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Benefiting from the essential oil extracted from the leaves of the camphor tree (*Cinnamomum camphora* L.) as a food preservative.

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Abstract

The purpose of this study is to gain benefit from the essential oil of camphor which is extracted from the leaf of the camphor tree as a preservative agent that is required to ensure that manufactured foods remain safe and unspoiled. In present study is aims to determine the bioactive component of the camphor oil and using this essential oil in food preservative, fino bread and with cheese were the sample foods used to assess their preservative efficacy; the two samples treated with camphor leaf oil (0.11, 0.24, and 0.33 mg) had good evaluation in the sensory, gaining the advantage of prolonging the preservation period. The essential oil observed an antifungal activity, no mycelium has been developed on fino bread and white cheese moistened with essentials oils. After ten days no food mold started to develop on fino bread and white cheese with essential oils while on pieces of fino bread and white cheese without essential oil the mold started to develop after three and four days, respectively. This observation showed the powerful use of essential oils from camphor leave as a natural food preservative in food.

Keywords

Camphor leaf - essential oils - bread- cheese- preservation..

Introduction

Camphor *(Cinnamomum camphora)* this large round-canopied evergreen tree has broad, large-diameter, unusually strong branches and can reach 70 feet in height with a broader spread but is usually 40 to 50 feet with a 40 to 60-foot spread. The glossy green, thin but leathery leaves give off a camphor aroma when crushed and create a dense shade. The stems and bark on young branches of Camphor-Tree are bright green, tinged with red when young, maturing into a dark grey-brown, rugged-looking trunk that appears almost black when wet from rain. Trunk and branch structures on older trees appear similar to mature live oaks. The inconspicuous, tiny, yellow flowers are followed by a profusion of small, black berries which can become an annoyance on walks and driveways because they are messy but are quite attractive to wildlife. Fruits will stain cars. Some occasionally germinate below the tree but are not nearly as much of a problem as some other trees. Birds can also carry the seed to remote areas where it will occasionally germinate. The leaves, twigs, and wood are the commercial source of camphor. (Ho Chen-Lung *et al*., 2009). *C. camphora* is primarily native to Japan and has been cultivated in the Himalayan region to produce camphor commercially, which is used in the pharmaceutical as well as the flavor industry. Traditionally in the Ayurvedic system, *C. camphora* has been used to treat bronchitis, cold, congestion, diarrhea, dysentery, edema, flu, gas, metabolic and heart problems, as well as various gynecological problems. In addition, the Yunani, “Greek”, medicinal system also uses *C. camphora* for a cephalic tonic, cardiac treatment, and also as an expectorant. *C. camphora* extracts have exhibited cytotoxic anti-inflammatory, termiticidal, acaricidal, antifungal, and anthelmintic activities. (Lee *et al*., 2006). The tree is famous for the characteristic 'camphor' formed in the oil cells of different plant parts. It is also applied externally to treat muscular strains and inflammations. At present there are only two known species with camphor smell namely *Cinnamomum camphora* and *C. capparu-coronde,* while the former is widely cultivated in China, Taiwan, southern parts of Japan, Korea, and Vietnam, the latter is restricted to the forests of Sri Lanka . Egypt is rich with local trees such as camphora that are grown in large numbers as wind shelters stretching along highways and farms, such particular use of the trees allowed for a huge number of trees to be grown annually. It has however developed in a very chaotic and unorganized manner, but has found its way to be available all year long and in different regions in Egypt. Local types of wood had very limited attention in previous research and literature; however, in the past years there were many studies on Egyptian homegrown trees and the environmental and economic benefits of incorporating these types into the market (Arnaud *et al*., 2019). Camphor oil is extracted by steam from the chipped wood, root stumps and branches of the camphor tree. It is then rectified under vacuum and filter-pressed (Frizzo Caren *et al*., 2000). There are many reports which prove that the use of camphor , solely or in combination with other treatments can be very effective for treating and preventing cancer, that the use of camphor odor as a conditioning agent for the cancer cells of yc8 lymphoma in mice, could have a suppressive effect on the growth of yc8 tumor when it is combined with immunotherapy treatment (Zuccarini paolo ,2009).

The essential oil from the camphor tree *(Cinnamomum camphora)* contains up to 84% d-camphor.(We *et al*., 2016). Dietary exposure to camphor has been estimated by the CEFS (Council of Europe, 2001), taking into account the consumption of foods flavored by using either herbs (basil, coriander, marjoram, rosemary, sage), their essential oils or the chemically defined flavoring substance d- camphor compound. European Flavors and Fragrances Association (EFFA, 2009) and the International Organization of the Flavors Industry (IOFI, 2023) as mg/kg of body weight according to the food commodity as follows: 15 mg/kg in baked foods, 24 mg/kg in ice creams, 25 mg/kg in candies, 25 mg/kg in prepared dishes, 6 mg/kg in non-alcoholic beverages and 10 mg/kg in alcoholic beverages. Concentrations of camphor in foods prepared with basil, coriander, rosemary and sage or with the essential oils of these (Chen-Lung Ho *et al*., 2009). The available data on toxicity of camphor are limited and thus a TDI cannot be derived. However, based on the available toxicity data and the Panel´s conservative estimate of chronic exposure (15 mg/day equivalent to 250 µg/kg body weight (bw/day) calculated using the maximum limits suggested by the Council of Europe, the Panel considered that there would be no safety concern regarding chronic toxicity. The Scientific Panel on Food Additives, Flavorings, Processing Aids and Materials in Contact with Food (Panel) considered that safety aspects of *d*-camphor in terms of acute toxicity needed to be addressed. The reported acute toxicity data on adults and children arise mostly from accidental ingestion of camphor-containing medications. The probable lethal oral bolus dose has been reported to be in the range of 50 to 500 mg/kg bw. No acute toxicity was reported after doses lower than 2 mg/kg bw and clinically insignificant signs of toxicity may be seen in sensitive individuals at doses of 5 mg/kg bw and higher, whereas clinically manifest toxicity in sensitive persons would require doses higher than 30 mg/kg bw. Potential acute exposure related to the consumption of large amounts of certain foods on a single day was estimated by the Panel for several age groups. It was lowest in adults (from 0.14 to 0.34 mg/kg bw according to the food commodity) and highest in children under 6 (from 0.41 to 0.83 mg/kg bw according to the food commodity).

