International Journal of Early Childhood Special Education (INT-JECSE)
DOI:10.48047/intjecse/v18i3.29 ISSN: 1308-5581 Vol 18, Issue 03 2026

Antimicrobial Effect of Peppermint Oil Extracts (Ocimum Basilicum, Family Labiatae) And Their Use in Meat Preservation

Majeed M. A. Ali[1]

1 Ibn Khaldun Private University College, Baghdad, Iraq.

***** Corresponding Author: e-mail : dr.majeed@ik.edu.iq

Abstract: Some physical properties, qualitative chemical composition, and the effect of the oil extract of basil (Ocimum basilicum) from the Labiatae family were investigated. The effect of this oil on inhibiting certain microorganisms isolated from meat was studied using the agar well diffusion method. The total number of microorganisms in minced meat treated with this oil for different periods (1, 72, and 192 hours) was calculated. The results showed that the oil had a clear effect in inhibiting the growth of microorganisms, especially Staphylococcus aureus. A decrease in bacterial numbers was observed in all oil-added treatments compared to the control. Furthermore, all treatments for all storage periods are tested.

Keywords: Antimicrobial; Peppermint Oil; Extracts; Basilicum; Meat Preservation.

[1] . Introduction

Humans have used natural medicine for thousands of years, considering it a divine blessing bestowed upon us by God in the therapeutic arsenal. Humans have long associated wild plants with various ailments and used them for treatment (1). These medicinal plants contain many active compounds, including antioxidants and microorganism inhibitors (2). Many of these medicinal plants and their volatile oils have been used to preserve and extend the shelf life of various foodstuffs and as flavorings in different food industries. (3) Garlic extract was used to inhibit Bacillus cereus, and (4)

Received: date: -15-07-2026
Revised: date: -05-08-2026
Accepted: date: -20-08-2026
Published: date: -30-08-2026
Curr. Ver.: date 02-09-2026

extracts of tilia, sage, and black tea were used to inhibit some foodborne microorganisms. (4) studied the effect of cinnamon oil extract in inhibiting pathogenic and spoilage bacteria in minced meat and extending its shelf life. (2) confirmed that the aqueous and oil extracts of Rosmarinus officinal is have the ability to inhibit a numbers of bacteria and other yeasts found in food. Studied inhibitory activity of extracts of the plant *Alhagi* against microorganisms that cause meat spoilage (5).

Varieties for oil production and use in the food and medicinal industries (6). It has been proven (7) that mint oil contains active antioxidant compounds with a significant effect in treating many diseases. It has been confirmed (8) that the oil extract from mint leaves has the ability to inhibit Salmonella and Staphylococcus bacteria. Others have demonstrated the variation in the percentage and effectiveness of the extracted oil against microorganisms depending on the plant species and harvest season; the oil extracted in summer was superior to that extracted in winter (9). As for (10), they found that mint oil has moderate antioxidant activity. It has been identified (11) that 21 active compounds in mint oil have an effect on

inhibiting E. coli bacteria. \ It has been indicated (14) and (13) that Basil extract possesses antioxidant activity as well as antiphrastic activity. Research (15) determined the Minimum Inhibition Concentration (MIC) of some food spoilage microorganisms. Research (16) demonstrated that the inhibitory effect of alcohol-extracted basil oil was greater than that of waterextracted basil oil. In studying the effects of extracts from different plants in this family, research (17) showed that Mentha piperita was superior in inhibiting E. coli bacteria compared to Mentha longifolia and Mentha aquatic. The oil was also found to have an effect in inhibiting hydroxide radicals. Since meat, especially minced meat, is a suitable medium for the growth of many microorganisms, leading to spoilage and significant economic losses, many food processing plants have resorted to adding chemical compounds to enhance food preservation.

2. Materials and its Methods

2.1. Extraction of Vegetable Oils

After drying the plant leaves using a thermal oven and grinding them, the volatile oils were extracted by hydro distillation, 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.

2.2. The Physical and characteristics Properties of Oils

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

The refractive index of the volatile oils was estimated using a refrigerant meter at 25°C.

The optical rotation of the volatile oils was estimated using a colorimeter at 25°C, based on the method described in reference (19).

2.3. Qualitative Chemical Analysis

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

2.4. Effects of volatile

It extracts on inhibiting the activity of microorganisms was studied using 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 with one remaining as a control containing only the suspension. Three replicates were performed for each isolate.

