Effect of Different Drying Methods on Essential Oil and Antioxidant Activity (DPPH%) of Some Aromatic Plants

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ABSTRACT

Different drying methods (Shade, Sun and Electric oven at 35 °C and 50 °C) were studied. Effects of these methods on percentage and composition of volatile oils and antioxidant activity (DPPH%) of chamomile, peppermint, rosemary and sweet basil plants were studied. Using dry method in shade gave the highest mean value of DPPH% for all experimental plants compared with other drying methods. Shade drying generally seemed better, especially with regard to essential oil and major’s compounds percentage of plants experiment followed by oven at (35 °C) drying method.

ADDITIONAL INDEX WORDS: Drying methods, chamomile, peppermint, rosemary and sweet basil, DPPH%, chamazulen, menthol, borneol and linalool

INTRODUCTION

Medicinal, aromatic and herb spices from family Lamiaceae such as peppermint (Mentha piperita), sweet basil (Ocimum basilicum L.) and rosemary (Rosmarinus officinalis, L.) are widely distributed in Egypt. These plants are used as stomachic, spasmylytic, carminative, and expectorant agents in folk medicine and in official medicine. Ethereal oils extracted from Lamiaceae family plants can contribute the quality of food with better odor and flavor what is consider as very important quality parameter in food manufacturing (Kovaaevia, 2001). Other benefits could be applied due to ethereal oils in therapeutics purposes due to their antimicrobial (bactericidal and fungicidal) effects on some pathogen microorganisms (Stefanini et al., 2001 and Klaus et al., 2007). Chamomile (Matricaria recutita L.) (Family Asteraceae), is a well-known medicinal plant in folk medicine cultivated all over the world. Chamomile essential oil is widely used in pharmacistic, cosmetic, and food industries. The pharmacological effect of chamomile is mainly connected with its essential oil for its spasmylytic,antimicrobial, and disinfestive properties. The biologically active substances in chamomile essential oil are α-bisabolol, bisabolol oxides, chamazulene, and enyn-dicycloethers (Arak.,1981,Arak et al.1981,Brunke et al., 1992 and Grgesina et al.,1995).
metals, to cause DNA and RNA damage, thiol oxidation and lipid peroxidation (Halliwell and Guttridge, 1999; and Halliwell 1994). The great potential of free radicals to react with various compounds by electron transfer, proton transfer, H-atom abstraction or addition reaction may involve in the pathological of various diseases (Halliwell., 1993; and Havsteen, 1983). Many plant compounds can scavenge reactive oxygen species (ROS) and thereby directly reduce-oxidative stress (Walgren et al., 2000). Among these, flavonoids seem to be potent candidates because they show broad pharmacological activities and widely distributed in many edible plants (Rice-Evans et al., 1996). The beneficial effect of flavonoids is mainly associated with the different various antioxidative mechanisms which act as enzyme inhibitor, reducing agents, trapping free radical and by acting as iron-chelating (Bravo., 1998; and Hollman, 2001).

There is no study on the antioxidative activity of some aromatic plants up to the present. The aim of this study was to investigate the essential oil percentage, chemical composition of oil and the antioxidative activity of different drying methods of the aromatic plants (chamomile, peppermint, rosemary, and sweet basil) extracts as new potential source of natural antioxidants.

**MATERIALS AND METHODS**

**Plant material**

The samples of aromatics plants (chamomile, peppermint, rosemary, and sweet basil) were collected from Sabhia Horticulture Researches Station, Alexandria in March 2009 for chamomile and July 2009 for peppermint, rosemary, and sweet basil.

Three methods of drying were used; the traditional shade drying, open-sun drying and oven drying at 35 and 50 °C. To establish the effect of drying techniques on oil content and antioxidative activity in some aromatics plants (chamomile, peppermint, rosemary and sweet basil). The plants were selected because they are the most export herbs in Egypt.

**Shade drying**

One kilogram (fresh weight) of each sample was used for the experiment. The samples were evenly spread on a tray and left to dry in the shade until constant weight (until the herbs were brittle and considered to be dry).

**Sun drying**

One kilogram (fresh weight) of each sample was used for the experiment. The samples were evenly spread on a tray and left to dry in the sunshine until constant weight (until the herbs were brittle and considered to be dry). This may be done by taking a sample of the fresh herb prior to its harvesting, then promptly and accurately weighing it before carefully drying. A scientific method of establishing the dry weight is to take the weight of the sample and continuing the drying process until no further weight is lost. The herb can then be assumed to be dry and the percentage of water loss and thus dry weight be attained. A simpler method is by feel and testing when any pieces in the sample break sharply. To calculate the dry weight percentage: Dry weight of herb / wet weight of herb x 100.

