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Review on Role of Novel Polymer in Drug Delivery System

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Abstract: *The current review article focuses on polymers in pharmaceutical drug delivery of therapeutic agents. The polymers are used as carriers for delivery of drug at target site. To overcome the shortcomings of conventional dosage forms, targeted and modified drug delivery system came into existence. A discussion of the role of polymer membrane-based drug delivery systems is presented. Thisis followed with a review of recent studies in our laboratories of the membrane formation and drug delivery characteristics of injectable polymer solution platforms.*

Keywords: Polymers, Drug Delivery

I. INTRODUCTION

Polymers have found applications in diversebiomedical fields such as drug delivering systems, developing scaffolds in tissue engineering, implantation of medical devices and artificial organs, prosthesis, ophthalmology, dentistry, bone repair, andmany other medical fields.[1]Polymers can be used as film coatings to disguise/mask the unpleasant taste of a drug, to enhance drug stability and to modify drug release characteristics. Pharmaceutical polymers are widely used to achieve taste masking; controlled releases (e.g. extended, pulsatile and targeted) enhanced stability and improved bioavailability. Monolithic delivery devices are systems in which a drug is dispersed within a polymer matrix and released by diffusion. The rate of the drug release from a matrix product depends on the initial drug concentration and relaxation of the polymer chains which overall displays a sustained release characteristic.[2]

Classification of Polymers

Based on source:

1. **Natural:**- Chitosan, Alginate, Gelatin, Collagen
2. **Semi-Synthetic**:- Hydroxy Propyl Methyl Cellulose (HPMC), Methyl Cellulose (MC), Hydroxy Propyl Cellulose (HPC)
3. **Synthetic:** Polyethylene, Polylactic acid, PolypropylePolyglycolic acid, PolyhydroxyButyrate

Type of Polymerization

- Addition Polymer:- Polyethylene, Polypropylene,Polyvinyl Chloride
- Condensation Polymer:- Polyurethane, Polyester[3]

Polymers in Pharmaceutical Applications

Water-Soluble Synthetic Polymers

- Poly (acrylic acid) Cosmetic, pharmaceuticals, immobilization of cationic drugs, base for Carbopol polymers.
- Poly (vinyl pyrrolidone) Used to make betadine (iodine complex of PVP) with less toxicity than iodine, plasma replacement, tablet granulation.

Cellulose-Based Polymers

Ethyl cellulose Insoluble but in water, aqueous coating system
Sustained released application

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II. GENERAL MECHANISM OF DRUG RELEASE FROM POLYMER

Diffusion

Diffusion occurs when a drug or other active agentpasses through the polymer that forms the controlled-release device. Diffusion occurs when thedrug passes from the polymer matrix into the external environment. In these systems, the combinations of polymer matrices and bioactive agents chosen must allow for the drug to diffuse through the pores or macromolecular structure of the polymer upon introduction of the delivery system into the biological environment without inducing any change in thepolymer itself[4].

Degradation

Biodegradable polymer degrades within the body as a result of natural biological processes, eliminating the need to remove a drug delivery system after release of the active agent has been completed,the degradationoccurs only at the surface of the polymer, resulting in a release rate that is proportional to the surface area ofthe drug delivery system.

Swelling

They are initially dry and when placed in the body will absorb water or other body fluids and swell. The swelling increases the aqueous solvent content within the formulation as well as the polymer mesh size, enabling the drug to diffuse through the swollen network into the external environment[5]

III. CLASSIFICATION BASED ONDIFFERENT CRITERIA

Basis on interaction with water

- Non-biodegradable hydrophobic Polymers:- E.g.Polyvinyl chloride,
- Soluble Polymers:- E.g. HPMC, PEG
- Hydro gels:- E.g. Polyvinyl pyrrolidine

Based on polymerization method

- Addition Polymers:- E.g. Alkane Polymers
- Condensation polymers:- E.g. Polysterene and Polyamide

Based on polymerization mechanism

- Chain Polymerization
- Step growth Polymerization

Based on chemical structure

- Activated C-C Polymer
- Inorganic polymers
- Natural polymers

Based on occurrence

Natural polymers:- E.g. 1. Proteins-collagen, keratin,albumin, cellulose
Synthetic polymers:- E.g. Polyesters, polyamides
Based on bio-stability

Polymers in pharmaceuticalapplications

Water-Soluble Synthetic Polymers

Poly (acrylic acid) Cosmetic, pharmaceuticals, immobilization of cationic drugs, base for Carbopol polymers.

Cellulose-Based Polymers

Ethyl cellulose Insoluble but dispersible in water, aqueous coating system for sustained release applications.

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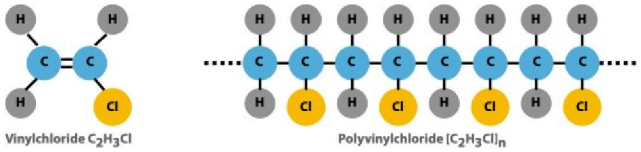
Carboxymethyl cellulose Super disintegrant,emulsion stabilizer

Water-Insoluble Biodegradable Polymers
(Lactide-co-glycolide)polymers Microparticle–nanoparticle for protein delivery.

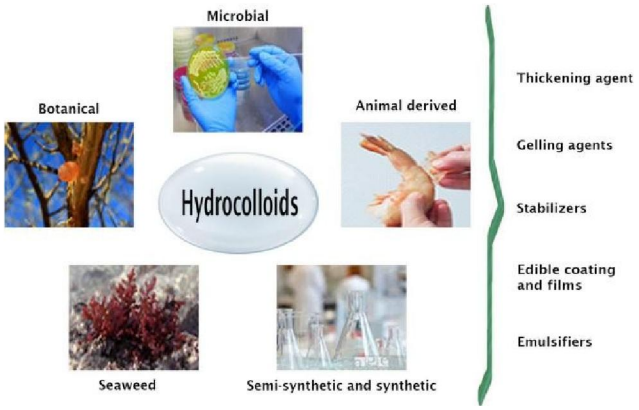
Starch-Based Polymers
Starch Glidant, a diluent in tablets andcapsules, a disintegrant in tablets and capsules, a tablet binder.