The commodity leading to the highest potential acute exposure was fresh cheese in all age groups. The acute exposure estimates for children and adults are about 60-120 times and 150-360 times, respectively, lower than the probable lowest lethal oral bolus dose of 50 mg/kg bw. The acute exposure estimates for children and adults are about 2-5 times and 6-14 times, respectively, lower than the dose of 2 mg/kg bw below which no acute effects have been reported in human case studies. Although these margins might appear to be low, the large number of cases describing the dose-response relationship suggests that the data sufficiently cover inter-individual variability in sensitivity. Therefore, the Panel concluded that it is unlikely that acute effects may occur in relation to consumption of foods providing less than 2 mg/kg bw in one large portion. The acute exposure estimates considered by the Panel are based on observed high consumption in only one Member State and on maximum limits suggested by the (Council of Europe, 2001). However, maximum permitted levels for *d*-camphor are not currently set in the EU legislation and there is uncertainty on its actual upper use levels in foods and beverages currently on the market and on the high consumption of food flavored with *d*-camphor all over Europe. The Panel therefore suggests that maximum limits should be set to ensure that exposure to camphor does not exceed 2 mg/kg bw on a single day in any age group. (AFC, 2003). Essential oil of camphor leaves activity against plant pathogenic fungi, such as Colletotrichum gloeosporioides, Botrytis cinerea, and Fusarium graminearum. Notable inhibitory activity was found after 48 h of EOC treatment, with half-maximal inhibitory concentrations (IC50) of 31.74, 35.79, and 38.02 mg/L, for the three separate strains, highlighting the potential use of EOC as a natural preservative for fruits and vegetables. It has been suggested that EOC could be used in the preparation of a strong fungistatic agent against C. cucurbitarum infection , emphasized the inhibitory action of (1R)-(+)-camphor against the growth of Choanephora cucurbitarum, a wet rot pathogen of Withania somnifera. Furthermore, in comparison to (1R)-(+)-camphor, C. camphora oil revealed superior activity. Fungal growth inhibition by (1R)-(+)-camphor and plant essential oil was due to cytoplasm coagulation and hyphallysis of C. cucurbitarum (Wang *et al*., 2020).

Modernistic mohair for food conservation and preservation is now emerging, as many studies have shown that the use of synthetic preservatives and chemical additives is leading to intoxication, cancer and other degenerative diseases. This has led to a growing consumer concern and the desire to consume healthier products containing natural preservatives and additives instead of synthetic ones. This generates the need to look for conservation alternatives that cover the same antimicrobial properties and compatibility with food. In this search, new antimicrobial agents of natural origin, as is the case of essential oils (EOs) obtained from aromatic and medicinal plants, have been found. EOs have antimicrobial activity against a wide range of microorganisms and antioxidant activity, this is generally attributed to phenolic compounds owned by EOs. Many studies in vitro have defined EOs as effective antimicrobial and antioxidant compounds, but they are not much used in industry. Mediterranean dietary food products (meat and meat products, cheeses and fruits) are highly appreciated by consumers; their preservation with EOs would represent an added value. The present study reviews the existing research work on the use of EOs as food preservatives as an alternative to synthetic preservatives and chemical additives in Mediterranean food products (Sauceda and Nereyda, 2011).

