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Mini Review

Polymers in Medicines and Pharmacology

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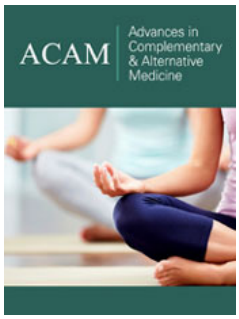

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Abstract

Polymers have been increasingly used in the field of medicines and pharmacology due to their unique properties and versatility. The emphasis of polymers in the pharmaceutical industries has been significant for past many decades and is expected to increase in the coming years. This review deals with the discussion of the various applications of polymers in medicines and pharmacology, as well as their potential benefits and challenges.

Keywords: Polymers; Medicines; Pharmacology

Introduction

The previous paper [1] dealt with the antibacterial properties of polymers. In this article, the development of sophisticated pharmaceutical products has been discussed which requires the multidisciplinary efforts. Polymers with special or multiple properties holds possibility for the development of smart polymeric systems which recognize and respond to physiological and pathological processes in the body. They have been used in a wide range of applications, including medicine and pharmacology. In medicines, polymers are used as drug delivery systems, wound dressings, and implantable devices. In pharmacology, polymers are used as excipients, coatings, and matrices for drug delivery [2-7].

Applications of Polymers in Medicines

Immunotherapy systems

Recent innovations also incorporate stimuli-responsive and multimodal theranostic polymers, enhancing imaging sensitivity and therapeutic precision. Furthermore, metal-doped and photothermal polymers have expanded the therapeutic scope, allowing synergistic chemo-, photo-, and immunotherapies.

Drug delivery systems

Suitable polymers have been used to create drug delivery systems that release drugs in a controlled manner. This can improve the efficacy and safety of drugs by reducing side effects and improving bioavailability. The controlled and targeted drug delivery are the most significant application of polymers as they are engineered to modify the drug release rate, enhance stability and direct the drug to a specific site in the body. This improves efficiency and minimizes the side effects. Polymers can be functionalized with specific ligands like antibodies peptides which bind to receptor cells, facilitating targeted delivery and maximizing therapeutic concentration at the site of action.

Wound dressings

Several polymers may be used to create wound dressings that promote healing and prevent infection. These dressings can be designed to release antimicrobial agents or growth factors to enhance wound healing. Alginate is an excellent absorber of wound exudate and promotes haemostasis and stop bleeding. Chitosan is antimicrobial and have bioactive properties and help in wound healing and tissue generation. Similarly, cellulose has a nanofibrillar structure

that offers excellent water retention and a microbial barrier. Hyaluronic acid on the other hand reduces inflammation and assist in the wound healing.

Implantable devices

Polymers can be used to create implantable devices such as pacemakers, artificial joints, and contact lenses. These devices can be designed to release drugs or other therapeutic agents to treat a range of conditions. Poly(lactic acid), a biodegradable polymer often used in orthopaedic implants. Polyether ether ketone has a good biocompatibility with high mechanical strength which make it a popular choice for spinal implants and cardiovascular devices. Ultrahigh molecular weight polyethylene, a very durable polymer is widely used in joint replacements and spinal implants.

Applications of Polymers in Pharmacology

Excipients

Polymers are used as excipients in pharmaceutical formulations to improve the stability and bioavailability of drugs. The excipients also facilitate tablets to break down and their dissolution after administration so that the drug gets released easily.

Coatings

Polymers have been used to create coatings for tablets and capsules to improve their stability and bioavailability. A polymer coating gives stability of drugs and minimize or mask the unpleasant taste or odour of certain drugs.

Matrices

Polymers are explored to create matrices for drug delivery. These matrices can be designed to release drugs in a controlled manner.

Benefits of Polymers in Medicines and Pharmacology

Polymers offer several benefits in medicines and pharmacology, including:

Improved drug delivery

Polymers improve the delivery of drugs by controlling the release rate.

Enhanced safety

Polymers reduce the risk of side effects by releasing drugs in a controlled manner.

Increased efficacy

Polymers improve the efficacy of drugs by improving their bioavailability and reducing the risk of side effects.

Challenges of Polymers in Medicines and Pharmacology

Despite the benefits of polymers in medicines and pharmacology, there are several challenges associated with their use, including:

Toxicity

Some polymers may be toxic, which can affect their safety and efficacy.

Biocompatibility

Polymers must be biocompatible to ensure they do not cause adverse reactions in the body.

Stability

Polymers can degrade over time, which can affect their stability and efficacy.

Biodegradability

Polymers can be designed to degrade over time, reducing the risk of long-term toxicity. The polymers must be biodegradable and break up into non-toxic components that the body can safely metabolize the accumulation of foreign materials.

Conclusion

Polymers hold the potential to revolutionize the field of medicines and pharmacology. Their unique properties and versatility make them an attractive option for drug delivery systems, wound dressings, and implantable devices. However, there are several challenges associated with their use, including toxicity, biocompatibility, and stability. Further research is needed to overcome these challenges and fully regulate the potential of polymers in medicines and pharmacology.

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