

ARE POLYMERS BEING UNDERPLAYED FOR FEAR OF SUSTAINABILITY

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ABSTRACT:

Polymers find a very special place in our life and day to day activities. In fact, it will not be an overstatement if we emphasize that they are now an essential and fundamentally needed part of our everyday living, and the very thought of replacing the same with any other alternative leaves even the most ingenious, innovative and dexterous scientist mentally disabled, wondering how to run their scientific skills further.

Polymers as we know are macromolecules extremely long repetitive molecules with n number of repetition. In fact, they have existed in our lives since the primitive era. The natural polymer like DNA, proteins, cellulose which have been there since human birth, are also polymers. People have been using polymers even though polymers of natural origins since a very long time or time immemorial. Environmental sustainability issues of synthetic polymers have always been a burning issue for environmentalists.

The innovation of Green product, or environmentally sustainable polymers are being recognized as the hope for better quality of life. Green product innovation by interaction between innovation and sustainability has become a strategic priority for all. Though the introduction of synthetic polymers in our everyday use has eased out various activities in human life, but the sustainability issue of non biodegradability later rang the alarm bell for many environmental scientists.

The most worthwhile option for dealing such issues sagaciously would be developing newer technologies either involving the usage of natural polymers, stringently following the green chemistry laws while production, or newer techniques of biodegradability and recycling may be implemented which can be tested for marketplace success.

Keywords: Polymers, sustainability, biopolymers, environment, technology, plastics, biodegradability.

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INTRODUCTION:

Polymers find a very special place in our life and day to day activities. In fact, it will not be an overstatement if we emphasize that they are now an essential and fundamentally needed part of our everyday living, and

the very thought of replacing the same with any other alternative leaves even the most ingenious, innovative and dexterous scientist mentally disabled, wondering how to run their scientific skills further into the three-dimensional arena of their mental expertise.

An invention which has occupied all the facets of our existence in a way they are now intertwined and inseparable. They have interwoven identities in almost every sphere of our everyday living right from packaging, clothing, furniture, utensils, construction, paints, automobiles, electronics, aeronautical engineering and even in the science of lifesaving medical devices, drug delivery systems to even artificial organs, or 3D organ printing which is the medical talk of the century and has left the entire mankind even the scientific ingenuity in awe.

Yet nowadays when we talk about plastic what immediately strikes the common man is that cheap commodity used for packaging, low cost substandard quality toys or other utility articles which would as the environmentalist put forward with evidence will, eventually pile up in our environment and possibly transform our earth into an unsustainable place for the present and the future generations to live.

Polymers as we know are macromolecules extremely long repetitive molecules with n number of repetition. In fact, they have existed in our lives since the primitive era. The natural polymer like DNA, proteins, cellulose which have been there since human birth, are also polymers.

People have been using polymers even though polymers of natural origins since a very long time or time immemorial. Taking an example of craftsmen of the medieval era who crafted lamps and lanterns out of animal horns, which is keratin a natural polymer. The same is the case of wool which have been utilized by mankind since ages.

But the history of polymers is even older than this, more than thousand years before Christ, the Olmecs in Mexico played with balls made of another natural polymer - rubber and this has continued over the generations. In eighteenth century the European, French explorer Charles-Marie de La Condamine, happened to discover the rubber tree in the Amazon basin. And then in 1840 that Charles Goodyear and Thomas Hancock took out patents for vulcanized rubber that is rubber treated with Sulphur to make it more durable. But even long before this polymers were used that is wood, even

wood is a polymer.

LITERATURE REVIEW:

Polymer chemistry is highly practical and used in many industries, including the following, like Adhesives, Alternative Energy, Biotechnology, Chemicals, Coatings, Medicine, Nanotechnology, Oil & Gas and Synthetic Fibers ¹. The building constructions class is amongst one of the greatest consumers of composite material from polymers. Unreinforced composite materials derived of polymers have been used by the construction sector in many different areas like trimmings, kitchenware utensils etc. However, a study suggests sustainability issues of concern becomes the first choice, certain fiber composites could be advantageous to certain traditional materials ². The utilization of (APC) or advanced polymer composites for the betterment or advancement of metallic structures offers an alternative in many cases of retrofits ³. Polymers and medicine are almost inseparable. Their uses are from conventional applications like syringes, catheters, blood contacting devices and matrices used for drug delivery, encapsulation of cell and tissue regeneration. V. Prasad Shastri reviewed, the polymers that show least biodegradation but biocompatible in biological fluids and aqueous environments. The uses of a variety of polymers with reference to their structures and enabling their application in biomedical research has been discussed at length ⁴. Organ printing, which is an innovative approach pertaining to the field of tissue engineering, utilizes deposition of cells in layers with the help of computers and gels to create 3-dimensional structures of cells. A wonderful discovery and promise in regenerative medicine, because it may help to uproot the issue of limited donor grafts for tissue and organ repair. Hydrogels are forms of polymer networks which are hydrated and are used in organ 3D printing as materials for scaffolding.

