Effect of Potassium Sorbate on Microbial Decontamination and Shelf Life of Fresh Cut Cabbage

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Abstract

Among of many fresh vegetables, cabbage (Brassica oleracea L. var capitata) is world wide consume as the salad or fresh-cut cabbage. However, the good and safe sanitizing treatments during preparing fresh-cut cabbage are required for controlling microbial contamination and maintaining qualities. The objective of this study was to investigate the effect of potassium sorbate (PS) on postharvest microbial decontamination and qualities of fresh-cut cabbage. Fresh-cut cabbage were dipped into PS solutions at 5 and 10 g/L for 1 and 2 min, and the untreated fresh-cut cabbage was served as the control. All treatments were packed in PET box and stored for 5 days at 4°C. The results revealed that the dipping of PS at 5 g/L for 2 min was the best treatment to reduce coliforms and total bacteria by 0.40 and 0.19 log CFU/g FW respectively. Moreover, this treatment also maintained the firmness of fresh cut cabbage although weight loss was not significant different with control, meanwhile the chlorophyll content and browning index were not significantly differences with other treatments. The dipping of 10 g/L PS for 2 min showed the reduction in total bacteria by 0.82 log CFU/g FW, but unexpected result showed that 10 g/L PS for 2 min had a less effect to reduce coliforms than 5 g/L PS for 2 min.

Keywords: fresh cut, cabbage contamination, food preservative

Introduction

Cabbage is world wide consume which often supply as pre-cut to manufactures of ready meals and pre-prepared salads. Cabbage is low in saturated fat, cholesterol, high in dietary fiber, vitamin C, vitamin K, folate, potassium, manganese, vitamin A, thiamin, vitamin B₆, calcium, iron and magnesium (Ensminger, 1995). Since the busy lifestyle lead people to prefer fresh-cut produces such as cabbage salad. However, the preparing process of fresh-cut cabbage may contaminate with microbial and also affect to its quality resulting to short shelf life. From 1996 to 2008, 82 foodborne illness outbreaks were associated with the consumption of fresh produce, 34% were linked to the consumption of leafy greens associated with outbreaks for 949 illnesses and 5 deaths (FDA 2009). In 1996-2006, there is one outbreak of the consumption of cabbages in U.S. (Guzewich, 2007). Although the number of outbreak on cabbage consumption is less, but now a day the consumption of cabbages has increased. Therefore, food safety management system should be used for minimizing the microbial load in fresh cut cabbage.

Potassium sorbate (PS) is an antimicrobial and low toxicity, it has been used as food preservative. PS is used to prevent mold and microbes, increase shelf life, and is considered to be safe because of its long term safety record. The antimicrobial efficacy of PS is greater againts yeast and molds, in addition PS can retard the germination of spores and the growth of vegetative cell of bacteria such as Salmonella typhimurium and E. coli (Tuncan and Martin, 1985). Therefore, the aim of this research was to study effect of PS on microbial decontamination and quality of fresh cut cabbage.

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Materials and Methods

Cabbage head were purchased from local markets in Bangkok Thailand, then the outer part or damaged leaves were removed and cleaned with tap water. Cabbage heads were sliced using slicing machine. Sliced cabbage were soaked in potassium sorbate (PS) solution at the concentrations of 0 (control), 5 g/L and 10 g/L for 1 and/or 2 min. The exceed solution was drained by using hand spindle, and 70 grams of sliced cabbage were then packed in PET box, and kept at 4°C for 5 days. Every preparation processes were done under aseptic techniques to avoid the re-contamination. Completely Randomized Design (CRD) factorial with 3 replications was conducted in this experiment. The microbial load and quality of sliced cabbage were recorded daily interval (day 1, 3 and 5). Total bacteria, coliforms, yeasts and molds were detected using Plate count agar (PCA), Eosin methylene blue (EMB) and Potato dextrose agar (PDA), respectively. Chlorophyll content and browning index were performed according to the methods of Moran (1982) and Yano et al. (1986) respectively. Firmness was measured using texture analyzer (Kramer shear, CHARPA). Weight loss was calculated from the initial fresh weight minus with the fresh weight of detected date and then converted to be the percentage of weight loss. Analysis of variance (ANOVA) and Duncan’s new multiple range test (DMRT) were used for comparison of means and least significant differences ($P < 0.05$) by SAS Program.

Results and Discussion

Potassium sorbate (PS) is widely used in various foods, one of them is fresh salad. This experiment we selected PS at 5 g/L and 10 g/L for treating sliced cabbage based on the using of PS in fresh cut lettuce (Ihl et al., 2003). Our results showed that the dipping of sliced cabbage in 5 g/L PS for 2 min (Figure 1) was the best concentration for reducing coliforms loads (Figure 1) and maintaining the texture (crispy) (Figure 3). York and Vaughn (1964) suggested that the role of PS as antimicrobial is due to sorbic acid diffuses into the membrane of microbial cells, then sorbic acid seems to inhibit several enzymes (fumarase, espartase and succinic dehydrogenase) which are involved in microorganism growth. Actually PS at higher concentration has more active or protonated sorbate to attacks bacterial cell membrane (Tuncan and Martin,1985). But unfortunately in this experiment, fresh cut cabbage treated with high concentration (10 g/L) of PS had higher coliform counts than 5 g/L PS (Figure 2). It might be due to the decrease of synergynestic effect on the inhibitory efficacy of sorbate with increasing sorbate concentration (Tuncan and Martin, 1985).

However, there were no significant differences between all treatments in weight loss, chlorophyll content, browning index, yeasts and molds, and the apperance of fresh cut cabbage (data not shown). In case of using fresh cut cabbage as the salad, its texture is an important factor for consumer perception (Taniwaki et al., 2006). Therefore, our results showed that dipping of 5 g/L PS for 2 min was able to preserve firmness (crispy) of fresh cut cabbage than other treatments (Figure 3).
Summary

The dipping of PS at 5 g/L for 2 min was the best treatment to reduce coliforms and total bacteria and by 0.40 and 0.19 log CFU/g FW respectively. Moreover, this treatment also maintained the firmness (crispy) of fresh cut cabbage although weight loss, chlorophyll content, browning index and the external appearance were not significant different with non-treated cabbage.

Literature cited


Figure 1 Coliforms on fresh cut cabbage which were dipped in PS solutions at 0 (H₂O), 5 and 10 g/L for 1 (A) and 2 (B) min and then stored at 4 °C for 5 days.

Figure 2 Total bacteria on fresh cut cabbage which were dipped in PS solutions at 0 (H₂O), 5 and 10 g/L for 1 (A) and 2 (B) min and then stored at 4 °C for 5 days.

Figure 3 The texture on fresh cut cabbage which were dipped in PS solutions at 0 (H₂O), 5 and 10 g/L for 1 (A) and 2 (B) min and then stored at 4 °C for 5 days.