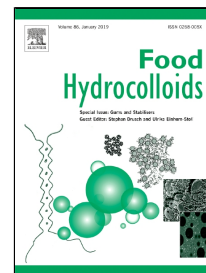


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Construction of Bi₂WO₆-TiO₂/starch nanocomposite films for visible-light catalytic degradation of ethylene

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Abstract

Bi₂WO₆-TiO₂ (BT)/starch nanocomposite films were prepared by incorporating BT nanoparticles through the casting method. The BT nano-particles used were synthesized by solvothermal method. The effects of BT loadings (0, 1, 2, 3, 4, and 5 wt% dry basis) on the optical, mechanical, microstructural, spectral, and thermal properties of the nanocomposite films were investigated, and their photocatalytic activities were evaluated from the degradation of ethylene under visible light. With the increase in BT loading, the tensile strength of the film specimens increased while elongation at break and transparency decreased; the nano-particle agglomerates increased when excess BT nano-particles were added into the films. When the loading was 4%, the film exhibited the highest photocatalytic activity, and the rate of ethylene degradation reached 12.47%. In conclusion, the BT/starch films can effectively degrade ethylene in gaseous phase, and they have the potential to be used as fruit and vegetable packaging materials.

Keywords: Starch film; Nanocomposite; Bi₂WO₆-TiO₂; Photocatalytic degradation; Ethylene; Visible light

1. Introduction

Ethylene (C₂H₄), a plant hormone, accelerates the ripening and senescence of fruits and vegetables. It can be released by horticultural products themselves through respiration (Ansari & Tuteja, 2015; Chaves & Mello-Farias, 2006); hence, removing C₂H₄ from the storage environment of horticultural commodities is the key to the prolongation of shelf life during the sale period and to reducing economic losses. Reported methods such as physical absorption (Albunia, Minucci & Guerra, 2008), as well as the use of oxidants (Mehlhorn, O'shea & Wellburn, 1991) and catalysis

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