

An Intelligent Ternary Hydrogel for Rapid Wound Healing

Jianwei Zhang, Lifei Chen, Cheng Chen*

Shanghai Key Laboratory of Engineering Materials Application and Evaluation,
School of Energy and Materials, Shanghai Polytechnic University, Shanghai 201209,
China

In this study, a ternary hydrogel composed of polyvinyl alcohol (PVA), chitosan (CS) and tannic acid (TA) with pH responsiveness, self-healing, swelling, water retention and adhesion was developed, which is expected to be used to accelerate wound repair. This PVA/CS/TA (PCT) hydrogel relies on the dynamic borate ester bond between PVA and TA to form a reconfigurable three-dimensional network, which enables independent self-healing without external stimulation. The independent hydrogel can form a combined hydrogel through simple contact, and thus can be used repeatedly. In addition, CS plays the role of antibacterial and pH responsive drug release in the composite hydrogel. The self-healed hydrogel still showed excellent swelling ability, water retention and tissue adhesion. In vitro experiments have confirmed its good biocompatibility and demonstrated that it promotes wound cell repair, in which TA plays a crucial role. Furthermore, in vivo studies have shown that the PCT hydrogel significantly enhances wound closure and collagen remodeling, making healing tissue more inclined towards pre-injury, thereby reducing scar formation. On the basis of wounds protection and repari promotion, the PCT hydrogel can be used for the pH responsive drug release. Model drug release result verifies that PCT hydrogel has environmental responsiveness, which will be beneficial to release corresponding drugs in the microenvironment of wound infection or inflammation in the future. PCT hydrogel is a competitive candidate for wound dressing in clinical application.

Keyword: hydrogel, wound healing , pH sensitive