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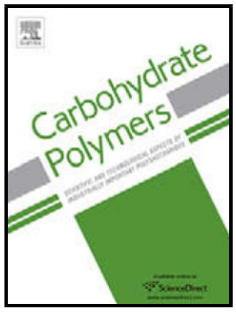

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Design and preparation of metal-organic framework papers with enhanced mechanical properties and good antibacterial capacity

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Highlights

- Cellulose nanofiber was used to improve the mechanical property of cellulose paper.
- ZIF-67 was in situ synthesized on the surface of cellulose-based composite.
- The cellulose-based composite exhibited good antibacterial performance.

Abstract

In this study, a biodegradable paper-based composite with good mechanical and antibacterial properties was obtained by first reinforcing the cotton pulp-based paper with carboxylated cellulose nanofiber (CNF) via the Williamson reaction, followed by *in situ* generating zeolitic imidazolate framework-67 (ZIF-67) nanoparticles on the surface of the resulting cellulosic material. The mechanical properties and antibacterial activities of the resulting composite were investigated. The tensile testing demonstrated that the composites prepared with 2.5 wt% CNF exhibited outstanding mechanical performance under dry and wet conditions with the tensile strength values of 17.20 and 1.90 MPa, respectively, approximately 1.3 and 11 times higher compared to that of the original cellulose paper. Furthermore, the antibacterial experiments showed that the composites exhibited significant bacteriostasis, and the antibacterial properties increased significantly with increasing ZIF-67 loading in the composites. Consequently, this biodegradable composite could be potentially used in the field of medical and health security.

Keywords: cellulose paper; cellulose nanofiber; metal-organic framework; mechanical performance; antibacterial activity

1. Introduction

With the increasing awareness of health security and the global demand for sustainable development, new biodegradable materials are constantly required to substitute the traditional medical packaging materials, such as polyethylene, polypropylene (Mitani, Narimatsu, Izushi, &

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