

Accepted Manuscript

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PII: S0144-8617(17)30334-X
DOI: <http://dx.doi.org/doi:10.1016/j.carbpol.2017.03.070>
Reference: CARP 12159

To appear in:

Received date: 10-12-2016
Revised date: 21-3-2017
Accepted date: 21-3-2017

Please cite this article as: Wang, Yixi., Wang, Zhicun., Wu, Keliang., Wu, Jianning., Meng, Guihua., Liu, Zhiyong., & Guo, Xuhong., Synthesis of Cellulose-Based Double-Network Hydrogels Demonstrating High Strength, Self-Healing, and Antibacterial Properties. *Carbohydrate Polymers* <http://dx.doi.org/10.1016/j.carbpol.2017.03.070>

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Synthesis of Cellulose-Based Double-Network Hydrogels Demonstrating High Strength, Self-Healing, and Antibacterial Properties

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Highlights

- A novel double network hydrogel with superior mechanical property was prepared.
- The prepared hydrogel maintained good self-healing properties.
- The hydrogel possessed an excellent antibacterial property (antibacterial rate>93%), which could protect itself from microbial attack.

ABSTRACT: Novel antibacterial double-network (DN) hydrogels with superior mechanical and self-healing properties are developed via the UV-initiated copolymerization of polyacrylic acid (PAA)-grafted quaternized cellulose (QCE) and polyvinyl alcohol (PVA). The QCE functioned as an antibacterial agent, resulting in excellent antibacterial capability (antibacterial rate>93%). The hydrogels are thus protected from microbial attack in natural environments, prolonging their lifetime. The PVA functioned as a physical cross-linker, resulting in superior mechanical properties. At PVA and QCE contents of 8% and 1.5%, respectively, the strain and stress at break of hydrogel were 465.37% and 1.13 MPa, respectively. The hydrogel maintained good self-healing properties owing to ionic bonding between the ferric ions and carboxylic groups, and hydrogen bonding between the PVA molecules. The hydrogel was responsive to pH; its water-holding ability could be controlled

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