Camphor oil is an effective stimulant, which boosts the activity of the circulatory system, metabolism, digestion, secretion and excretion. This property helps in treating problems and ailments associated with improper circulation, digestion, sluggish or overactive metabolic rates, obstructed secretions, and a wide variety of other less common conditions. It is also beneficial in the treatment of epilepsy, hysteria, viral diseases like whooping cough, measles, flu, food poisoning, infections of the reproductive organs, and insect bites. It is famous for its ability to inhibit various types of microorganisms and pathogenic bacteria such as Escherichia coli, Staphylococcus aureus, Bacillus subtilis and many more. Camphor is a well-known universal spice not only due to its health benefits but also due to its great flavor and ability to preserve food. In food preservatives it applies both anti-fungal and anti-bacterial principles in order to prevent the food from being spoiled. In medicine aspect, camphor is mainly used to treat various types of disease. For example, it is used for treating diarrhea, flatulent dyspepsia, kidney weakness, fevers and palpitation. Furthermore, it is also applicable in treating minor muscle aches and pains. Other than that, camphor can also be used to enhance airflow in the nose. It works by stimulating cold receptors in the nose (Philpott,1929). Camphor also has broad - spectrum activities against the influenza virus and inflammation (Lee *et al*., 2006). Heavy metals are persistent environmental contaminants responsible for several human illnesses (Luckey *et al.* 1975). Heavy metal contamination is an important environmental issue since they are non-biodegradable (Wu and Zhang 2010). Hence they are not readily detoxified and removed by metabolic activities once they are available in the environment. This may subsequently lead to their build up to toxic levels, through bio-accumulation in ecosystems or human tissues. Bio-accumulation of heavy metals in man, animals and plants result in metal poisoning (Audu and Lawal 2006). The heavy metals documented to commonly cause problems in humans include lead, cadmium , nickel and lead as they tend to accumulate and disrupt normal function in the brain, kidneys and immune system (Passwater and Cranton 1993).

Cinnamomum camphora has been used as spice and food flavoring around the world and the usage is not only for the flavors but also for its health benefits. Research interest has focused on the essential oil of the species with chemopreventive, antibacterial, hypolipidemic and antiplatelet properties (Craig ,1999).

Materials and Methods

Camphor (*Cinnamomum camphora*) leaves, were obtained from Horticultural Research Institute, Agricultural Research Center, El-Giza Governorate, Egypt. fresh Fino bread (44g) , validity period is two days and fresh white cheese -low salt (100g), validity period is three days were procured from the local market in March, 2023.

Extraction of essential oil from camphor leaves: Weigh fresh camphor leaves, wash them, and then cut them into small pieces. The essential oil is extracted from camphor leaves using the hydro distillation method. During this method, water vaporizes and produces steam, which carries the most volatile of the aromatic material with it. The steam is then chilled in a condenser and the resulting distillate that includes essential oil and water is collected. Then the dean-stark apparatus is used to separate essential oil from water. The oil samples obtained from hydro distillation were freed from water by adding anhydrous sodium sulfate (Na2SO4) and absolute oil samples obtained were conserved in small opaque vials. The amount of extracted oil was determined, and the quantity obtained is 10.3 g from these quantities the percentage yield of camphor essential oil has been calculated as follows: Yield % = weight of essential oil /weight of leaves X100 (Ertas *et al*., 2005).

Gas Chromatographic–Mass Spectral Analysis: Essential oil described by Gas-chromatography–mass spectrometry (GC-MS) analysis Quantitative and qualitative analysis of the essential oil was done using a GC-MS (Model GC-2010 plus, SHIMAD24, Japan) at the Faculty of Pharmacy, (ASU),Cairo, Egypt, equipped with Rtx-5 MS(Cross bound 5% diphenyl 95% dimethyl polysiloxane capillary column (30 m × 0.25 mm film thickness 0.25 μm). For GC-MS detection, an electron ionization system with an ionization energy of 70 eV was used. Helium gas is used as a carrier gas at a constant flow rate of 1 ml/min. Injector and mass transfer Interface line temperatures were set at a 250 and 280°C, respectively. Essential oils solution (1 μl) in hexane was injected and investigated with the column held initially at 45°C for 2 min and then increased to 300°C with a 5°C/min heating ramp and subsequently kept at 300°C for 5 min. (Su *et al*., 2012).

Analysis of heavy metals in camphor oil : One gram of camphor oil was separately placed in 250 mL beaker and acid digested with 10 mL of concentrated nitric acid (HNO3). The mixture was boiled for 25-35 minutes to oxidize all the easily oxidizable organic matters. When all the organic matter was acid digested, 4 mL of 70% perchloric acid (HClO4) was then added following cooling. Heating was repeated until red nitrogen dioxide (NO2) fume production ended indicating completion of camphor oil digestion. After cooling, the solutions were transferred in 50 mL volumetric flasks and filled with distilled water. The solution was then filtered using a 45 μm filter paper. concentration for heavy metals; chromium (Cr), cadmium(Cd), lead (Pb), nickel (Ni), copper (Cu), iron (Fe) and zinc (Zn) in the solution, were determined by flame emission Atomic Absorption Spectroscopy (AAS). This was calibrated using the analytical (working) curve technique and the standard solutions (Abou-Arab,2000).

Antibacterial activity assay: The essential oils and major components were screened for antimicrobial activity against Gram-positive bacteria, (*Bacillus cereus and Staphylococcus aureus)* and Gram-negative bacteria, (*Escherichia coli)* were determined using the method of (Sahm and Washington,1991).

Food preservation estimation: To assess this activity, both healthy fino bread and fresh white cheese were used. A quantity of a given camphor essential oil (0.11, 0.24 and 0.33 mg) both separately was smeared on the total surface of a small portion of one of these foods. The food was then kept in a sterilized beaker at the optimum temperature of *Rhizopus nigricans*, 25ºC at 75% relative humidity (Znidarsic *et al*., 2002). The observation was done for twelve days. The experiment test was conducted analogous to the control experiment without camphor essential oil and the experiment was repeated three times.