2.5. 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. Three samples were used for the volatile oils treatment, and one sample served as the control treatment. Each sample was replicated. The total bacterial count was measured 1,72,192 hours after the treatment using plate counting and a 1.0×10^5 dilution (20).

2.6. 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.

3. Results and Discussion

Table (1) shows the physical results, demonstrating the superior extraction rate of peppermint oil. The specific gravity ranged from 0.903 for peppermint 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 glycosides, coumarins and others with low effects, flavonoids. 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. The effect of the oil on the other bacteria and yeasts studied varied, particularly on Escherichia coli and on Pseudomonas spp. 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 Corvine C10H14O (22).

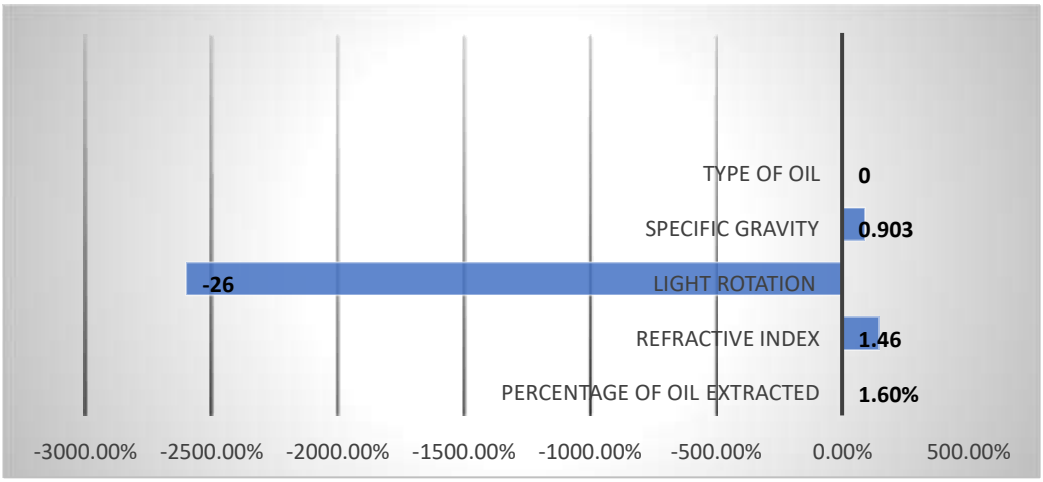
Table (4) shows a decrease in bacterial count after approximately one hour in treatments to which peppermint oil was added (23). The difference was clear between the treatments, with the count after 72 hours being (810 × 6.33) for the control treatment and (7.66 × 510) for the control treatment (24). At P≤0.01 level all treatments to which vegetable oils were added and the control treatment for all three storage periods (25). It was observed that the reduction in bacterial counts was due to the presence of peppermint oil, which is consistent with (24) and (26).

Table 1. Physical Properties of Peppermint Oil

Percentage of Oil Extracted	Refractive Index	Light Rotation	Specific Gravity	Type of Oil
1.6%	1.46	-26	0.903	Peppermint oil

Figure 1. Physical Properties of Peppermint Oil

Table 2. Analysis of active compounds and Qualitative chemical of aromatic plants.



Active compounds	Test type	Peppermint

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

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 peppermint oil extracts.

Microorganisms	**Peppermint oil.**
Staphylococcus aureus	**16**
Escherichia coli	**8**
Pseudomonas spp.	**12**
Bacillus subtilize	**8**
Saccharomyces cerevisiae	**10**
Torulopsis spherical	**8**

