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Polymers and Biopolymers in Field of Medicines

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ABSTARCT

A polymer is a large molecule of many repeated units. Polymers range from synthetic plastics such as polystyrene to natural biopolymers such as DNA and proteins. Polymers and biopolymers are also used in field of medicines and such type of polymers are bio-safe, non-toxic and environmentally friendly. Biopolymers are the polymeric materials which is used to interact with tissues, bones, teeth and other living substances and thereafter environmentally friendly, that are degradable polymers which are also used in efficient drugs such as insulin. Thus, their effective response had led a wide range to make it successful in field of medicines.

KEYWORDS:

- Non-Toxic ,
- Large molecules
- Medicines
- Safe
- Degradable
- Environmentally
- Tissues
- Effective response

INTRODUCTION

The formation of a big molecule by the union small molecules of many repeated units is known as polymer. These polymers may be man-made such as plastic films, plastic resins like Bakelite, etc. or other may be natural polymers such as DNA, proteins, etc.

Some scientists are now expressing their concern on the field of medicines.

Polymers have become a necessary commodity for everyone and are used in manufacturing the medicines however all polymers are not used in this purpose. For medicinal purpose a polymer should be bio-safe, non-toxic, environmentally friendly.

Biopolymers are also used in medicinal purpose which are further used in repairing of tissues, bones, teeth, tendons, ligaments, etc. More advance these are used to repair the organs such as lungs, kidney, etc. Drugs such as insulin are summed up with a polymeric capsule for their sustained release.

Polymers may be natural, synthetic or semi-synthetic depending upon there source of origin. Polymers like proteins, starch are biopolymer or natural polymers. Celluloid is one of the semi-synthetic and Nylon, PVC are synthetic polymers. Therefore, polymers like ***Collegen*** obtained from bovines of cows and such polymers are used in repairing the bones, teeth, heart valves etc. Similarly,***Chintosan*** obtained from crabs and many other marine animals are used as a filler in tablets, Cellulose is used in preparation of drugs such as pills and tablet coatings and granules and many other microcapsules.

Cancers have been the most dangerous disease since the decade.

Scientists are doing great effort and many researchare done on cancer and more than half of the population all over the world are suffering from cancer and mostly half of them die due to these diseases.

Polymers and biopolymers are used in the treatment of cancers numerous products involve polymers and biopolymers.

By the word biopolymer, is a polymer which is biocompatible, and which can degrade the enzymes or decomposition by the actions of bacteria and fungi. Therefore, biopolymers are mostly used in the medical and in the biomedical applications.

Natural polymers are advantageous as they are non-toxic, non-inflammable and many more but they may have some disadvantages like high cost, high water absorption, low physical and chemical property but on the other hand biopolymers are more relevant as these have better physical properties and have intrinsic properties and suitable for medicinal applications and biopolymers have been used since many decades for medicinal use such as surgery and body implants. The research is still on regarding the biopolymers for more better mechanical and more relevant properties and more biocompatible.

POLYMERISATION REACTIONS (A process of making giant molecules)

FREE RADICAL ADDITION:

1: INITIATION:

Radical initiators such as Benzoyl peroxide, Azobis-isobutyronitrile, etc. further generate the free radical which further initiate the reaction into Vinyl monomer.

Benzoyl Peroxide Free Radical Free Radical

Azo bis- isobutyronitrile

Free Radical

Vinyl Monomer Formation of a new Free Radical

2: PROPOGATION:

The above new radical produced in free radical addition adds another monomer to form or produce the other radical and thus similarly the successive addition of monomers to such radicals leads to the formation of a long chain of radicals.

Monomer

Secondary Radical (more stable)

3: TERMINATION

The termination itself means the repetition. So, the termination of a radical is done in 3 steps:

1. Coupling
2. Disproportionation

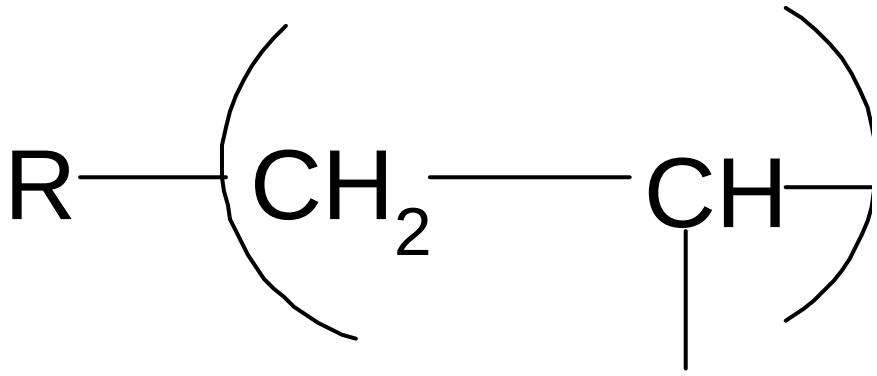
3. Chain transfer

A) COUPLING:

It may take place in two ways:

2 Radical Unit

B) Disproportionation:



***CHAIN* TRANSFER:** Similarly, in such type there is a transfer of chain and the reaction moves on by the transfer of chain and starting from a monomer.

Biopolymers /Polymers in treatment and medicinal field:

Advances in biopolymers in medicines and modern therapies has uplifted in the medicinal field like the:

1. ***pH-responsive polymers***: A wide survey has studied that the natural polymers also *responses* to the pH changes.