Sensory evaluation of fino bread and fresh white cheese: Ten panelists from the staff of Food Technology Research Institute, Agric. Res. Center, in Egypt, was asked for sensory evaluation of fino bread appearance (10), taste (10), odor (10), volume (10), crumb texture (10), crumb grain(10), crust color (10), and overall acceptability (10) according to the method described by Pyler. [13]. In the sensory evaluation of white cheese an overall score of points out of (100 points) was given for flavor (50 points), body & texture (35 points) , appearance (10 points) and color (5 points)to the method described by Pappas *et al.* (1996).

Antifungal activity assessment: To assess the fungicidal activity,the mycelium of *Rhizopus nigricans* was previously grown on either fino bread and fresh white cheese. A small portion of the fino bread or fresh white cheese previously treated with essential oils was used. A quantity of a given essential oil was smeared on the total surface of a small portion of one of these foods. Thereafter, beakers containing these foods were kept at 25^0C and 75% of relative humidity. This experiment was done in triplicate and a control experiment without any essential oil was also conducted at the same time (Frizzo Caren *et al*., 2000).

Statistical analysis : The obtained data were exposed to analysis of variance. Duncan's Multiple range tests at ($p \leq 0.05$) level were used to compare between means. The analysis was carried out using the PRO-ANOVA procedure of Statistical Analysis System (SAS, 1996).

Results and Discussion

Identification of the essential oils of camphor leaves.

Data presented in Table (1) showed the essential oils composition of camphor *(Cinnamomum camphora)* leaf. The identification of the essential oils of camphor leaf observed the deferent of the levels of essential oils composition , whereas the camphor oil had the highest level in the essential oils composition of d-Camphor and Methyl salicylate leaf was 26.54 and 26.71% followed by Menthol, Eucalyptol, Flavone, 3',5,7-trihydroxy-4'-methoxy, 3',4',5,7-Tetrahydroxy-3-methoxyflavone, 2-Camphanol acetate, Phytol, Corymbolone, Octacosanol ,trans-Geranylgeraniol, Glycerol trilaurate, 1-Glyceryl stearate, 2-Decanol, n-Hexacosanol ,1-Palmitoylglycerol, Norphytan, *p*-Menthone, Norphytan, α-Campholenal Phytanic acid, D-Limonene, o-Cymol, Methyl oleate, Glycerol 1-myristate, 5-Caranol, (1S,3R,5S,6R), Phytane, Hexa-hydro-farnesol, Geranyl isovalerate and m-Cymene were 8.52, 8.44, 5.06, 4.98, 2.64, 1.79. 1.63,1.55, 1.18, 1.17, 1.00, 0.91, 0.80, 0.78, 0.67, 0.66, 0.65, 0.54, 0.51, 0.49, 0.43,0.38, 0.36, 0.32, 0.30 and 0.29 , respectively.

Table 1. Essential oil compounds of camphor leaves.

NO.	RT	Name	Area Sum %
1	6.71	o-Cymol	0.51
2	6.77	D-Limonene	0.54
3	6.81	m-Cymene	0.29
4	6.93	Eucalyptol	8.44
5	7.92	*α*-Campholenal	0.66
6	8.06	5-Caranol, (1S,3R,5S,6R)	0.38
7	8.52	d-Camphor	26.71
8	8.69	*p*-Menthone	0.67
9	8.79	Menthol	8.52
10	9.14	Methyl salicylate	26.54
11	9.67	Phytanic acid	0.65
12	9.73	Geranyl isovalerate	0.30
13	10.19	2-Camphanol acetate	2.64
14	10.78	Glycerol 1-myristate	0.43
15	11.33	2-Decanol	0.91
16	12.1	Norphytan	0.67
17	12.39	1-Palmitoylglycerol	0.78
18	12.49	Phytane	0.36
19	12.88	1-Glyceryl stearate	1.00
20	12.98	Hexa-hydro-farnesol	0.32
21	13.12	n-Hexacosanol	0.80
22	13.54	Methyl oleate	0.49
23	13.84	Octacosanol	1.55
24	14.36	Corymbolone	1.63
25	14.75	Phytol	1.79
26	15.01	trans-Geranylgeraniol	1.18
27	15.50	3',4',5,7-Tetrahydroxy-3-methoxyflavone	4.98
28	15.64	Glycerol trilaurate	1.17
29	17.32	Flavone, 3',5,7-trihydroxy-4'-methoxy	5.06