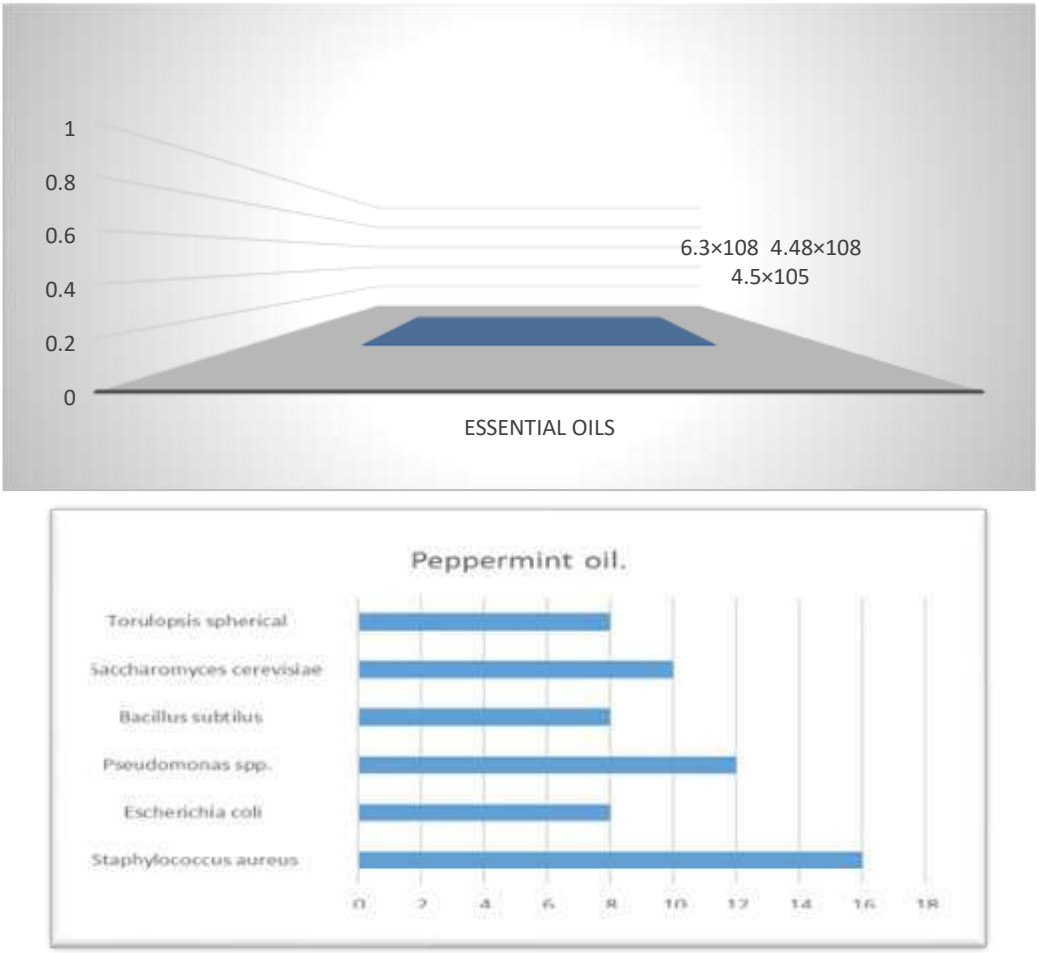


Figure 2. Average diameters of inhibition of the growth of some species of bacteria and yeasts (mm) using a concentration of 10 l/mlμ of peppermint oil extracts.

Table 4. Effect of essential peppermint oil from the genus Labiatae in reducing the total bacterial count during different storage periods.

192 hour	72 hour	1 hour	essential oils
3.33×10^{10}	6.33×10^{8}	$^{5}10 \times 6.33$	Control treatment
4.0×10^{7}	8.66×10^{5}	4.33×10^{4}	50/gm l μ Peppermint oil
6.3×10^{8}	4.48×10^{8}	4.5×10^{5}	LSD

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

4. Conclusion

Its essential oils have been studied and used throughout history, particularly for their protective properties. For many years, and continuing to this day, they have been used in food products, perfumes, and oral and dental care products. Studies have shown that basil possesses remarkable antimicrobial and antibacterial properties. It has been shown that basil

essential oils and their main components have experimentally demonstrated exceptional antimicrobial activity across a wide range of species against most Gram-negative and Gram-positive bacteria, yeasts, and related species arising from their development. 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.

Author Contributions: A short paragraph specifying their individual contributions must be provided for research articles with several authors **(mandatory for more than 1 author)**. The following statements should be used "Conceptualization: X.X. and Y.Y.; Methodology: X.X.; Software: X.X.; Validation: X.X., Y.Y. and Z.Z.; Formal analysis: X.X.; Investigation: X.X.; Resources: X.X.; Data curation: X.X.; Writing—original draft preparation: X.X.; Writing—review and editing: X.X.; Visualization: X.X.; Supervision: X.X.; Project administration: X.X.; Funding acquisition: Y.Y."

