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ABSTRACT

The active poly(vinyl alcohol) (PVA) films incorporated with clove oil (CO) at level of 1%, 3%, 5%, 7% and 9% (w/w) was prepared. The effects of CO content on the structural, mechanical, gas barrier and thermal stability properties of the films were investigated. The antimicrobial and antioxidant activities in vapour phase of the films were evaluated by investigating the microbiological analyses and lipid oxidation of the packed *trichiurus haumela* without contacting the PVA films. The oil droplets were observed on the surface and cross-section of the films as CO increased from 3% to 9% via scanning electron microscope (SEM). It resulted in the heterogeneous film structure featuring discontinuities. Some negative impacts on the properties of the films were observed with increasing CO. Compared with pure PVA film, the tensile strength (TS) of film added with 9% CO decreased 14.13%, the elongation at break increased 26.64%, water vapor transmission rate (WVTR) reduced 54.31%, oxygen transmission rate (OTR) increased 90.77% and thermal stability was worsened slightly. The bacterial growth and lipid oxidation of the packed *trichiurus haumela* were inhibited by the packaging with CO-containing films. The PVA film containing 9% CO showed the best quality protective effectiveness. Its microbiological shelf-life could be extended for 2 days and 28.07% reduction of malonaldehyde was obtained on day 7 comparing with control sample, indicating the antimicrobial and antioxidant activities were effective in vapour phase. It could be a promising active packaging for potential application in the non direct contact packaging-food system to create a protective atmosphere around the packaged foodstuffs.

KEYWORDS: poly(vinyl alcohol), clove oil, vapour phase, antimicrobial, antioxidant, active packaging film

1. Introduction

Active food packaging is a promising and rapidly emerging technology in which the antimicrobial or antioxidant agents are incorporated into the packaging materials. It can provide the packed food high quality, safety and long shelf life, usually by reducing or retarding the growth of microorganisms and inhibiting the lipid oxidation (Muriel-galet, Cran, Bigger, Hernández-muñoz, & Gavara, 2015). Recently, there is a considerable interest in active food packaging films made from biodegradable polymers due to the serious environmental problems caused by conventional plastic food packaging material (Siracusa & Dalla, 2008). Poly-(vinyl alcohol) (PVA) is a biodegradable synthetic polymer