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Stimuli-Responsive Zwitterionic Dressings for Chronic Wounds Management

Authors : Konstans Ruseva, Kristina Ivanova, Katerina Todorova, Margarita Gabrashanska, Tzanko Tzanov, Elena Vassileva

Abstract : Zwitterionic polymers (ZP) are well-known with their ultralow biofouling. They are successfully competing with poly(ethylene glycols) (PEG), which are considered as the “golden standard” in this respect. These unique properties are attributed to their strong hydration capacity, defined by the dipole-dipole interactions, arising between the ZP pendant groups as well as to the dipoles interaction with water molecules. Beside, ZP are highly resistant to bacterial adhesion thus ensuring an excellent anti-biofilm formation ability. Moreover, ZP are able to respond upon external stimuli such as temperature, pH, salt concentration changes which in combination with their anti-biofouling effect render this type of polymers as materials with a high potential in biomedical applications. The present work is focused on the development of zwitterionic hydrogels for efficient treatment of highly exudating and hard-to-heal chronic wounds. To this purpose, two types of ZP networks with different crosslinking degree were synthesized - polysulfobetaine (PSB) and polycarboxybetaine (PCB) ones. They were characterized in terms of their physico-mechanical properties, e.g. microhardness, swelling ability, smart behaviour. Furthermore, the potential of ZP networks to resist biofilm formation towards Staphylococcus aureus and Escherichia coli was studied. Their ability to reduce the high levels of myeloperoxidase and metalloproteinase, two enzymes that are part of the chronic wounds enviroenment, was revealed. Moreover, the in vitro cytotoxic assessment of PSB and PCB networks along with their in vivo performance in rats was also studied to reveal their high biocompatibility.

Keywords : absorption properties, biocompatibility, enzymatic inhibition activity, wound healing, zwitterionic polymers
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