The importance of using basil (Mentha spicata) oil extracts and their using food industries

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Abstract

The present study investigated that physical properties and its characteristics with addition to the chemical composition of basil oil extract (Ocimum basilicum) from the mint family (Lamiaceae). The ability of this oil to inhibit the growth of certain microorganisms isolated from meat was studied using the agar diffusion method. The total number of microorganisms in minced meat treated with this oil was counted for different time periods (1–72 and 192 hours). The results of this research showed that this oil has a clear effect in inhibiting the growth of microorganisms, especially Staphylococcus aureus. A decrease in the number of bacteria was observed in all oil-treated groups compared to the control group. Furthermore, this decrease was observed across all treatment groups and the control group for all storage periods. Essential oil extracts from this plant, belonging to the mint family, have the potential to inhibit the growth of microorganisms when used in specialized food industries, particularly those related to meat.

Keyword: basil ,(Mentha spicata) oil ,extracts, using,food industry.

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Introduction:

Studies have focused on improving mint varieties for oil production and use in the food and pharmaceutical industries (6). It has been established (7) that mint oil contains potent antioxidant compounds with a significant effect in treating many diseases. It has also been confirmed (8) that mint leaf oil extract is capable of inhibiting the growth of Salmonella and Staphylococcus bacteria. Other studies have shown that the percentage and effectiveness of the extracted oil against microorganisms varies depending on the plant species and harvest season; oil extracted in the summer was more effective than oil extracted in the winter (9). (10) It was found that mint oil has moderate antioxidant activity. (11) Twenty-one active compounds in mint oil have been identified as having an effect on inhibiting the growth of Escherichia coli bacteria. Studies (14) and (13) indicated that basil extract possesses antioxidant and antiphrastic properties. Research (15) determined the minimum inhibitory concentration (MIC) for some food spoilage microorganisms. Research (16) showed that the inhibitory effect of alcohol-extracted basil oil was greater than that of water-extracted basil oil. In studying the effects of extracts from different plants in this family, research (17) showed that peppermint (Mentha piperita) was more effective in inhibiting

Escherichia coli (E. coli) compared to spearmint (Mentha longifolia) and water mint (Mentha aquatic). The oil was also found to have an effect in inhibiting hydroxide radicals. Because meat, especially minced meat, provides a suitable environment for the growth of many microorganisms, leading to spoilage and significant economic losses, many food processing plants have resorted to adding chemical compounds to improve food preservation.

Materials and its Methods:

The method of preparing the oils is under study:

After drying the plant leaves using a thermal oven and grinding them, the volatile oils were extracted by hydrodistillation, as described in reference (18), using a Clevenger apparatus. 50 grams of oil were collected per sample for 2.5 hours. The oil (top layer) was separated and transferred to special bottles with tight-fitting lids. The samples were then stored pending study of their effect on microorganisms.

Properties and characteristics of natural oils:

The using of a sensitive balance, A 1 ml volume of oil was taken into a volumetric pipette at 25°C, and the average of three readings was calculated.

The optical rotation of the volatile oils was estimated using a polarimeter at 25°C, based depended on references.

3- Qualitative chemical analysis:

It was performed to identify some of the active chemical compounds in plant leaves, according to the method described in references.

4- The effect of volatile oil:

It extracts on inhibiting the activity of microorganisms was studied using the ager well diffusion method. The effect of 0.1 ml of oil was observed on identified isolates of food spoilage bacteria obtained from the Nutrition Research Institute: Pseudomonas spp., Bacillus subtilis, Escherichia coli, Staphylococcus aureus, and two yeast genera: Saccharomyces and Torulopsis. Nutrient agar (plant count agar) inoculated with 0.2 ml of a microbial suspension containing 1.0×10^5 cells/ml was poured into individual plastic dishes. Wells were made in the agar at equal intervals, and 0.1 ml of the oil extract was placed in each well, with one remaining as a control containing only the suspension. Three replicates were performed for each isolate. The dishes were incubated at 37°C for 48 hours. The effectiveness of the extract was determined by measuring the diameter of the inhibition zone and calculating the three replicates.

5- Preparation of Meat Samples and Study Treatments:

360 grams of locally sourced minced veal from butcher shops in Baghdad were randomly selected and divided into 36 samples, each weighing 10 grams. One sample served as the control treatment.

Each sample was replicated three times and stored at 4-6°C for three periods. The total bacterial count was measured 1,72,192 hours after the treatment using plate counting and a 1.0×10^5 dilution.

6- Statistical Analysis:

The SPSS 12 software was used for statistical analysis using a one-way ANOVA method to study the effect of the different treatments.

Results and Discussion:

Table (1) shows the physical results, demonstrating the superior extraction rate of basil oil. The specific gravity ranged from 0.903 for basil oil, which is consistent with the findings of researchers (7)(14).