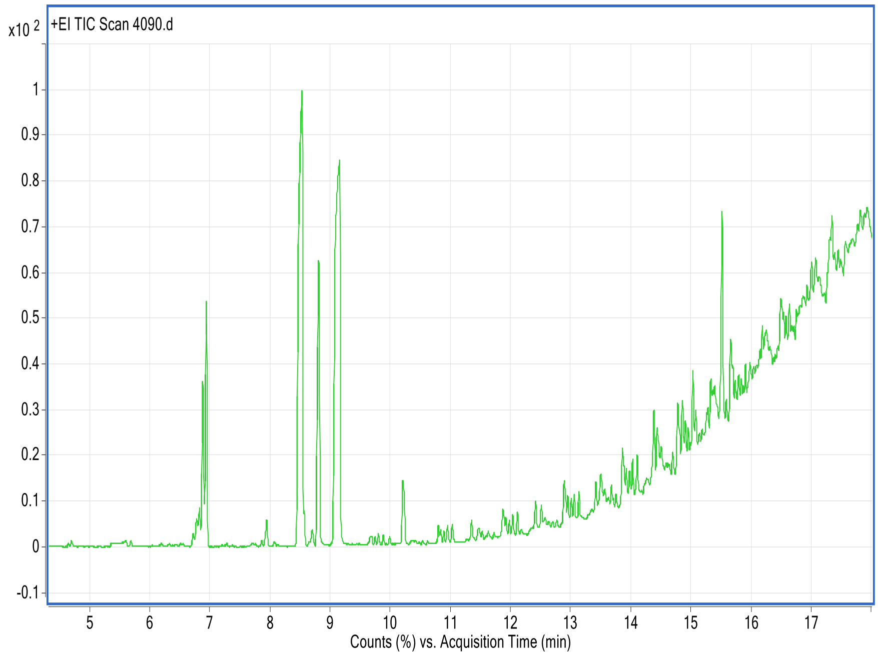

Fig .1. The representative gas chromatograms of camphor leaf essential oil.

Determination of heavy metals of camphor leaf essential oil.

The results of Table (2) showed that the contents of heavy metal elements in the camphor leaves essential oil are, chromium (Cr), cadmium (Cd), nickel (Ni), copper (Cu), lead (Pb), iron (Fe) and zinc (Zn) were recorder a normal value had 0.1, 0.03, 1.21, 3.6, 0.7, 80 and 30.4 μg/g, respectively. These results were in agreement with (Kabata- Pendias and Pendias 2001) who reported that the normal concentrations of trace elements in mature leaf tissues generalized lead (Pb), chromium (Cr), copper (Cu), iron (Fe) and zinc (Zn) were (µg/g) were 5-10, 0.1-0.5, 5-30, 45-200, 25-150, respectively.

Table 2. Heavy metal content of camphor leaf essential oil.

Heavy metal content in camphor leaf essential oil (µg/ g)						
Cr	Cd	Ni	Cu	Pb	Fe	Zn
0.1	0.03	1.21	3.6	0.7	80	30.4

Antimicrobial effect of camphor leaf essential oil.

The traditional use of *c. camphora* for antiseptic purposes can be attributed to the antimicrobial activity of its essential oil , which has demonstrated a broad range of antimicrobial activities against Poudel *et al*.(2021). Data presented in Table 3 showed the antimicrobial effect of camphor *(Cinnamomum camphora)* leaf oil on various clinical strains . From Table 3, it could be concluded that the camphor leaf oil showed growth inhibition of gram positive (Bacillus ceries and Staphylococcus aureus) and negative experimental organisms (Escherichia.coli). The zone of inhibition towards bacteria confines in the order 66mm , 43mm and 32mm, respectively in Staph.aureus , E.coli and Bacillus ceries .

Table 3. Antimicrobial effect of camphor leaf essential oil on various strains.

Organisms Bacterial	Inhibition zone diameter (mm)		
	Bacillus ceries	*Staphylococcus* aureus	*Escherichia*.coli
Inhibition zone diameter (mm)	32	66	43

Sensory evaluation of fino bread and white cheese.

People are uncomfortable with the thought of having their food chemically treated to boost its shelf life. The environmental problems caused by the overuse of inorganic and chlorinated organic compounds have been a matter of concern for both scientists and the public in recent years. Our objective in the present context is to review the roles of camphor as a food preservatives and its use as a natural Pesticide (Ben Marzoug *et al.* , 2011) . The results of (Table 4) indicated that the sensory parameters such as general appearance (10), taste (10), odor (10), volume (10), crumb grain (20)), crust color (10), crumb color (20) , softness (10) and overall score (100), it could be observed ,the treated fino bread (0.11 and 0.24 mg) gave no significant differences in the results in the evaluation points: general appearance, taste, odor, volume, crumb grain and crust color, crumb color compared with the control were (9.67, 9.66, 10.00, 9.67, 19.66, 10.00 and 19.66) , (9.67, 9.00, 8.67, 9.33 , 19.07 , 10.00 , 19.34) and (10.00, 10.00, 9.33, 10.00, 20.00, 10.00, 20.00) , respectively. While the treated fino bread (0.33 mg) recorded slightly decreased in the evaluation point compared with control were (8.00, 8.33, 7.33, 7.66,18.00, 8.33, 17.34 and 7.00) and (10.00,10.00, 9.33, 10.00, 20.00, 10.00, 20.00 and 10.00) , respectively, and the treated fino bread (0.11mg) had no significant differences in the overall score compared with control were 98.3 followed by the treated fino bread (0.24mg) was 94.34 then the treated fino bread (0.33mg) was 81.99. In Table (5) showed that the sensory evaluation of control white cheese and the treated preservation, the sensory parameters such as color (5) ,flavor (50), body (35) , appearance (10) and overall acceptability (50), the treated white cheese (0.11mg) had no significant value in color compared to control, all the treated (0.11, 0.24, 0.33 mg) also had no significant values in flavor compared with control were (49.77, 49.54, 49.63) and (49.67) , respictevely ,also the overall acceptability had the highest significant value in the treated (0.11mg) followed by (0.24 and 0.33 mg) were (49.0, 47.0 and 45.0) compared to control was (49.2). From the previous results in Tables 4 and 5 , the two samples treated with camphor oil had a good evaluation in the sensory compared to the control , subsequently gaining the advantage of prolonging the preservation period compared to the control.