These hydrogel matrices provide an ideal supporting environment for the cells to help them proliferate though they may be of either natural or synthetic origin ⁵. Silicone an artificial wonder polymer, which is a macromolecule, has been of immeasurable use in plastic surgical implants. Leaders in Plastic and reconstructive surgery change the lives multitudes of their patients every year who have been suffering from congenital or birth malformations like cleft lip and cleft palate, trauma wounds, animal bites, and fatal burn injuries, or those in need of reconstructive surgery after the suffer malignancy or other serious chronic conditions ⁶. A certain study discusses the steady progress in the recent years in the synthesis of newer and advanced polymers and functional polymer fibers.

This study gives the readers complete knowledge about the characteristics and strengths of certain high end fibers such as Kevlar, PBO, Spectra and Dyneema fibers and to discuss new super strong M5 fibers, highly elastic XLA™ fibers and self-crimping T-400, T-800, and other fibers ⁷.

Environmental sustainability issues of synthetic polymers have always been a burning issue for environmentalists. The innovation of Green product, or environmentally sustainable polymers are being recognized as the hope for better quality of life. Green product innovation by interaction between innovation and sustainability has become a strategic priority for all. Responding issues relating to environmental sustainability and certain commercial concerns, DuPont has introduced a new polymer platform, Sorona®, based on 1,3-propanediol which fulfills the sustainability criterion ⁸. Bio polymers have become easy alternatives for the environmentally harmful petroleum based polymers ⁹.

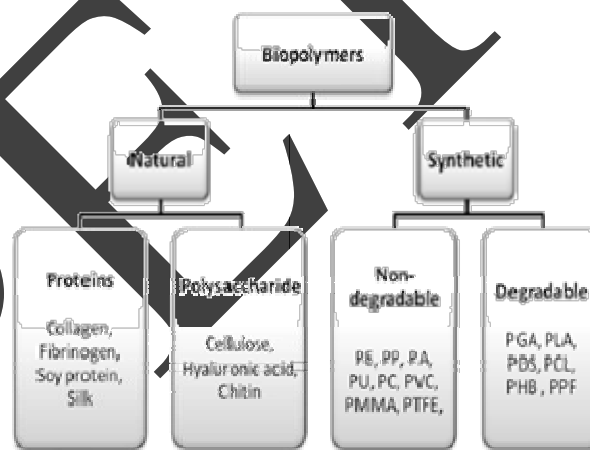
Nature offers its own treasures of biopolymers which can be commercially produced and used on large scale and can be brought into use to avoid this burning concern of environmental sustainability. Biopolymers like cellulose is the most abundant carbohydrate in the world, starch is found in maize, potatoes, wheat, tapioca etc., which is utilized for, manufacturing of paper, textile sizing, making cardboards and adhesives. Collagen a bountiful protein used as gelatin brought into extensive usage in food industries and pharmaceuticals in capsules. Casein, a biopolymer from cow's milk is applied for adhesive material, protective coatings and binders etc. certain polyesters are produced by bacteria, which can be obtained in large scale through commercial production by using fermentation processes. Artificial synthetic polymers or plastics though having immense commercial utility, but being non- biodegradable do not satiate the environmental issue of sustainability. Established on the concept of the correlation between the polymer structure and properties and the natural processes, new materials are being developed which are biodegradable.

A study demonstrates the basic principles of biodegradable plastics which relate to their properties, manufacturing, classification and also their impact on the environment ¹⁰. Another emerging field is Natura polyceutics which defines the upcoming science and technology platform that blends natural polymers and pharmaceuticals for the conception and advancement of drug delivery systems. Natural polymers because of certain eco- friendliness, environmental sustainability environmental sustainability, chemical versatility, are promising in this field ¹¹.

