EFFECT OF NANOCOMPOSITE PACKAGING CONTAINING AG AND ZNO ON REDUCING PASTEURIZATION TEMPERATURE OF ORANGE JUICE

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ABSTRACT

Nanocomposite low-density polyethylene (LDPE) films containing Ag and ZnO nanoparticles were prepared by melt mixing process through the twin-screw extruder. Packages prepared from nanocomposite films were then filled with fresh orange juice, pasteurized (at 55 and 65C for 16 s) and then stored at 4C. Microbial stability, ascorbic acid (AA) content, browning index and color value of the juice were evaluated after 7, 28, 56, 84 and 112 days of being stored. The two-way interaction between heat treatment and packaging type on the characteristics of the orange juice was investigated. Consequently, application of LDPE nanocomposite packaging containing Ag markedly decreased the pasteurization temperature (65C) of orange juice by 10C. Moreover, the reduced degradation of AA was observed in orange juice, which was filled in nanocomposite packaging containing nano-ZnO.

PRACTICAL APPLICATIONS

Development of the novel technologies that offer reduced energy consumption and increased quality of fruit juice are of the interest in the food industry. Compared with pure packaging, antimicrobial nanocomposite packages containing Ag and ZnO as an alternative nonthermal-processing technology can reduce the temperature of orange juice light pasteurization while produce juice with higher quality.

INTRODUCTION

Orange juice is the predominant juice manufactured by the beverage-processing industry with a share of approximately 50% of the total fruit juice trade (Bull *et al.* 2004). Two type of pasteurization are traditionally applied to citrus juices: full pasteurization at 76–99C for a few seconds to 1 min and light pasteurization at 66–75C for 1–16 s (Alwazeer *et al.* 2002). Light pasteurization treatment is sufficient for inactive microorganisms and most enzymes provided that the product is chemically, microbiologically and visually stable (Sadler *et al.* 1992). It is suggested that reduced heat may conserve energy and time during heat processing (Shearer *et al.* 2002). Therefore, a great interest is increased in the development of novel nonthermal technologies that offer the advantages of low processing temperatures, low energy use, the retention of nutrients and sensory attributes, while still inactivating microorganisms to levels that do not pose a public health risk (Smith *et al.* 2002). This has formed the basis of the successful "hurdle technologies" that have fostered the development of new routes to food preservation around the world. Proper use of hurdles can appreciably lengthen shelf life of unpasteurized juices without unduly affecting quality (Bates *et al.* 2001). In accordance with this approach, rather than focusing solely on an antimicrobial method, several sublethal treatments could be used to achieve a safety level in the juice (Hodgins *et al.* 2002). However, sublethally injured cells are more susceptible to antimicrobial components (Kalchayanand *et al.* 1994). Nanotechnology as the new method in food packaging industry can potentially provide solutions to food packaging challenges, such as short shelf life (Joseph and Morrison 2006; Chaudhry *et al.* 2008). Antimicrobials active packaging based on metal nanocomposites, which are made by incorporating some metal nanoparticles (NPs) such as Ag, ZnO and CaO into