Table 4. Sensory evaluation of control fino bread and the treated preservation.

Sensory	General appearance (10)	Taste (10)	Odor (10)	Volume (10)	Crumb grain (20)	Crust color (10)	Crumb color(20)	Softness (10)	Overall score (100)
The treated fino bread (0.11 mg)	9.67^{a}	9.66^{ab}	10.00^{a}	9.67^{a}	19.66^{a}	10.00^{a}	19.66^{a}	9.98^{a}	98.3^{a}
(0.24 mg)	9.67^{a}	9.00^{ab}	8.67^{ab}	9.33^{a}	19.67^{a}	10.00^{a}	19.34^{a}	8.66^{b}	94.34^{b}
(0.33 mg)	8.00^{b}	8.33^{b}	7.33c	7.66^{b}	18.00^{b}	8.33^{b}	17.34^{b}	7.00^{b}	81.99^{c}
fino bread (control)	10.00^{a}	10.00^{a}	9.33^{b}	10^{a}	20^{a}	10.00^{a}	20.00^{a}	10.00^{a}	99.33^{a}

Means followed by the same superscript letter in the same colum are not significantly different ($p < 0.05$).

Table 5. Sensory evaluation of control white cheese and the treated preservation.

Sensory	Color (5)	Flavor (50)	Body(35)	appearance (10)	Overall acceptability (50)
The treated White cheese (0.11 mg)	5.00^{a}	49.77^{a}	34.00^{b}	9.67^{ab}	49.00^{a}
(0.24 mg)	3.67^{b}	49.54^{a}	33.30^{c}	9.66^{ab}	47.00^{b}
(0.33 mg)	3.65^{b}	49.63^{a}	33.00^{c}	9.00^{b}	45.00^{c}
white cheese (control)	5.00^{a}	49.67^{a}	35.00^{a}	10.00^{a}	49.20^{a}

Means followed by the same superscript letter in the same colum are not significantly different ($p < 0.05$).

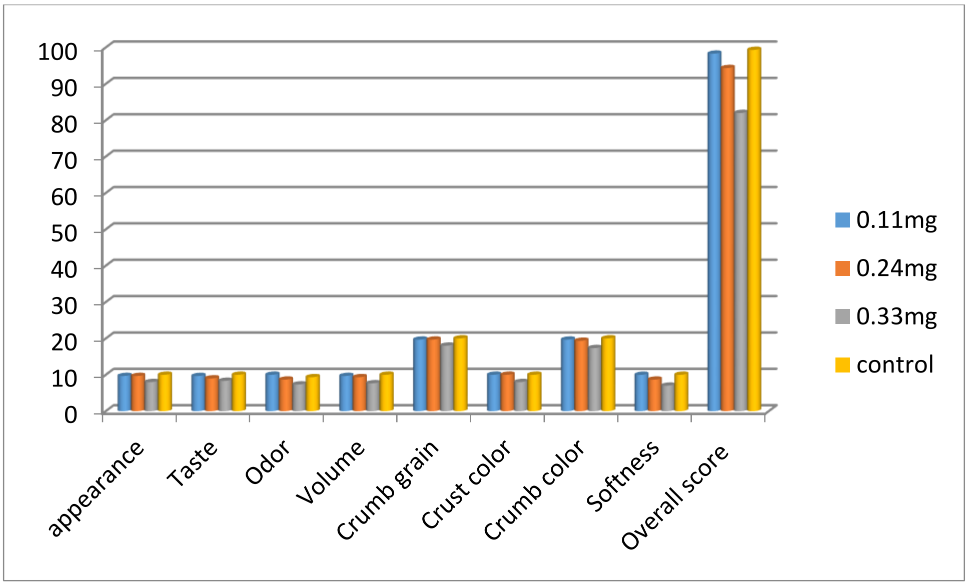

Fig. 2. Organoleptic analysis of control fino bread and the treated preservation.

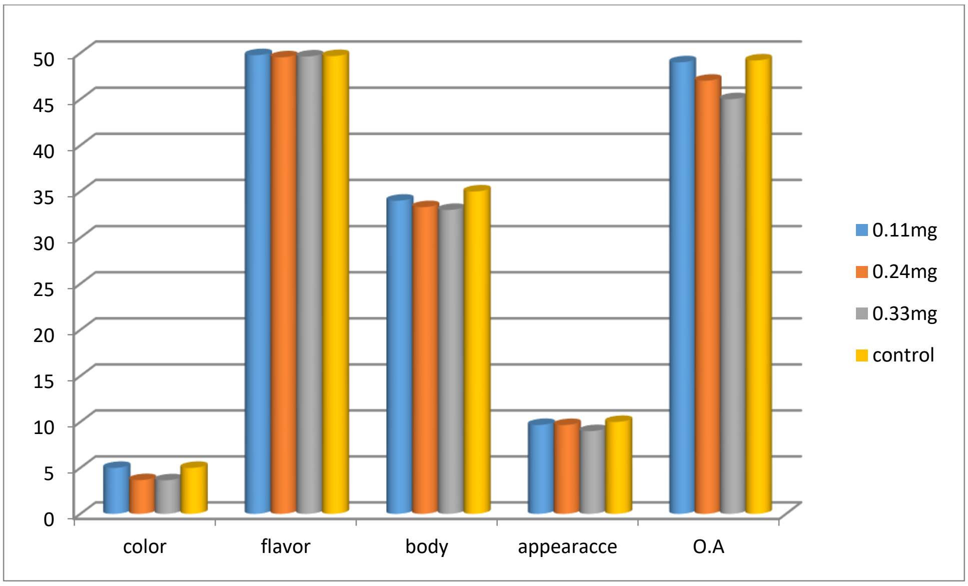

Fig .3. Organoleptic analysis of control white cheese and the treated preservation.