The results, as shown in Table (2) through qualitative chemical analysis, indicate that the plant leaves contain active compounds. This result is consistent with the findings of some researchers (21, 23, 22). These compounds have a significant effect in inhibiting microorganisms.

Table (3) shows that the oil extracts have a clear effect in inhibiting some bacteria and yeasts that cause food spoilage(14). The oil was found to have a significant effect in inhibiting the growth of Staphylococcus aureus bacteria, with an inhibition diameter of 16 mm. Peppermint oil was used. These results are consistent with the findings of (15), (17), and (21), which indicated that the oils of these plants contain compounds effective against bacteria, especially Staphylococcus aureus, such as Carvone C10H14O(22).

Table (4) shows a decrease in the medium range total bacterial in the treatments to which basil oil was added (23). The difference was clear between the treatments, with the count after 72 hours being (810 × 6.33) for the control treatment and (7.66 × 510) for the control treatment (24). The results showed highly significant differences at level between all treatments to which vegetable oils were added and the control treatment for three storage periods (25). It was observed that the reduction in bacterial counts was due to the presence of basil oil, which is consistent with (24) and (26).

Table (1) Physical Properties of basil Oil

Type of oil	specific gravity	light rotation	refractive index	percentage of oil extracted
Basil oil	0.6%	1.55	-6.3	0.924

Table (2):chemical analysis of the present quantities in the (Basil oil) volatile oils of aromatic plants.

Basil oil	Test type	active compounds
++ ++	Fehling reagent Benedict reagent	Glycosides
++ ++	Mayer reagent Wagner reagent	Alkaloids
++	Sodium hydroxide with UV.	Coumarins
++	Ferric chloride 1%	Phenols
++	Potassium hydroxide in ethanol	Flavones
++	Lead acetate 1%	Tannins
++	Ethanol + Hydrochloric acid	Resins
++	Mercury chloride	Saponins

Table (3): Average diameters of inhibition of the growth of some species of bacteria and yeasts (mm) using a concentration of 10 l/mlμ of basil oil extracts.

Basil oil.	Microorganisms
19	Staphylococcus aureus
7	Escherichia coli
11	Pseudomonas spp.
8	Bacillus subtilus
12	Saccharomyces cerevisiae

12	Torulopsis spherical

Table (4) Effect of essential basil oil from the genus Labiate in reducing the total number of bacteria across different storage periods.

essential oils	1 hour	72 hour	192 hour
Control treatment	$^{5}10 \times 6.33$	6.33×10^{8}	3.33×10^{10}
50/gm l µ basil oil	4.66×10^{4}	8.33×10^{5}	3.0×10^{7}
LSD	4.5×10^{5}	4.48×10^{8}	6.3×10^{8}

