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Biomaterials with Bio-Based Components: Applications in Healthcare

Miura Nishi*

Department of Chemical Engineering, School of Chemistry and Chemical Engineering, China

INTRODUCTION

A variety of recent advances in antimicrobial biomaterial methods have been made, including the use of per biocidal polymers, biomaterials with specialised surface architecture, nanotechnological platforms for targeted drug delivery, and innovative biotechnological antimicrobial chemicals and engineered living materials. Because of the diversity of targeted therapies and prevalent bioactive materials, their design, complexity, and composition are primarily aimed to combat a specific microbial disease or diseased tissue. Because of the variety of microbial applications, they all have a niche. Due to their effectiveness and acceptable clinical-practice effects, classic and last-generation antibiotics are still being proposed, particularly for urgent treatment and advanced infections, but the trend is to consume other antimicrobial compounds that do not produce bacterial resistance, with the prominence of bactericide metals.

DESCRIPTION

Polymers have a wide range of biomedical uses, ranging from implant material production to targeted medication delivery. Polymers formed from chemical monomers, such as polypropylene, polystyrene, and polyethylene, have great mechanical stability and may be used for a variety of electrical or thermal applications. Certain chemical-based synthetic polymers, on the other hand, are harmful to people, animals, plants, and microbiological organisms. As a result, biopolymers have been developed as an alternative to make them suitable for biomedical purposes. Despite the fact that biopolymers have useful biomedical uses, they are not stable in biological fluids and can be hazardous in some situations. Recent advancements in nanotechnology have broadened its implicational relevance in a variety of sectors, particularly in the evolution of biopolymers to turn them into nanomaterials. Bacterial repellence in suturing materials is a desirable feature that has so far only been achieved by dosing the suture material with antibiotics. Alternative antibacterial treatments are extremely desirable, given the rising possibility of bacterial resistance. The usage of nanostructured surfaces on medical fabrics and disposable medical devices to prevent biofilm development is a promising method since it is simple to implement and can be applied to many polymer types. Plasma treatment has recently been used to create nano topographies on textile fibres. Chemical changes, ablation and engraving of the fibre surface, and finally material deposition are all part of plasma therapy. The amount to which these reactions arise is determined by the plasma treatment settings and the material itself. Biodegradable polymers are those that degrade naturally into by-products after serving their original purpose by bacterial or enzyme activity. For tissue engineering and regeneration, these biomaterials are quite interesting. You can grow cells, tissues, and novel bio structures on a biodegradable scaffold. The wound-healing process may be impacted by polymeric materials such as Polyvinyl Alcohol (PVA), a self-healing polymer, Hydroxypropyl Methylcellulose (HPMC), a highly swell able hydrogel, and Polyglycolic Acid (PGA), a biodegradable suture material. Since PGA sutures offer a domain or framework that fosters cell adhesion, tissue regeneration, and wound healing, their ability to impact cell and macrophage migration has been demonstrated. The many hydroxyl groups in PVA's carbon structure promote hydrogen bonding, which has an impact on the polymer's physical characteristics and interaction.

CONCLUSION

Antimicrobial coatings aid in the prevention of pathogenic infections in the hospital setting and provide some specialised functionalities for medical devices. Coated polymers with a high molecular weight outperform those with tiny molecules in numerous ways, including improved stability, reduced leaching, and more functionalization by chemical and physical designs. Less leaching, in particular, will assist to lessen the harmful effects on the human body or pollution on the natural environment.

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Corresponding author Miura Nishi, Department of Chemical Engineering, School of Chemistry and chemical engineering, China, E-mail: nishi_m@edu.cn

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