Antifungal activity of the essential oil of camphor leaves against Rhizopus nigricans.

Camphor essential oils and their major constituents possess toxicity against a wide range of microbes including bacteria and fungi, both soil-borne and post-harvest pathogens. They have been found to reduce mycelial growth (Fiori *et al.*, 2000), Further, studies have also documented that camphor essential oils are effective even against resistant strains of microbes. For example, (Sherry *et al.*, 2001) demonstrated that a topical application of camphor oil can effectively remove the methicillin resistant Staphylococcus aureus infection and were inhibited by the commercially available camphor oil containing 63% 1,8-cineole. Camphor oils not only show toxicity against a wide range of fungi and bacteria but also possess antiviral activity. Also (Rao 2007) reported that camphor essential oil delayed mycelium elongation and reduced sporulation for each fungus species in culture.

White cheese was more resistant to the mycelia compared to *fino bread*. This may be due to the. the use of salt during white cheese manufacture constitutes another advantage for its conservation against mold, since Dimitreli and Thonareis (2004), frequently reported the antifungal activity of salt. In the first days, essential oils significantly inhibited the growth of mycelia on fino bread and white cheese. Data in Table (6) showed that the essential oil from camphor leaf oil , it observed an antifungal activity, no mycelium has been developed on fino bread treated with (0.24 and 0.33 mg) and white cheese treated with (0.33 mg) moistened with essential oils from camphor leaf compared to the control after twelve days no food mold started to develop on fino bread and white cheese with essential oils while on pieces of fino bread and white cheese without essential oil the mold started to develop after three and four days, respectively. This observation showed the powerful use of essential oils from camphor oil as food preservatives.

Table 6. Fungicidal activity of essential oil from camphor leaf against Rhizopus nigricans.

Days	Control experience		Treatment experience					
	fino bread	White cheese	fino bread			White cheese		
			(0.11 mg)	(0.24mg)	(0.33 mg)	0.11 mg)	(0.24mg)	(0.33 mg)
1	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-
4	+	-	-	-	-	-	-	-
5	++	+	-	-	-	-	-	-
6	+++	++	-	-	-	-	-	-
7	+++	++	-	-	-	-	-	-
8	+++	++	-	-	-	-	-	-
9	+++	+++	-	-	-	-	-	-
10	+++	+++	-	-	-	-	-	-
11	+++	+++	-	-	-	+	-	-
12	+++	+++	+	-	-	+	+	-

Conclusion

The essential oil of camphor leaf could be considered as natural preservation in the field of industry as well as the flavor and boost shelf life It can also be a good flavoring and preservative agent in the food. The results of the study show that camphor leaf oil *(Cinnamomum camphora L.)* protects from pollution and tendency to increase shelf life which leads to moreover improvement in health.

