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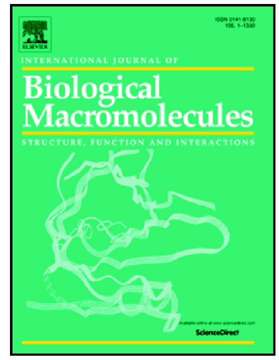


# Chemical cross-linked polyvinyl alcohol/cellulose nanocrystal composite films with high structural stability by spraying Fenton reagent as initiator

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**Chemical cross-linked polyvinyl alcohol/cellulose nanocrystal composite films with high structural stability by spraying Fenton reagent as initiator**

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**Abstract:** Cross-linked polyvinyl alcohol (PVA) composite films with high structural stability were prepared by free radical copolymerization between cellulose nanocrystal (CNC) and maleic anhydride (MAH) modified PVA through spraying Fenton free radical as initiator. The influence of chemical cross-linked and physical network structure on mechanical, thermal and water absorption properties of the composite films were investigated. Compared to PVA and PVA/CNC composite film, significant improvements in the mechanical, thermal and water uptake properties of the cross-linked composite film were found. The tensile strength of the cross-linked composite film was enhanced from 23.1 MPa (neat PVA film) and 32.6 MPa (PVA/CNC-10%) to 42.5 MPa, and the maximum thermal degradation temperature was increased from 266.8$^{o}$C and 281.2$^{o}$C to 366.7$^{o}$C (cross-linked composite film). Besides, the water absorption was reduced from 385.9% and 220.6% to 175.7% for cross-linked composite film. It indicates that compared with physical network structure in PVA/CNC composite film, the multiple cross-linked networks showed excellent thermal stability, resistance of water swelling and structural stability at the same CNC loading level. Thus, the PVA/CNC composite film with the multiple cross-linked network shows greater property reinforcements.

**Keywords**: Polyvinyl alcohol; Cellulose nanocrystal; Cross-linked network

## 1. Introduction

The development and growth of biopolymers in the biomedical application have received great attention in the world. Polyvinyl alcohol (PVA) based biocomposites have been widely used in food packaging and biomedical application because they provide good mechanical and thermal properties [1, 2]. However, the biocompatibility and water resistance of obtained composites is considerably poor. In this context, various types of cross-linking mechanisms including physical, chemical, and radiation have been reported in the application of PVA-based nanocomposites because they can improve the biocompatibility and mechanical

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