Plastics and Rubbers



- Polyurethane Transdermal patch backing, blood pump, artificial heart, and vascular grafts, foam in biomedical and industrial products.
- Poly (vinyl chloride) Blood bag, and tubing
- Poly (vinyl acetate) Binder for chewing gum

Hydrocolloids



Chitosan Cosmetics and controlled drug delivery applications, mucoadhesive dosage forms, rapid releasedosage forms[6].

Application in conventional dosage forms:-

- Tablets: As binders to mask unpleasanttaste for enteric coated tablets
- Liquids: Viscosity enhancers Forcontrolling the flow
- Semisolids:- In gel preparation
- In Ointments
- In transdermal Patches[7]

Advances of Polymers:
Advances in polymers led to development of several novel drug delivery systems due to proper consideration of surface and bulk properties of polymers. Due to this reason, polymers have been widely used in developing new technologies by many researchers. These new technologies contribute to make medical treatment more efficient and side effects are also reduced. Polymer play an important role in the Drug delivery system in terms of materials to assist delivery, excipients, and technology[8]

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Future prospective of advanced drugdelivery using polymers:
Engineered Polymers for Advanced Drug Delivery

Smart polymers: -
Modern drug delivery technology has been made possible by the advances in polymer science. Advancement in polymer science andengineering has developed new polymers for well controlled delivery of therapeutic drugs. Oneof them will be the smart polymer (stimuli- sensitive polymer).

Smart polymeric systems
Passive targeting based on the EPR effect uses a unique physiological property of a disease (physiological targeting), while conjugation oftargeting moiety to drug carriers is a biochemicaltargeting strategy. Smart polymeric systems also provide a targeting strategy,which is activatedand triggered by a specific environmental signal (triggered targeting)

Polymeric systems for molecular imaging
Advancement in imaging technology has shifted conventional invasive and anatomical diagnosis to noninvasive and physiological/molecularimaging technique.
Applying the molecular imaging technique to clinical imaging modalities, such as magnetic resonance imaging (MRI), positron emission tomography (PET), fluorescent optical imaging, and ultrasound imaging, however, has been hampered by poor sensitivity, specificity, and targeting ability of current imaging probes. Small molecules that are directly labeled with a wide range of chemicals have been limited in use due to their lack of specificity, instability, toxicity, and rapid clearance.
Polymeric probes for molecular imaging take all advantages of polymer-based drug delivery systems, which can significantly increase plasma half-life and blood stability, reduce systemic toxicity, and especially improve contrasting ability by introduction of targeting moiety[9].

Criteria followed in polymer selection

- The polymer should be soluble and easyto synthesis.
- It should have finite molecular weight.
- It should be compatible with biologicalenvironment.
- It should be biodegradable.
- It should provide good drug polymerlinkage.

IV. CONCLUSION

The development of drug delivery carriers based on natural and synthetic polymersare rapidly emerging field. It takes advantages of the remarkable delivery mechanism, which has used by pathogens and mammalians cells, such as selective targeting and prolonged circulation by evasion of the immune systems. The biomimetic and bio-inspired systems have a bright future ahead with a lot of potentials to solve any obstacles encountered in the drug delivery system. The unique properties of dendrimers such as their high degree of branching, multivalence, globular architecture, and well-defined molecular weight make them promising newscaffolds for polymeric drug delivery systems

REFERENCES

[1]. Vicky V. Mody, Introduction to Polymeric Drug Delivery, Internet Journal of Medical Update, 5(2): 2010 July;1 - 2.
[2]. Reja M, Quadir MA, Haider SS, Comparative evaluation of plastic, hydrophobic and hydrophilic polymers as matrices for controlledrelease drug delivery, J Pharm Sci 692, 2003, 274 - 291.
[3]. Chandel P, Rajkumari, Kapoor A, Polymers – A Boon To Controlled Drug Delivery System, International research journal of pharmacy (IRJP) , 2013, 4(4), 28 – 34

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[4]. Poddar RK, Rakha P, Singh SK, MishraDN, Bioadhesive Polymers as a Platform for Drug Delivery: Possibilities and Future Trends, Research J on Phamacetical Dosage Form and Technology, 2,1,2010, 40 - 5

[5]. Kiran Sharma, Natural biodegradable polymers as matrices in transdermal drug delivery, Int. J. Drug Dev. & Res., April - June 3 (2): 2011, 85 - 103 27.

[6]. Verhoeven, J, Controlled - release formulations, a hydrophilic matrix containing furosemide, Int. J. Pharm, 45, 1988, 65 - 69.

[7]. Ankita Raizada, Polymers In Drug Delivery: A Review, IJPRD, 2(8),2010, 9 - 20.

[8]. DK, De T, Baral A , Polymers In Pharmacy: Their Versatile Applications, An International Journal of Advances in Pharmaceutical Sciences , volume 4 , Issue 1, 2013,54-65

[9]. Raizada A, Bandari1 A, Kumar B, Polymers in drug delivery : A Review International journal of pharma research and development (IJPRD),2010,vov-2,issue-8, 9- 20

[10]. Kim S, Kim JH, Jeon O, and Chan I, Park KK, Engineered Polymers for Advanced Drug Delivery, Eur J Pharm Biopharm 2009 March, 71 (3), 420-43