BAGHDAD JOURNAL OF BIOCHEMISTRY AND APPLIED BIOLOGICAL SCIENCES
2023, VOL. 4, NO. 3, 99-101, e-ISSN: 2706-9915, p-ISSN: 2706-9907
https://doi.org/10.47419/bjbabs.v4i03.260

REVIEW ARTICLE

Polymer Brushes: Novel Surfaces for Biomedical Applications

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Keywords Polymer brushes, Protein Adsorption, Tissue Engineering

Polymer brushes play an important role in surface modification techniques to improve the biocompatibility of modified surfaces inside the human body for different biological and biomedical applications. This modification gives the ability to control biointerfacial interactions such as cell attachment, protein adsorption and bacterial biofilm formation. Surface modification with polymer layers can be utilized to alter the surface properties, including biocompatibility, antifouling ability, corrosion resistance and wettability, and it can be achieved by immobilization or spraying of polymers from solution. Also, it is easy to graft polymers with reactive end groups onto surfaces, leading to the formation of polymer brushes at high density, which have specific features, such as chemical robustness, tunable mechanical properties and the flexibility to use polymers of different chemistry or introduction of bifunctional polymers for specific immobilization of other molecules, especially proteins and enzymes. The specific properties of polymer brushes make them ideal candidates to be used in the biomedical field. For example, polymer brushes can be synthesized on different substrates, particularly metallic and non-metallic surfaces [1] . The technique is flexible in nature, which enables the terminal functional groups of the attached chains to be tailored with ligands for enhancing as cell adhesion and proliferation while at the same time preventing non-specific adsorption of other proteins [2] . In addition, Due to interfacial attachment to biomaterials, polymer brushes can be designed to encourage cells to attach and grow through simple modification and conjugation processes, finding applications in drug delivery, implants and tissue engineering Fig.1[3].

Therefore, we analyze the modification technique's strengths and weaknesses of utilized polymer brushes. Polymer brush is used as a coating on surfaces implanted inside the human body, meaning this material should be nontoxic and biocompatible. Toxicity is a general title; this is an important issue as long we deal with the human body. As a result of modification surfaces by polymer brushes, our researchers highlighted specific types of polymers, such as Poly(ethylene glycol) [4] , [5] with high molecular weight to be chosen as one of the most important polymers to be coated on the modified surface which implanted inside the human body. The second main significant factor in selecting the polymer brushes is the biocompatibility. The human body should not reject the polymer, and should not have any negative effects when it is implanted inside the human body. What does that mean?

Received 2023-09-09
Revised 2023-09-18
Accepted 2023-09-25
Published 2023-09-30

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DOI https://doi.org/10.47419/bjbabs.v4i03.260

Pages: 99-101

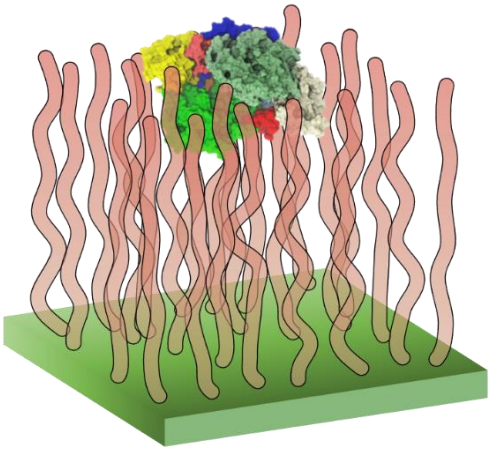

Figure 1 Polymer brush cell adhesion.

Human cells such as stem cells, osteoblast cells and other human cells should be familiar with the polymer coated to the surfaces implanted inside the human body. In addition, these modified surfaces by polymer brush should prevent bacterial adhesion to prevent any infections by bacterial growth. Therefore, from these findings, we acknowledge the exploitation of different polymer brushes to be used in our next future research. Different polymer brush applications can be used in fields such as tissue engineering, drug delivery systems and biomedical devices. In addition, different functionalized polymer brushes can have their chain length, density and microstructures easily adjusted. Polymer brushes can mimic functional elements of the extracellular matrix structure (ECM) to motivate cell attachment and growth, but they also need to be very stable in vivo if they are ideal candidates in biomedical applications. Polymers are widely used in scientific and industrial fields because of their versatility. The physical and chemical properties of polymers make them applicable in different applications, and they can be further altered by surface treatment to be more appropriate for specific applications.

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