WIDESPREAD APPROACH FOR RESEARCH IN INTRODUCING NEWER BIOPOLYMERS IS THE ANSWER FOR TODAY:

As the environmental concern for sustainability is an issue which can by no means be neglected or underrated, the answer to this would be to focus on the development of newer biodegradable polymers with origin of natural polymers. Funds must be made available by government and non-government bodies for scientific research to promote the development of this wonderful class of commercially propitious material, for example chitosan a linear polysaccharide, which finds enormous applications commercially, can be extensively explored for further applications and developing newer derivatives, which can be of profound usage. The starting materials of biopolymers can be substances like Starch, Sugar, Cellulose or even Synthetic materials, like aliphatic aromatic co polyesters which are fully degradable can be worked upon since recently their high cost makes the usage rare in the commercial arena. The price concern of plant based polymers has slowed down their usage and commercial availability. Further another prerogative could be converting non-biodegradable plastics to biodegradable plastics with the help of certain natural polymers. In fact, substantial amount of scientific work is being carried out regarding this option. But rather than slowing down, further boost to augment scientific work to develop newer techniques to counteract this issue of cost could be dealt with. This should be the priority, at the same time green chemistry norms to be stringently followed while analyzing the non-biodegradable polymers, and if unanimously agreed upon by authorities, such synthesis may be discontinued. At the same time, newer ways of enzymatic and microbial degradation can be worked upon so that sustainability issue can be met with. Waste disposal issues are of growing concern worldwide as a result of, massive usage of polymers which is growing day by day, certain such polymers are completely non-biodegradable and hence being dumped endangering our planets human, animal and plant life. The high recalcitrance of many synthetic plastics results in their long persistence in the environment, and the growing amount of plastic waste ending up in landfills and in the oceans, has become a global concern, as it has endangered land and water life enormously. In recent years, a number of microbial enzymes capable of modifying or degrading recalcitrant synthetic polymers have been identified and developed. They are certainly a boon to the human society and the scientific community. They are emerging as candidates for the development of biocatalytic plastic recycling processes, by which valuable raw materials can be recovered in an environmentally sustainable way.

Technology advancement and development of systems for the collection, sorting and reprocessing of recyclable plastics are creating new avenues for recycling, and with the integrated approach of the public, industry and governments it can substantiate the possibility to divert the majority of plastic waste from landfills to recycling over the next few decades. The environmentally critical issue of waste disposal can also be dealt positively by working on recycling of polymers. Recycling is a promising option to satisfy the environmental concerns and a meaningful proposition currently available to negate the impacts and put forth one of the most dynamic areas in the plastics industry today. Recycling provides opportunities to reduce oil usage, carbon dioxide emissions and the quantities of waste requiring disposal.



CONCLUSION:

Though the introduction of synthetic polymers daily life has eased out various activities in human life, but the sustainability issue of non biodegradability later rang the alarm bell for many environmental scientists.

Environmental scientists and then was made an issue of concern worldwide. This movement was carried forward by many scientific and social communities to discontinue the use of plastics.

Plastics have now found place throughout the globe, there are effectively no races that haven't been exposed to them. Various studies have shown the presence of steady-state concentration of plastics' in the human body fluids to an harmful extent, thereby showing the ongoing constant exposure, metabolism and excretion of these compounds.

Since polymers have been with man in use for more multitude of years, and by now they're everywhere, for better and for ill, in fact they have now become an inseparable part of our daily existence, hence eliminating them due to sustainability issues without giving them a fair chance to improve their worth could be disadvantageous to our race.

The most worthwhile option for dealing such issues sagaciously would be developing newer technologies involving the usage of natural polymers, stringently following the green chemistry laws while production, which can be tested for marketplace success. Strong impetus must be provided for the research and even development of biodegradable polymers.

Newer technologies for recycling of plastics must be intensified, so as to find newer solutions of sustainability. As all these depends on how strongly the society is committed to these concerns regarding environmental concerns, hence a mass level awareness and promotion of scientific development must also be created to evolve greener pastures for biopolymers to lead the human civilization towards a more sustainable, viable and imperishable society, precursory towards better life.

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