Funding: Please add: "This research received no external funding" or "This research was funded by NAME OF FUNDER, grant number XXX". Check carefully that the details given are accurate and use the standard spelling of funding agency names. Any errors may affect your future funding **(mandatory).**

Data Availability Statement: We encourage all authors of articles published in FAITH journals to share their research data. This section provides details regarding where data supporting reported results can be found, including links to publicly archived datasets analyzed or generated during the study. Where no new data were created or data unavailable due to privacy or ethical restrictions, a statement is still required.

Acknowledgments: In this section, you can acknowledge any support given that is not covered by the author contribution or funding sections. This may include administrative and technical support or donations in kind (e.g., materials used for experiments). Additionally, A statement of AI tools usage transparency has been included in the Acknowledgement section, if applicable.

Conflicts of Interest: Declare conflicts of interest or state **(mandatory)**, "The authors declare no conflict of interest." Authors must identify and declare any personal circumstances or interests that may be perceived as inappropriately influencing the representation or interpretation of reported research results. Any role of the funders in the study's design; in the collection, analysis, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results must be declared in this section. If there is no role, please state, "The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results".

References

1-Karim, Fawzi Muhammad; Quraan, Saleh Ahmad. (1986) Medicinal Plants in Jordan. Yarmouk University. Irbid.

2- Auroba, M. S. and Majid, M. (2010). Evaluation of inhibition activity of Rosmarinus officinalis plant watery and oily effects on some pathogenic microorganisms . J. collage of veterinary Baghdad Uni. 2, 46-50

3- Yildirim, A.; Mavi, A.; Oktag, M.; Kara, A.A.; Algur, O.F. and Bilaloggu, G. (2000). Comparison of antioxidant and antimicrobial activities of tilia . J. Agric. Food Chem. 48, 503-504

4- Turgis, M.; Han J. ; Borsa, J. ,and Locroix, M. (2008). Combined effect of natural essential oils modified filed atmosphere packaging . J. food port. Jun 7(6) 1150-1161 **5**. Omran Sahar, Al-Zubaidi Labib, Hamoud Salman, and Al-Hayali Miad (2011). Inhibitory activity of alfalfa plant extracts in microorganism isolates and their potential use in food preservation. First Conference on Biological Sciences Research, University of Kufa – College of Education for Women.

6. Hassan Abdul Ali Mahdi and Sadiq Al-Hakim (1989). Food Processing, Part One, University of Baghdad.

7. Al-Araji Sand, Ihsan Saad Ali, and Hussein Khamas Talib (2000). Study of the chemical composition of mint leaves and their use in preparing a nutritional and therapeutic syrup. Iraqi Journal of Agricultural Sciences, Volume 31, Issue 4, 2000, pp. 261–272.

8- Tassou, C. C. (1993). Microbiology of olives with emphasis on the antimicrobial activity of the phenolic compounds . Ph .D. thesis . university of Bath U.K.

9- Abdulla ,H .; Farooq , A. ;Foonam, S. and Mohammad, A.(2010). Seasonal variation in content ,chemical composition and antimicrobial and cytotoxic activities of essential oils from Mentha species. Journal of the Science of food and Agriculture Vol.90 Issue11,1827

10- 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.

11- 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

12- 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.

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

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

15 - 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.

16- 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.

17- 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.

18- 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

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

20- 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

21- 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.

22- 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.

23- 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.

24- reza sharafati chaleshtori" Antioxidant and antibacterial activity of basil (Ocimum basilicum L.) essential oil in beef burger"Journal of Agricultural Science and Technology Last updatedNovember 30, 2024.

25- T. Mehdizadeh1 , M.S. Hashemzadeh2 , A. Nazarizadeh3 , M. Neyriz-Naghadehi4 , M. Tat2 , M. Ghalavand2 , R. Dorostkar" Chemical composition and antibacterial properties of Ocimum basilicum, Salvia officinalis and Trachyspermum ammi essential oils alone and in combination with nisin" Research Journal of Pharmacognosy (RJP) 3(4), 2016: 51-58.

26- Pawel Kafarski, Sara Jaramillo-Carmona" Qualitative Profiling, Antioxidant and Antimicrobial Activities of Polar and Nonpolar Basil Extracts" Foods . 2024 Sep 21;13(18):2993. doi: 10.3390/foods13182993.