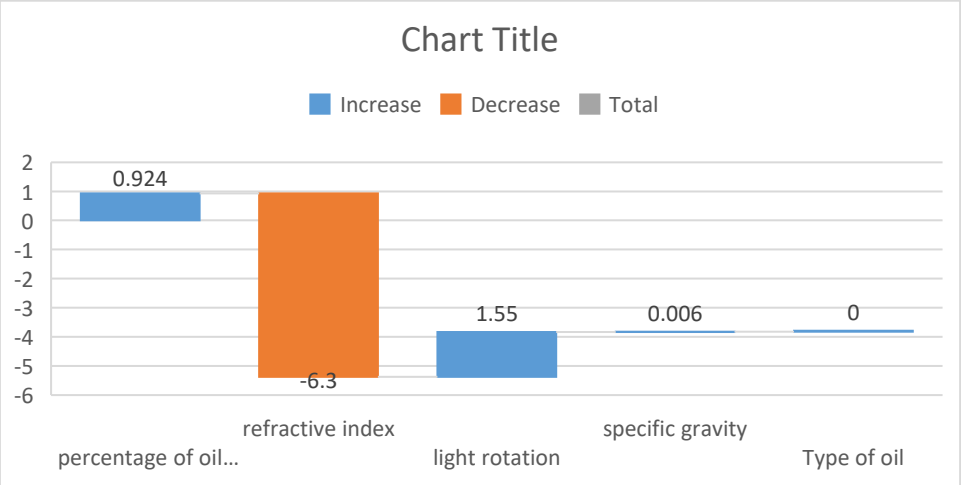


FIGURE (1) Physical Properties of basil Oil

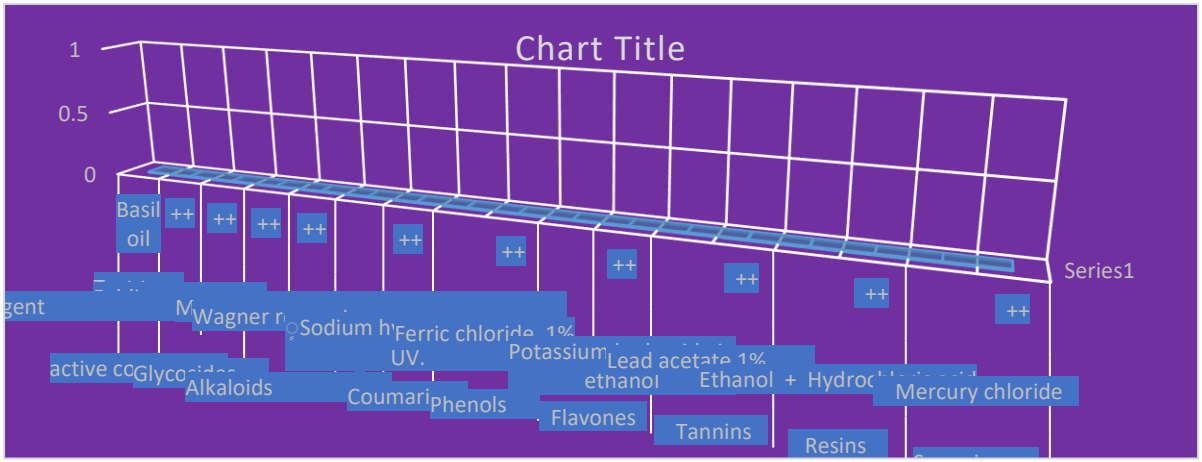


Figure (2): Average diameters of inhibition of the growth of some species of bacteria and yeasts (mm) using a concentration of 10 l/mlµ of basil oil extracts.

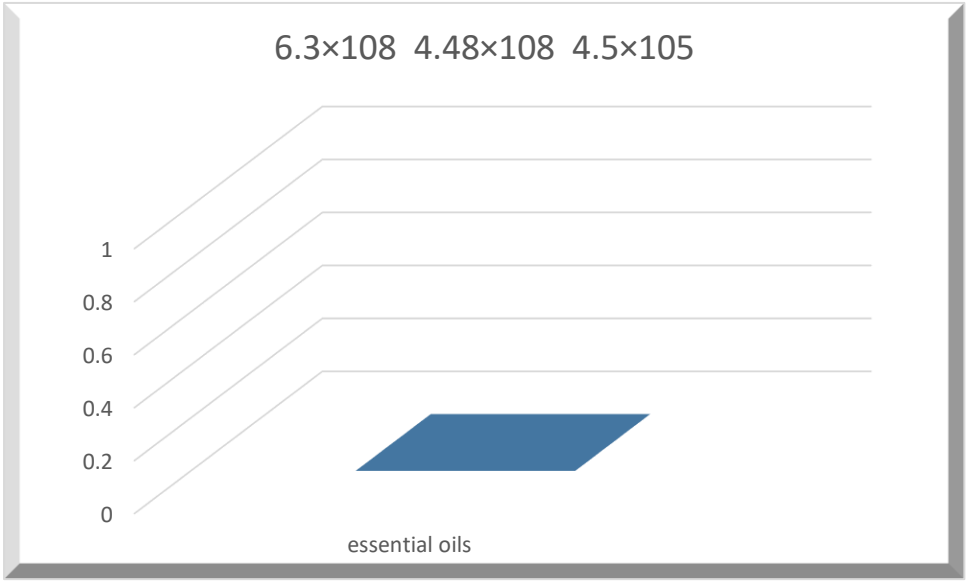


Figure (3): Effect of essential basil oil from the genus Labiatae in reducing the total bacterial count during different storage periods.

