Application of Citric Acid, Sodium Chloride and Peroxyacetic Acid as Alternative Chemical Treatment for Organic Trimmed Aromatic Coconut

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ABSTRACT

Shelf-life of trimmed coconut is usually extended using sulfite agents or chlorine. However, in organic produce, applications of sulfite agents is prohibited while chlorine is restricted. The objective of this study was aimed to extend the shelf-life of organic trimmed aromatic coconut using citric acid (CA), sodium chloride (NaCl) and peroxyacetic acid (PAA). Organic trimmed aromatic coconuts were dipped in CA (10% and 20%) in combination with NaCl (10% and 15%) followed by dipping in PAA (80 ppm). All samples were compared with control (no dipping) and those dipped in 3% sodium metabisulfite (SMS). During 8 weeks of storage at 2 °C, qualities of treated coconuts including visual quality, color values (L*, a*, b*) and total plate count (TPC) on surface of samples were evaluated. Chemical qualities (titratable acidity (TA), pH and total soluble solids) of coconut water were also determined. The results showed that beside SMS, treatment 20% CA + 15% NaCl was the most effective treatment for maintaining visual quality and color as well as controlling microbial growth (P < 0.05). Moreover, PAA treatment could only help reducing the TPC up to five weeks of storage and resulted in yellowish color. Therefore, 20% CA + 15% NaCl could be an alternative chemical treatment in controlling postharvest deterioration of organic trimmed aromatic coconut.

Keywords: Organic trimmed aromatic coconut, Citric acid, Peroxyacetic acid, Shelf–life, Sodium chloride

INTRODUCTION

'Aromatic Green Dwarf' or 'Nam Hom' coconut is one of the most important exported plant which contribute to the economy of Thailand. The key aroma compounds of water and meat of this fruit are similar to pandan leaf (Jangchud et al., 2007). There are three types of organic aromatic coconut usually exported to other countries: green, trimmed and polished aromatic coconut. Trimmed coconut is very popular due to convenience and transportation cost reduction (Mohpraman and Siriphanich, 2012). However, by removing outer layer, trimmed coconut has shorter shelf-life due to microbial spoilage and surface discoloration caused by enzymatic browning.

Consumption of organic aromatic coconut has dramatically increased due to consumers' concern about possible health risks and environmental impacts of conventional produce production methods. According to US regulation, organic produce are required to be produced and processed without synthetic pesticides, growth hormones, antibiotics, modern genetic engineering techniques, hemical fertilizers, or sewage sludge (Winter and Davis, 2006). Recently, sulfite agents (e.g. sodium metabisulfite, potassium metabisulfite, sulfur dioxide, sodium sulfite and sodium bisulfite) and chlorine are commonly used to extend shelf-life of trimmed aromatic coconut. However, sulfite agents and chorine were reported to cause allergenic effects (Vally et al., 2009; Abadias et al., 2011). Consequently, the application of sulfite agents were prohibited and levels of chlorine residue for wash water in direct crop or food contact were limited not exceed 4 ppm) (CFR, 2011). Therefore, it is necessary to develop a better treatment to maintain quality of organic trimmed aromatic coconut.

Previously, there are many studies on sulfite substitutes for fresh produces such as ascorbic acid (Javdani et al., 2013), 4-hexylresorcinol (Hexyl), calcium chloride ($CaCl_2$) (Ghidelli et al., 2013), sodium chlorite (Lu et al., 2007) or combination of inhibitors and sanitizer (Wang et al., 2007). Among safe and widely used additives, citric acid (CA) and sodium chloride (NaCl) were reported to help prolonging quality of fresh-cut products (Plaza et al., 2003; Manolopoulou and Varzakas, 2011; Park et al., 2011). Nonetheless, chemical treatments have limited success in extending the shelf life of product because of low efficiency, off flavors, and injury (Lu et al., 2007). Peroxyacetic (PAA), a mixture of acetic acid (CH_3COOH) and hydrogen peroxide (H_2O_2) in an aqueous solution, is considered giving positive effect towards novel way to improve microbiological stability fresh produce and could be used as chlorine substitution (Fawell, 2000).