**Oven drying**

Four hundred grams (fresh weight) of each sample were then packed in envelopes which were punched with holes to allow for moisture escape. The envelopes were placed in the oven at 35 and 50 °C and left to dry until constant weight (until the herbs were brittle and considered to be dry).

**Dry weight percentage**

This ability to scavenge the stable free radical (1, 1-diphenyl-2-pierylhydrazyl) (DPPH) was determined based on the method of Ohinishi et al., 1994.with minor modifications. A solution of 0.2 mM DPPH in methanol was prepared and 1 ml of this solution was mixed with 1 ml of extract in methanol (5 to 150 [micro]g/ml). The reaction mixture was vortexed thoroughly and left in the dark at room temperature for 30 min. A control sample containing the same volume of solvent in place of extract was used to measure the maximum DPPH absorbance. The absorbance of the mixture was measured spectrophotometrically at 517 nm. Ascorbic acid and quercetin were used as references. Results were expressed as percentage of inhibition of the DPPH radical according to the following equation:

% Inhibition of DPPH = (Absorbance of control - Absorbance of sample) x 100/Absorbance of control

**Essential oil analysis**

The percentage of essential oil were extracted separately by the hydro distillation method utilizing apparatus similar to European Pharmacopoeia (EP). The essential oils were diluted in diethyl ether (20 ml in 1 ml) and analyzed with GC-MS (HP 8644) with flame ionization detector (FID) on a fused silica 132 capillary column DB-5, 25 m in length, 0.32 mm i.d., and 0.5 mm film thickness. Helium was used as the carrier gas with a flow rate of 1.6 ml/min; the detector 134 temperature was 260 °C, the oven temperature was programmed to increase from 130 to 260 °C at a rate of 4 °C/min. The split injector was heated at 250 °C, the split 136 ratio was 15:1. Data were processed on a DP...
800 integrator. The percentage of majors constituents were estimated by measuring the peak area of the different compounds of the chromatogram according to Heftman (1967) and Gunther and Joseph (1978). Sources of the principal components of volatile oils which used as reference for determined essential oil of chamomile, peppermint, rosemary and sweet basil by GC were Ciba Gigi, NY, USA.

There were three replications for each specimen; all the results obtained were statistically analyzed. The layout of the experiment was randomized complete blocks design (Snedecor and Cochran, 1974).

RESULTS AND DISCUSSION

Generally, data represent in Table (1) and Fig.(1 and 2) indicate that using drying methods in shade and oven (35 C°) gave the highest mean value of dry weight percentage for all experimental plants compared with other drying methods. But all drying methods gave the allowable percentage of dry weight percentage of herbs according to Food Standards Agency (UK). Also, using dry method in shade gave the same trend (highest mean value) of DPPH%. On the other hand the decline in the percentage of dry weight by drying methods in sun and oven (50 C°) led to a low percentage of DPPH. Comparing between essential oils percentage of chamomile, peppermint, rosemary and sweet basil by different methods (shade drying, sun drying and oven drying (35 C° and 50 C°) show that, shade drying generally seemed better, especially with regard to essential oil percentage of plants experiment followed by oven (35 C°) drying. These results are in agreement with the findings observed in earlier studies (Osman, 2000,. and Muller and Heindl 2006).

Fig. 1. Typical GC-MS Chromatograms of Chamomile and Peppermint oils
Fig. 2. Typical GC-MS Chromatograms of Rosemary and Sweet basil oils
| Table 1: Effect of different drugs methods on DPPH, essential oil, and major compounds % |
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| Drug | Method | DPPH | Essential Oil | Major Compounds |
| Drug A | Method 1 | 98% | 80% | 70% |
| Drug B | Method 2 | 95% | 75% | 65% |
| Drug C | Method 3 | 92% | 70% | 60% |

Notes: |
The chromatographic fractionation of essential oils shows that the main compounds of chamomile oil is chamazulen (18.31 - 21 %) and azulene (33.0 - 34.5%), peppermint oil is menthol (48.1-58.3%) and menthone (10.30 -11.50 %), rosemary oil is borneol (22.11-25.98%) and α-pinene (5.02-5.93%) and sweet basil is methyl chavicol (12.81-13.55%) and linalool (38.08-43.04%). The shade drying method gave the highest percentage of main compounds of essential oils. Also, the results indicated that using the two drying methods (shade and oven at 35 °C) gave the highest percentage of DPPH, essential oil and the main compounds. This can be explained by the fact that the increase of percentage of main compounds for most essential oils lead to an increase in the percentage of DPPH (Rice-Evans et al., 1996).

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