Controlled release of therapeutical agents from polymer brush coatings by employing reversible polymer condensation using ionic cross-linkers

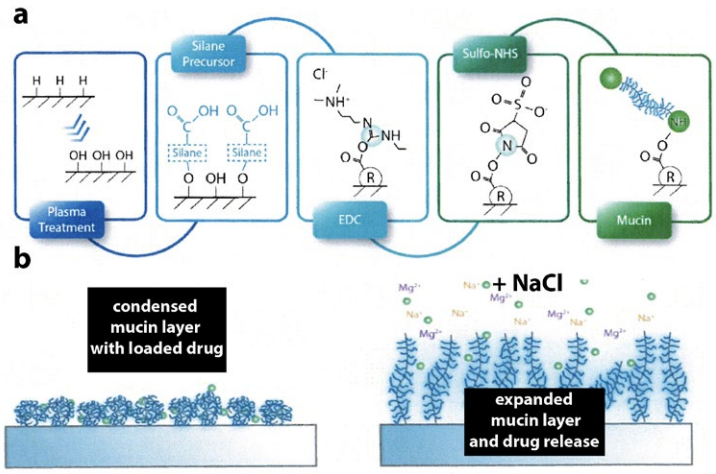
Reference No: B79086

CHALLENGE

Soft tissue implants, such as heart valves, catheters and stents are frequently used in cardiovascular diseases. Medical devices that remain in or on the body for short periods of time, such as catheters, artificial bowel outlets and tubes for supplying medication are also widely used. Post-surgery inflammations after implantation are one of the most common problems in modern clinical practice. In a conventional approach, local antibiotic depots, e.g., antibiotic loaded bone cement, are used to reduce inflammatory reactions after implantation. However, these approaches are prone to induce local overdosing and also fail to provide ongoing inflammatory protection during the critical time window. Thus, a repeated administration of antibiotics becomes necessary, which in return often leads to antibiotic resistance of the pathogens.

INNOVATION

The invention describes a mechanism by which polyanionic or polycationic macromolecules can be condensed into nanoparticles using glycerol and reversibly stabilized with various ionic crosslinkers. This mechanism is used for surface-bound mucin nanoparticles that can store and subsequently release therapeutic agents, such as antibiotics. One possible application is the coating of implants with the inventive mucin-drug complex. Physiological salt concentration trigger the unfolding of the mucins and thus the local release of the encapsulated drug.



a) Coating process which allows covalently linking mucin to the surface of a medical polymer.

b) Drug release mechanism (simplified). The condensed mucin layer on the coated surface retains the drug and remains stably condensed until it is exposed to physiological salt concentration.

COMMERCIAL OPPORTUNITIES

Coating of medical devices or implants to reduce post-surgery inflammation

DEVELOPMENT STATUS

Proof-of-Concept

REFERENCES:

1. Winkeljann, B., Leipold, P. A., & Lieleg, O. (2019). Macromolecular Coatings Enhance the Tribological Performance of Polymer-Based Lubricants. Advanced Materials Interfaces, 1900366
2. Yan, H., Chircov, C., Zhong, X., Winkeljann, B., Dobryden, I., Nilsson, H. E., ... Crouzier, T. (2018). Reversible condensation of mucins into nanoparticles. Langmuir. doi:10.1021/acs.langmuir.8b021

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