Photothermal Therapy with In Situ Self-healing, Antibacterial, Conductive and Biocompatible Dual Network Hydrogel Promotes Infected Skin Wound Healing

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Abstract

Herein, we develop a novel dual network hydrogel system for the treatment of infected full-thickness skin wounds, leveraging the synergistic effects of TA-modified MXene and bacterial cellulose within a polyvinyl alcohol-borax/GelMA hydrogel matrix. The incorporation of bacterial cellulose, a natural biopolymer produced by certain bacteria, enhances the mechanical properties and biocompatibility of the hydrogel while providing a scaffold for cell adhesion and proliferation. The addition of TA-modified MXene further enhances the antibacterial efficacy of the hydrogel and enables photothermal therapy through NIR light absorption. Moreover, the fabricated hydrogel demonstrated excellent biocompatibility. Furthermore, the in vivo study confirmed that hydrogel can accelerate infectious wound healing under NIR irradiation. The resulting hydrogel system offers a multifunctional platform for combating infection, promoting wound healing, and facilitating tissue regeneration in infected skin wounds.

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