymers are proteins (polymers of amino acids), nucleic acids (polymers of ribose or deoxyribose sugars with attached purine or pyrimidine bases), and the polymers of glucose (starch, glycogen, cellulose). Synthetic polymers were originally derived from these natural polymers. The first commercially successful synthetic polymer was cellulose nitrate which was first practically molded as a substitute for ivory in billiard balls. Nitration of cellulose, produces mixtures of cellulose tri nitrate, called guncotton, and cellulose dinitrate called pyroxylin.

II. CLASSIFICATION OF POLYMERS

Polymers are classified under sub categories i.e based on source, structure, mode of polymerisation and composition of polymers ,molecular forces .

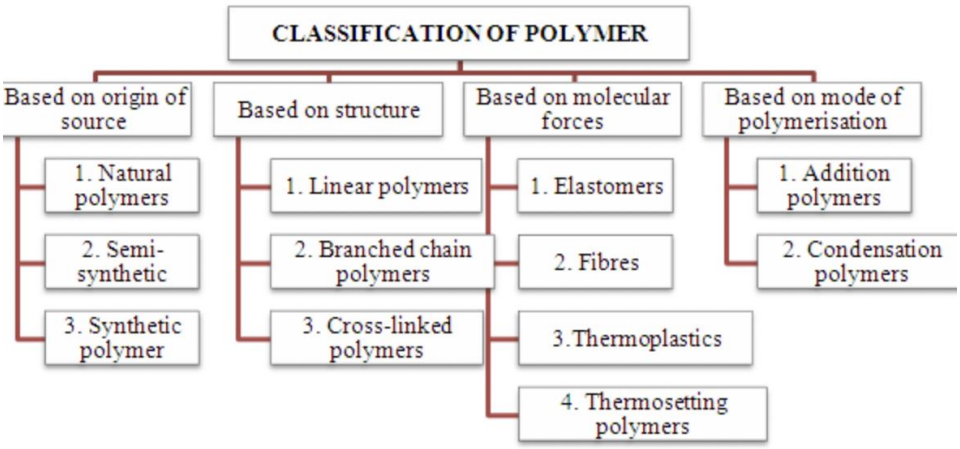

Figure 1. Classification of polymers

III. APPLICATIONS OF POLYMERS

There are various usages of polymer in daily life

- Bioplastics are used for packing bottles ,films, cartons, plates, disposable cups, etc .
- Thermoplastics starch (TPS) are used to manufacture food service .
- Starch is mixed with crude oil are used as carrier bags.
- Polyethylene terephthalate (PET) are used in making utensils like forks, spoons, knifes ,etc
- Protein (zein) and by product of paper industry (lignin) also used in the making of bioplastics .
- Biopolymers together with nanotechnology is used in food industry , biomedical application ,water treatments ,etc.
- Polysaccharides are used as demulcents in drug formulation, dental impression, treatment of intestinal disorders.
- Polystyrene is used in cabinets, petridishes, CD cases plastic cutlery ,etc .
- Polyvinyl acetate is used adhesives and latex paints.
- Polymers are a highly diverse class of materials which are available in all fields of engineering from avionics through biomedical applications, drug delivery system, biosensor devices, tissue engineering, cosmetics etc.

IV. DEGRADATION OF POLYMERS

Polymer degradation is the process which deteriorates polymer properties or their outward appearance. Polymers released in to the environment undergoes three types of degradation Types of polymer degradation Physical degradation, Chemical degradation and Biological degradation The rates of physical and chemical degradation are faster than environment degradation.

4.1 PHYSICAL DEGRADATION

Physical degradation takes place in the presence of heat of light. It is of two types

Thermal degradation

Photo degradation.

4.1.1 THERMAL DEGRADATION

In this the polymer on high temperature causes the chemical changes in the polymeric chain called depolymerisation and defragmentation of the polymeric material (3). The rate and extent of degradation may be monitored by physicochemical analysis of reaction and its by products. In a polymer there are usually many different bonds and types of bonds that can break if this ensemble of different bonds were represented in a bulk material of small molecules, there would be a distribution of bonds broken.

In thermooxidative degradation the polymeric backbone starts to break down on increase the temperature. The above methods are mainly used for recycling of inert polymers.

