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Investigating the Effect of Preservatives and Antioxidant on the Oxidative and Microbial Properties of Walnut Butter during the Shelf-life

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Abstract

Walnuts contain many nutritional compounds, including omega-3, various vitamins, especially vitamin E and types of minerals. Therefore, the development of foods based on walnut and studies on chemical and microbial stability during storage, is very important. In this research, the effects of various concentrations of BHT (three levels 100, 150 and 200 mg/L) on changes in peroxide value and acid value of walnut butter, as well as the effect of two types of preservatives of benzoic acid and sorbic acid, each in two levels (400 and 800 mg/kg) were separately and mixed, on the total count of microorganisms and the count of mold and yeast of walnut samples during 75 days of storage at ambient temperature is investigated. The results of this study showed that by adding BHT at 200 mg/L, the peroxide value decreased significantly compared to the control sample. After production, acidic value was 0.3% and it rose to 0.4-0.5% after 75 days of storage. Also, benzoic acid was more effective in reducing total bacterial count and counting mold as well as yeast during storage in comparison with sulfuric acid.

Keywords: Antioxidants, Preservatives, Shelf life, Walnut Butter

Introduction

Walnut butter is a combination product made from walnuts, which is roasted, and sweetener (sugar or other sweeteners) and a little salt. Today, food additives are widely used in the food industry, such as emulsifiers, antioxidants, preservatives etc., to improve the quality and extend the shelf-life of foods. Of course, it should be noted that the values of each of the listed cases should be optimal. Therefore, optimizing these compounds will play an important role in improving its quality and shelf life. The oxidative degradation of fats causes the

development of undesirable flavor in the product through the production of toxic and active physiological compounds (Gardner, 1979; St. Angelo & Ory, 1975). In addition to oxidative degradation, microbial deterioration also affects the shelf life of products such as walnut butter. In this research, we tried to investigate the effect of preservatives and antioxidant on the oxidative and microbial properties of walnut butter during the shelf-life.

Material and methods

The roasted walnuts (for this purpose, the walnut was exposed to a temperature of 120 for 30 min) milled by a mechanical mill (Arman Kherad Toos, Iran). 20% grinded sugar, 0.5% salt and 5.0% lecithin were added to milled walnuts. Mixture was then turned into a paste by a ball mill (at ambient temperature for 60 min).

The BHT antioxidant walnut- based formula was added at 0, 100, 150 and 200 mg/kg. To evaluate the process of walnut butter oxidation during storage, peroxide number (Shantha & Decker, 1994) and acid number (AOCS, 1993) tests were performed on samples. In order to investigate the microbial stability of walnut samples during storage, the total count of microorganisms and the count of mold and yeast were carried out on samples (Institute of Standards and Industrial Research of Iran [ISIRI], 2016a).

Results and discussion

The results of variance analysis indicated a significant effect of adding BHT on PV of walnut butter samples ($P<0.05$). PV of walnut samples containing different concentrations of BHT antioxidants were shown in Fig. (1) as compared to control (without antioxidants) during 75 days of storage at 25 °C. The results indicate that, with increasing time, PV of walnut butter samples increased significantly ($P<0.05$), while in samples containing different concentrations of BHT as well as the control sample, the acceleration of PV increase was different. The highest increase in PV acceleration was attributed to the control sample.

The results of statistical analysis indicated that there were no significant changes in the acid number of walnut samples containing different concentrations of BHT compared to the control during storage ($P<0.05$). After production, acidic value was 0.3% and it rose to 0.4-0.5% after 75 days of storage. According to the national standard of Iran, the maximum permitted acidic value for almonds and pistachio is 2.5% (Institute of Standards and Industrial Research of Iran [ISIRI], 2001, 2016b).

In general, the results of the mean comparison indicated that the difference between the total bacterial count in the walnut butter samples containing the preservative variables was significant only up to the 15th day ($P<0.05$). After this period, the number of bacteria in walnut samples did not show significant difference until the end of storage period ($P<0.05$).

The results of the mean comparison indicated a significant difference in the number of mold and yeast in the walnut samples of the first day ($P<0.05$), which seems to be due to the microbial load of raw material and production conditions. In all samples, with the exception of samples containing 400 mg/kg sorbic acid and benzoic acid from day one until day 15, the number of mold and yeast increased, but then followed a steady or descending trend.

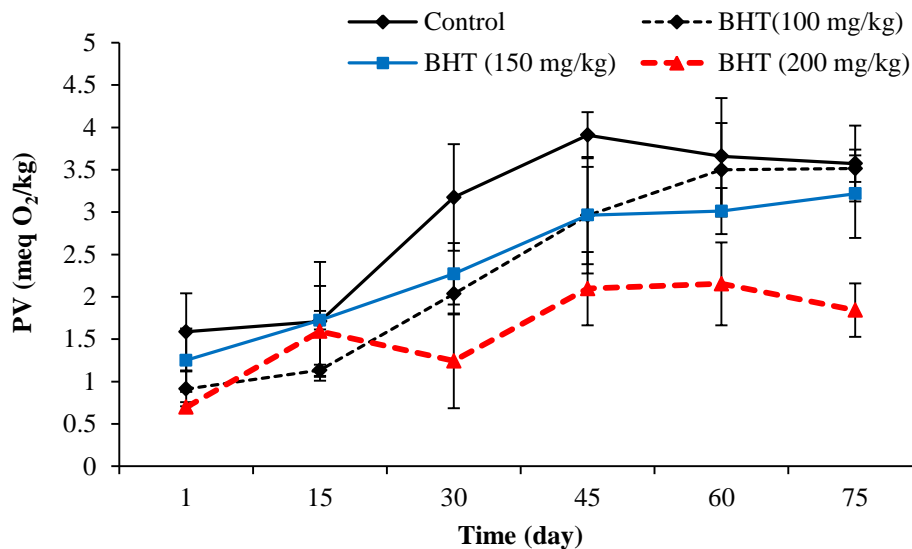


Fig. 1. PV changes of walnut butter samples containing different concentrations of BHT antioxidant compared to the control sample during 75 day storage at 25 °C.

Conclusion

The results of walnut oxidative monitoring during 75 days of storage indicated an increase in peroxide value from day one to day 75 with a steep slope in the control sample. The presence of BHT antioxidants at a concentration of 200 mg/L significantly reduced the peroxide value, but did not significantly affect the acid number of walnut samples. Benzoic acid, in comparison with the sorbic acid, demonstrated greater efficacy in reducing the total bacterial count and the count of mold and yeast during the storage period.

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