

Effect of MAP and Different Atmospheric Conditions on the Sensory Attributes and Shelf life Characteristics of Fresh Pistachio Nuts

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Abstract: Modified atmosphere packaging (MAP) was used to increase the shelf life of fresh in hull pistachio nuts (*Pistacia vera* L.), meeting the market demand for fresh high quality products. Fresh in hull pistachio nuts were stored at 5°C and three different gaseous conditions including 10% O₂, 20% CO₂ and 70% N₂ (MAP1), 100% CO₂ (MAP2) and ambient atmosphere for 42 days. The samples of 300 g of pistachio nuts were packaged in sealed high barrier poly propylene (PP) bags (26×20 cm). The permeability of films for CO₂ was 3910 cm³/m² dbar at 23°C and 50% RH. The thickness and the surface of the used films were 2.00 mm and 78.90 cm², respectively. External appearance, weight loss, firmness and color attributes and microbial growth were investigated at regular intervals throughout the storage period. Significant differences were found between packaged and unpackaged fresh in hull pistachio nuts in the most of parameters considered. The firmness in the nuts decreased markedly in control samples. This trend was also observed in the nuts stored under 10% O₂, 20% CO₂ and 70% N₂. However, the firmness in those nuts stored in 100% CO₂ increased. On the other hand weight loss was quite slighter in the samples stored at MAP comparing to the control ones (p<0.01). MAP had a significant effect (p<0.01) on the storage time, with the external appearance being the limiting factor for shelf-life of pistachio nuts. Storage in 100% CO₂ and 5°C showed the best results among the treatments in terms of retaining physical properties and sensory attributes, increasing the health and extending the shelf-life of fresh in hull pistachio nuts.

Keywords: Pistachio nuts; Modified atmospheres packaging; Quality attributes; Firmness.

INTRODUCTION

Pistachio nut (*Pistacia vera* L.) is one of the popular tree nuts which is grown mainly in Iran, USA, Syria, Turkey, Greece and Italy (Kucukoner and Yurt, 2003). Based on FAO statistics (Razavi *et al.* 2007), Iran produced about 275,000 Mt of pistachio nuts in 2003, which represented approximately 54.7% of the world's pistachio production. Oxygen is necessary for autoxidation of fats and as pistachio nut is an oily nut it should be stored at very low oxygen pressures to minimize the rate of oxidation. Therefore, the removal of atmospheric oxygen from a fat or food product exerts a protective effect (Swern, 1964). A common method of controlling the oxidation reaction is reducing the O₂

concentration in the storage atmosphere over the food by vacuum or nitrogen filling for dry or intermediate moisture foods (Kacyn *et al.* 1983) or CO₂ filling which acts as a biostat for fresh fruits and vegetable to prevent anaerobic microbial growth and lipid oxidation (Hotchkiss, 1988).

Modified atmosphere packaging alters the normal composition of air to provide an optimum atmosphere for reducing the product respiration rate, which leads to quality preservation and increase in shelf life. This atmosphere can be passively achieved inside a package due to respiration, consuming oxygen and producing mainly carbon dioxide, and gaseous exchange between the atmosphere on the inside and the outside of the package (Farber *et al.*, 1991). However, Brecht

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