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

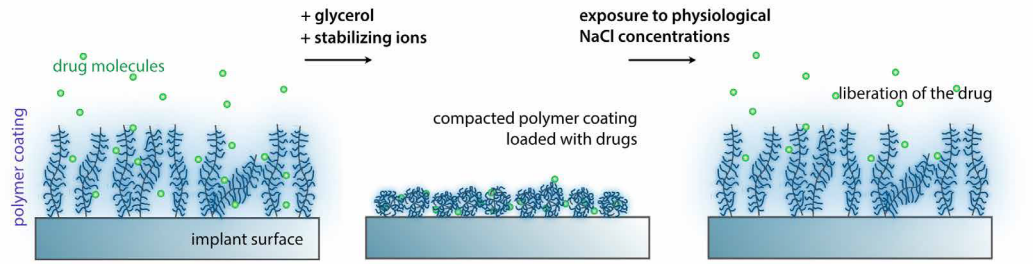
Reference No: B79086

CHALLENGE

Post-surgery inflammations are one of the most common problems in modern clinical practice. The consequences for the patients reach from simple inconvenience to revision surgeries, or even death. If the implant has to be removed prematurely as a consequence of inflammation, the duration of both, patient hospitalization and physical inactivity is increased. This leads to elevated economic and social expenses. In conventional approaches, antibiotics are either administered systemically or via local antibiotic depots. 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 brush polymer coatings are used as local drug depots. Drug molecules are temporally entrapped in the coating by compacting the brush layer and transiently stabilizing it with multivalent ions. Upon exposure to the physiological environment of the human body (i.e., physiological NaCl concentrations), this compacted state is reversed thus liberating the encapsulated drug substance. A proof-of-concept study has demonstrated that only few requirements have to be met for this mechanism to operate; any soluble, charged polymer (e.g., hyaluronic acid or poly-L-lysin) can be used, and the coating can be generated on a broad range of surfaces (including polymeric and metallic materials; the mechanism is fully compatible with a range of surface modification strategies). Furthermore – depending on the polymer used for coating generation – a multitude of different drugs can be encapsulated. Thus, this invention is highly versatile and can be tailored for different application scenarios.



COMMERCIAL OPPORTUNITIES

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

DEVELOPMENT STATUS

Proof-of-Concept

REFERENCES:

1 Kimna, C., Winkeljann, B., Song, J., and Lieleg, O., (2020). Smart biopolymer-based multi-layers enable consecutive drug release events on demand, Advanced Materials Interfaces. 7 (19) 2000735

2 Yan, H., Chircov, C., Zhong, X., Winkeljann, B., ..., Lieleg, O., Crouzier, T. (2018). Reversible condensation of mucins into nanoparticles. Langmuir. 34 (45) 13615-13625

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