

EFFECT OF COLD STORAGE AND DIFFERENT PACKAGING MATERIALS ON THE QUALITY OF FRESH ROSEMARY HERB: II- EFFECT ON THE ESSENTIAL OIL PERCENTAGE AND COMPOSITION.

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ABSTRACT

Fresh culinary herbs are one of the fastest growing markets for gourmet production on a world wide scale. Some herbs are sold fresh rather than dry because they do not retain their flavor when dried. Rosemary (*Rosmarinus officinalis* L.) plant is an important aromatic culinary herb. Essential oil of rosemary is considered one of the strongest natural antioxidants. A study was carried out during two successive summer seasons 2006 and 2007, at the Post Harvest Lab in the Vege. and Floric. Dept., Fac. of Agric., Mansoura Univ.

This part (II) aimed to investigate the effect of cold storage temperatures and different packaging materials on the essential oil percentage and composition of fresh rosemary herb and the changes that took place during storage until the end of their shelf life as fresh herbs. Fresh rosemary herbs were packaged in nine different packaging materials: Butter bags (P1), Cellophane bags (P2), Nylon bags (P3), Polyethylene bags (P4), Aluminum foils (P5), Aluminum plates covered with foil (P6), Aluminum plates covered with plastic film (P7), Foam plates covered with foil (P8), Foam plates covered with plastic film (P9), and then stored at (1, 3, and 5 °C) for 6 weeks. Gas Liquid Chromatography (G.L.C.) analysis was carried out in second season summer 2007 to compare between the composition of the oil of the freshly harvested herb and the oil of herbs packaged in Aluminum plates covered with foil (the package that gave best marketability for fresh herb shown in Part 1) after one and three weeks of storage under the three cold storage temperatures.

The results showed that the essential oil percentage of the herb increased with increasing the length of the storage period. Oil percentage in herbs stored at 3 °C was superior to those stored under the other two temperatures in both seasons. Herbs kept in Butter bags (P1) had maximum oil percentage until the second week of storage. Cellophane bags (P2) were the highest in the fourth week of storage, while at the fifth week of storage; Foam plates covered with foil (P8) was the highest. At the end of six weeks of storage at 3 °C only Aluminum plates covered with foil (P6) and Aluminum foils (P5) were marketable in both seasons, but (P6) had higher oil percentage than (P5).

GLC analysis identified 14 compounds constituted 88.8 % of the essential oil of rosemary fresh herb after harvest (control). The identified compounds included seven hydrocarbons forming 57.25 % and seven oxygenated forming 31.55 % of the total compounds. Hydrocarbons were α - pinene (11.93 %), β - pinene (7.01 %), limonene (3.01 %), *p*- cymene (10.11%), camphene (7.94 %), γ - terpinene (9.23 %), and α - terpinolene (8.02 %). Oxygenated compounds were 1,8 cineole (7.27 %), linalool (6.79 %), verbenol (1.94 %), borneol (3.83 %), thymol (4.47 %), camphor (2.3 %), and terpineol (4.95 %). The total percentage of hydrocarbons and oxygenated compounds decreased after storage compared with the control. The total percentage of each of hydrocarbons and oxygenated compounds were higher at 3°C than those at either 1 or 5 °C at the two comparable storage periods. At a storage temperature of 3°C, all hydrocarbons had higher percentages after one week of storage than after three

weeks of storage, except for β -pinene and limonene, while all oxygenated compounds had higher percentages after three weeks of storage than after one week of storage, except for thymol and terpineol.

INTRODUCTION

Rosemary, *Rosmarinus officinalis* L., Fam. Lamiaceae (Labiatae), is a common plant of the Mediterranean coastland, Portugal, and Spain (Keville, 1999). The prime effectiveness of this herb is culinary rather than medicinal. As a medicinal herb, it has been considered a digestion aid, an astringent, a diaphoretic, and a tonic (Chiej, 1984).

The oil of rosemary is found in the leaves and flowers, and its yield varies from about 0.725 % in summer to 0.435 % in winter. The components of rosemary oil are α -pinene, β -pinene, limonene, cineole, camphor, borneol, *p*-cymene, linalool, terpineol-4ol and caryophellene (Panda, 2000).

Giese (1994) reported that the chief sources of flavor in many spices are oils that volatilize at low temperatures. Most spices contain between 0.5 and 3.0 % volatile oils. Mae (2004) mentioned that essential oils are volatile at room temperature and will eventually evaporate, and that when a ground spice is exposed to air, bright light or heat, the concentration of oil is diminished and the spice loses its flavoring ability.

Herbs can be packaged in bags designed to minimize water loss and store refrigerated (Bhide, 2006). When herbs are packaged this way, it is particularly important to maintain constant temperatures, to reduce condensation inside the bag and the consequent risk of fungal or bacterial growth (Cantwell, 1992). Most fresh herbs of the Labiate's family keep well when packed in cartons lined with folded perforated polyethylene (PE), in which water loss, leaf abscission and decay are minimal (Aharoni *et al.*, 1993). The salad mix contained the leafy herbs was stored at 0°C, 5°C, or 10°C for 14 days in perforated or non perforated BOPP bags (Tomkins and Chennel, 2000). Lamberti and Escher (2007) reported that Aluminum foils is an important material in laminates and has wide application in food packaging. Its barrier function against the migration of moisture, oxygen and other gases, and volatile aroma, as well as against the impact of light is generally higher than any plastic laminate material.

The length of storage affected the essential oil content and composition of many medicinal and aromatic plants (Baritoux *et al.*, 1992). These changes depend on condition of plant material, method and conditions of drying and storage (i.e. temperature and humidity), (Joyce and Reid, 1986), and the chemical composition of the essential oil (Paakkonen *et al.*, 1990). Singh *et al.* (1994) also reported that the storage period length affected the percentage of *Cymbopogon* essential oil and the relative percentages of its constituents.

Most herbs such as thyme, oregano, rosemary, sage, mint, and marjoram retain good visual quality after being held up to 4 weeks at 0°C., while basil suffers from chilling injury, including loss of flavor, after 5 to 7 days at 7.5 °C, and after only 2 days at 2 °C (Cantwell and Reid 1993). Kmiecik *et al.* (2001) found that the content of volatile oil of dill was reduced by 53 - 55 % after