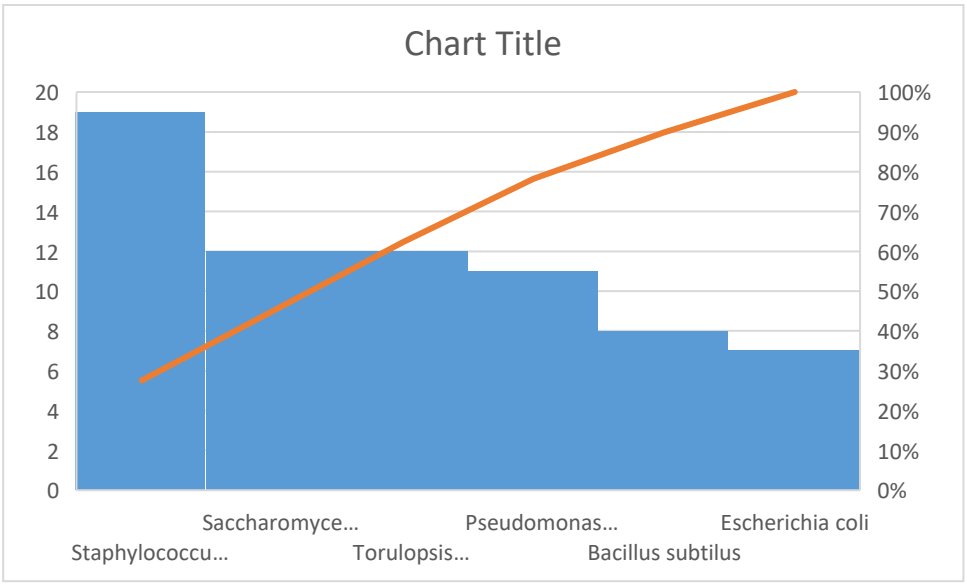


FIGURE (4) Average diameters of inhibition of the growth of some species of bacteria and yeasts (mm) using a concentration of 10 l/mlμ of basil oil extracts.

Conclusion:

Studies have shown that basil possesses antimicrobial and antibacterial properties in clear and scientifically measured ways, consistent with laboratory experiments. Basil's essential oils and main components demonstrate and exhibit distinctive antimicrobial activity against a wide range of Gram-negative and Gram-positive bacteria, yeasts, and fungi. This research paper primarily examines basil essential oils in terms of their chemical composition and their effect on the structure of microorganisms. Laboratory experiments have confirmed their antimicrobial activity and their

potential for future use in preserving various foods and food products. They can be used as a slow-release antimicrobial agent in effective packaging.

References:

1- Ebrahimzadaeh, M.A. ;Nabavi, S.M. and Nabavi , S.F. (2010). Antioxidant and antihemolytic activities o*f Mentha longifolia*. Pharmacology online Vol. 2 ,464-471.

2- Rasouli, I. and Rezaei, M.B. (2002).Bioactivity and chemical properties of essential oils from *Zataria multiflora and Mentha longifolia* .J journal of Global Optimization 24(1) 141-46

3- Asekun, O.T.;grierson,D.S. and Afolayan, A.j. (2006).Effects of drying methods on the quality and quantity of the essential oil of *Mentha longifolia*. Food chemistry Vol. 101 issue 3, 995-998.

4- Simon, G. E. Quinn J. and Murray, R.G. (1990). A source of essential oils . p 484-489

5- Brown, D. (1995). Encyclopedia of herbs and their uses. Dorling Kindersley .London ISBNO 7513, 20-31 .

6 - Al-Azzawi, Ahmed (1999). A chemical study of basil plant extracts and evaluation of their effectiveness against some pathogenic microorganisms. Master's thesis, University of Baghdad, Institute of Genetic Engineering and Biotechnology.

7- Gulluce, M.; Sahin, F.; Soknen, M.; Ozer, H. ;Daferera, D.; Sokmen, A.; Polissiou, M. and Adiguzel, A. (2007). Antimicrobial and antioxidant properties of the essential oils and menthanol extract from *Mentha longifolia*. Food chemistry Vol.103 issue4 1449-1456.

8- Dukic, N.M.; Bozin,B.; Sokovic, M. and Mihajlovic,B. (2003).antimicrobial and antioxidant activities of three *Mentha species*. Essential oils. Plant Med. 69(5) 413-419.

9- Cuvelier, M.E.; Richard, H.; Berset, C. (1996). Anti oxidative composition activity and phenols of pilot- plant and commercial extracts of sage and rosemary .J. Am , oil chem. Sec. 73, 645-665

10- Guenther ,E. (1972). essential oils .Vol 1 R.E. Krieger publishing company , Hunting ton , New York, USA p 18.

11- Calabrese , V. ; Scapagnini, G. ; Catalano C. ; Dinotta, F.and,Morganti, P. (2000) . Biochemical studies of a natural antioxidant isolated from rosemary and its application in cosmetic dermatology . International Journal of Tissue Reactions 5; (1) 13-22

12- Al-Any, A.B. J. ; Nadir, M.T. ; and Al-Khazraji, N.K. (1996). The antimicrobial activity of volatile oils isolated from some Iraqi plant. J. Al-An bar Univ.(1) 82-86.

13- Chen, G.T.; Gao, HY. and Zheng, J.(2006). Study of chemical constituents in active parts of *Mentha spicata*. Zhongguo Zhong,Yao Za Zhi aor.31 (7) 560-562.

14- Koliopoulos,G. ;Pitarokili, D.;kioulose,E. michaelakis,A. and Tzakou,O. (2010) . Chemical composition and parricidal evaluation of Mentha ,Salvia and Melissa essential oils. Parasitol Res. Jul. 107(2): 327-335.