4.1.2 PHOTO DEGRADATION

It is the photo –initiated oxidation. Primary effect of light is the generation of free radicals. It has relatively little effect on the propagating steps of the radical chain reactions. To absorb energy (hν) chromophoric groups must be present. The absorbed radiation will be attenuated as it passes through the polymer and the reaction will be concentrated on the surface layer. Ketones are formed by processing at severe conditions and are formed by photolysis of hydroperoxides. Photo degradation is fast when chromophoric groups like C=O are present. This can be used to facilitate easy degradation of plastic materials. there are three main types of degradation through sunlight

- Photolysis - absorption as a result of the inherent polymeric structure results in chemistry causing changes in the molecular structure
- Photo-auto oxidation initiated by photolysis reactions of the polymer itself
- Photo-oxidation initiated by impurities not part of the inherent polymer structure.

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4.2 CHEMICAL DEGRADATION

When depolymerisation takes place in presence of any chemical then it is called as chemical degradation of polymers.

4.3 BIODEGRADATION

According to European Standard EN 13432:2000, Biodegradation is the degradation of an organic material caused by biological activity, mainly micro-organisms' enzymatic action. This leads to a significant change in the material chemical structure. The end-products are carbon dioxide, new biomass and water (in the presence of oxygen: aerobic) or methane (oxygen absent: anaerobia).

V. POLLUTION DUE TO POLYMERS.

5.1 EFFECT ON SOIL

Some of the polymers like polyethylene, polystyrene, polypropylene, polyvinyl chloride, etc. They are non biodegradable .when thrown on land it makes the soil less fertile.

5.2 EFFECT ON MARINE LIFE

When thrown in water it chokes our ponds, pools, rivers, streams and oceans and harms the sea life .

Half of the sea turtles worldwide have ingested plastic .Some of them starve after doing so because their stomach are full.

On many beaches , plastic pollution is so pervasive that its affecting turtle's reproduction rates by altering temperature of the sand where incubation occurs.At least 800 species of worldwide are affected by marine debris and as much as 80% of marine life is littered by plastic .

5.3 PLASTIC PACKAGING

Plastic packaging is wasted plastic send to landfills . Plastic are very stable and therefore, stays in the environment along time after they are discarded especially if they are shielded from direct sunlight by being buried in landfills.

This waste rots and decomposes and produces harmful gases (CO2 and CH4) which are both greenhouse gases and contribute to global warming.

5.4 LANDFILLS

Landfills also pollute local environment including the water and the soil. These waste can harm humans ,plants and animals if they encounter these toxins buried in the ground ,in streams run off in groundwater that supplied drinking water .Some toxins such as mercury persist in the environment and accumulate .Chlorinated plastic can release harmful chemicals into the surrounding soil, which can then sleep into groundwater or other surrounding water sources and also the ecosystem of the world.

5.5 BURNING OF PLASTICS

In open air, leads to environment pollution due to release off poisonous chemicals .The polluted air when inhaled by humans and animals affect their health and can cause respiratory problems

Figure 2 Pollution due to Polymers


VI. REMEDIES FOR POLYMERIC POLLUTION

Recycling of plastics is tricky business and many plastic are better that sending waste to landfills and relying on new raw material to drive the consumers economy .As these non biodegradable products do not dissolves in water so organic solvents like acetones can be used to dissolve it .New synthetic polymers are used in removal of pollutants from industrial effluents.3R's i.e reuse reduce and recycle can be preferred.

VII. CONCLUSION

This paper discuss the effect of synthetic polymeric effects on the human race and as well as on marine life also briefing the methods to solve it.

VIII. REFERENCES

1. B. Imre, B. Pukánszky (2013) European Polymer Journal 49, 1215–1233
2. Thermal Degradation of Polymeric Materials, Krzysztof Pielichowski, James Njuguna, e-book, www.google .com
3. Takashi Kashiwagi, T. Hirata, and J. E. Brown, Thermal and(1985), Oxidative Degradation of Poly(methyl methacrylate): Molecular Weight, Macromolecules 18, 131-138
4. Averous L. (2004) Biodegradable Multiphase Systems Based on Plasticized Starch: A Review, J. Macromol. Sci. Polymer Reviews, 44(3), 231-274
5. Valentine Siracusa, Pietro Rocculi, Santina Romani and Macro Dolla Rosa (2008) Biodegradable polymer for food packaging. Trends in Food Science & Technology, 19, 634-643.
6. T. M. Aminabhavi, R. H. Balundgi & P. E. Cassidy (1990) A Review on Biodegradable Plastics, Polymer-Plastics Technology and Engineering, 29:3, 235-262.
7. Isabelle Vroman and Lan Tighzert Biodegradable Polymers, Materials (2009), 2, 307-344; doi:10.3390/ma2020307