For instance: There might be a wide variation in the gastrointestinal which mostly be strongly acidic in the stomach and further leads to the drugs involvement to the intestine. Therefore, these pH – responsive can be used to further decrease the release of drugs in the stomach.

Similarly, the pH sensitive hydrogels have also been known in the cancer drugs targeting that the acidic medium has been noticed in the tumour tissues as compared to the healthy tissues. So, thus these hydrogels can thus release the acidic drugs and further minimise the effect of other numberof drugs releasing elsewhere.

2: ***Hyaluronic Acid:***It is a natural linear co-polymer of the D-glucuronic and N-acetyl, D-glucosamine. This type of acid is present in the neutral tissue and the synovial fluid and the most important property about this tissue is that these are compatible and biodegradable, and they have tissue healing properties such as promotion of cell migration. It is also surveyed that these types of polymers also show the bacteriostatic action too.

Table1 :

Uses of Hyaluronic Acid In Biomedical Field

AREA	APPICATIONS
Diseases Indicator	Identifies the presence of tissue diseases and tumors.
Eye surgery	Retinal reattachment, Protects Corneal tissue, and other eye surgery.
Ear surgery	Healing of the tympanic membrane.
Scar control	Surgery
Wound Healing	Tissue repair
Tendon Surgery	Repairs the joint and tendon's especially in the animals.
Antiadhesion	General Surgery

Basically, this polymer that is the *Hyaluronic Acid* is an attractive polymer because it is degraded into simple sugars. It is mainly used in the treatment of eye surgery, ear surgery and wound healing.

Therefore, the table displayed above explains and figure outs the area and the medical applications of this acid.

3: Fibrin: It is one of the natural polymers which is advancely used in the science as in a medicinal area. It is basically a fibrous protein used in the clotting of blood. It is formed by the polymerisation process which leads to convert the fibrinogen into fibrin.

POLYMERS USED IN THE CARDIOPULMANARY BYPASS SURGERY :

Some polymers are used in the vascular protheses or for the good blood flow and such polymers are also used in the oxygenate blood without any blood damage. These polymers have also played an indispensable role in the cardiopulmonary bypass surgery which therefore leads to the better flow of blood all over the body.

EXTRACORPOREAL MEMBRANE OXYGENERATION (ECMO):

It is one of the bestand majoroutbreaks which came out and is now one of the best surveys done. These ECMO uses hydrophobic, microporous and a hollow fibrous membrane with a property of porus. These lifejackets allow the blood to bypass in the heart and lungs.

Basically, the blood is moved in these ECMO machines then these ECMO oxygenate the blood artificially and then further and the end remove the carbon dioxide.

Biopolymers and Polymers in treatment of CANCER

Cancer has been the most deleterious disease all over the world and fortunately its spread is increasing day to day. Today also many people died due to this disease and the percentage of this is increasing day to day. Taking in an account of this global issue scientists are trying to develop the novel carriers of anticancer drug delivery especially the cancer tumors.

Millions of people are diagnosed with this disease and it has become the second largest and most widely spread disease just after the cardiovascular diseases. Globally over 20% of the people suffer from the breast cancer. The most used treatments for the cancer are surgery, chemotherapy, hormonal therapy, immunotherapy.

Chemotherapy is a cancer treatment based on the treatment using drugs and chemicals which is one of the most important treatment for the surgery and the tumors. The resistance of the cancer cells is the most challenging technique in this process.

This technique acquires the use of drugs and beside the drugs, carriers. Polymers, biopolymers, nanocomposites polymers. The biopolymers as by the definition degrade the enzymes. So, the nanocomposites biopolymer has very good quality of holding protecting and releasing the bioactive drugs for instance enzymes, probiotics. The research tells that the source of biopolymers and their uses, including the cancer drug carriers has become one of the most successful research.

For instance, the biopolymers such as collagen, chitosan and many more, especially the chitosan (CS) as a drug carrier and the curcumin (CUR) as a cancer drug are widely used for the treatment of cancer in the chemotherapy theory.

BIOPOLYMERS FOR MEDICAL APPLICATIONS

1: **MICROBIAL POLYSETERS:** *Polyhydroxyalkanoates (PHA):*

These are basically the flexible thermostatic biopolymers which are mainly intercellular materials for bacterial cells. These PHA have a property of rigidity and are flexible plastics which have a strong property of tough elastomers which further depends on their chemical structure. Currently

these biopolymers are investigated in the medical applications. The applications are mainly controlled in the drug release, bandages, bone plates and wound care.

2: **POLYAMINO ACIDS:**These are a type of synthetic polymers which are further formed by the polymerization of the same amino acid. The polyasapartate polymers are basically analogousof natural proteins and these compounds are derived naturally and these can be further used in place of the petroleum derived polymers.

Table 1

Uses of polyasapartate polymers in different field of medicines

AREA	**APPLICATION**
Superabsorbent	Diapers
Dental Treatment	Toothpaste (Tartar control agents)
Biomedical Devices	Microencapsulation for drug delivery, Prosthetic devices for heart valves
Chitin	Incorporated into bandages, wound healing treatment, tissue repair, blood clothing.

The application of the polymers and biopolymers have been highly significant and effective in the medical life. These are safe, bio-degradable, non-toxic, relevant and simple and less costly.

Their sudden and active response to the environment is also one of the factors in their advancement. Thus, the use of polymers and biopolymers in the medicine had further led out to come with flying colours as these are innumerable.

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