References

- **Abou-Arab AK. 2000** " Heavy Metals in Egyptian Spices and Medicinal Plants and the Effect of Processing on Their ' J. Agric. Food Chem., 48, 2300-2304, Cairo, Egypt.
- **AFC, 2003**. Scientific opinion of the Panel on Food Additives, Flavorings, Processing Aids and Materials in contact with Food (AFC) on a request from the Commission on Camphor in flavorings and other food ingredients with flavoring properties. *The EFSA Journal 729, 1-15.*
- **Arnaud C, Brancheriau L, Sabatier S, Heinz C, Chaix G and Tomazello-Filho M. 2019.** Interactions between the Mechanical and Hydraulic Properties of Eucalyptus Trees Under Different Environmental Conditions of Fertilization and Water Availability. *BioResources*, *14*(3), 7157–7168.
- **Audu, AA and Lawal, AO. 2006.** Variation in metal contents of plants in vegetable garden sites in Kano metropolis. J. Appl. Sci. Environ. Mgt. June, 2006 Vol. 10 (2) 105 – 109.
- **Ben Marzoug HN1, Romdhane M, Lebrihi A, Mathieu F and Couderc F**. **2011**. Eucalyptus oleosa essential oils: chemical composition and antimicrobial and antioxidant activities of the oils from different plant parts (stems, leaves, flowers and fruits). Molecules; 16: 1695–1709.
- **Chen-Lung Ho, Wang Eugene I and Chen, Yu-Chang Su .2009.** Essential oil compositions and bioactivities of the Various parts of cinnamomum Camphora sieb. Var.Linaloolifera Fujuta ; 31(2):77-96.
- **Council of Europe .2001.** Committee of Experts on Flavouring Substances of the Council of Europe. 48th Meeting Strasbourg, 2.-6-April 2001.
- **Craig WJ. 1999**. Health-promoting properties of common herbs. The American Journal of Clinical Nutrition 70(3): 491S-499S.
- **Dimitreli G and Thomareis AS. 2004**. Effect of temperature and chemical composition on processed cheese apparent viscosity. Journal of Food Engineering 64(4) 265-271.
- **EFFA, 2009**. European leaders in the world of flavor providing long term positioning as a trusted and impactful partner and supporting the flavor industry by providing coordination and direction,1-15.
- **Ertas ON, Guler T and Simsek UG**. **2005.** The effect of an essential oil mix derived from oregano clove and anise on broiler performance. Int J Poul Sci , 4: 879-884.
- **Fiori ACG, Schwan-Estrada KRF, Stangarlin JR, Vida JB and Scapim CA**. **2000**. Antifungal activity of leaf extracts and essential oils of some medicinal plants against Didymella bryoniae. J Phytopathol. 2000; 148: 483–487.
- **Frizzo Caren D, Santos Ana, C, Paroul Natalia, Serafini Luciana A , Dellacassa and Eduardo Lorenzo Daniel.2000.** Essential oils of champhor Tree (cinnamomum Camphora Ness & Eberm) cultivated in southern Brazil. Brazillian Archives of Biology and Technology ; 43 (3).
- **IOFI, 2023**. International Organization of the Flavor Industry,1-3.
- **Kabata-Pendias A and Pendias H .2001**" Trace elements in soils and plants, 3rd ed., CRC Press, Boca Raton, FL.
- **Lee HJ, Hyun EA, Yoon WJ, Kim BH, Rhee MH, Kang HK, Cho JY and Yoo ES. 2006.** In vitro anti-inflammatory and anti-oxidative effects of Cinnamomum camphora extracts. Journal of Ethnopharmacology, 103, 208-216.
- **Luckey, T, Venugopal and B, Hutchson D. 1975.** Heavy metal toxicity, safety and homology. *Qual. Suf. Thieme Stuttgart, Supplement* 1: 120.
- **Pappas CP , Kondlyi E , Voutsinas LP and Mallatou H .1996.** Effects of starter level, draining time and aging on the physicochemical, organoleptic and rheological properties of fetacheese. Int. J. Dairy Technol., 49: 73-78.
- **Passwater RA and Cranton, EM. 1993.** Trace Element: Hair Analysis and Nutrition, Hew Canan Ct, Keasts, p. 38.
- **Philpott NW. 1929.** Intramuscular Injections of camphor in the treatment of engorgement of the breasts, Can Med Assoc J.; 20(5): 494–495.
- **Poudel DK, Rokaya A, Ojha PK, Timsina S, Satyal R, Dosoky NS, Satyal, P and Setzer WN**. **2021.**The Chemical Profiling of Essential Oils from Different Tissues of Cinnamomum camphora L. and Their Antimicrobial Activities. Molecules, 26, 5132.
- **Pyler EJ.1973.** Baking scie. and Tech. vol. I, Pub. By Siebel Publishing Co. Chicago,

- ILL (Chapter 3).
- **Rao V. 2007.** Extraction of essential oil and its application. Project Report. 9-35.
- **Sahm DH and Washington JA .1991**. Antibacterial susceptibility tests: Dilution methods. In *Manual of Clinical Microbiology*. Balows A, Hausler WJ, Herrmann KL, Isenberg HD, Shamody HJ (Eds). American Society for Microbiology, Washington DC, USA. processed cheese apparent viscosity. Journal of Food Engineering, 64(2): 265-271.
- **SAS Program 1996**.SAS/STAT User,s Guide Release 6.12 ed.Cary,NC,USA:SAS Inst.Inc.
- **Sauceda, R. and Nereyda E. 2011.** uso de agentes antimicrobianos naturales en la conservación de frutas y hortalizas. (natural antimicrobial agent use in the preservation of fruits and vegetables). Ra Ximhai. 7(1):153-70.
- **Sherry E, Boeck H and Warnke PH**. **2001**.Topical application of a new formulation of eucalyptus oil phytochemical clears methicillin-resistant Staphylococcus aureus infection. Am J Infect Control. 29: 346.
- **Su J, Chen J, Liao S, Li L, Zhu L and Chen L. 2012**. Composition and biological activities of the essential oil extracted from a novel plant of Cinnamomum camphora Chvar. Borneol. J Med Plants Res **6**: 3487–3494.
- **Wang L, Zhang K, Zhang K, Zhang J, Fu J, Li J, Wang G, Qiu Z,Wang X and Li J.2020**. Antibacterial activity of Cinnamomum camphora essential oil on Escherichia coli during planktonic growth and biofilm formation. Front. Microbiol. 11, 561001.
- **We Z, Du Y, Guo Z,, Lei K, Jia Y, Yie M, Kang Y, Wei Q, He YW, Hu Y, Yuan M and Yuan S. 2016.** Essential oil and its major compounds from oil camphor inhibit human lung and breast cancer cell growth by cell-cycle arresting.Int J Clin Exp Med;9(7):12852-12861.
- **Wu C and Zhang L. 2010.** Heavy metal concentrations and their possible sources in paddy soils of a modern agriculture zone, south-east hern China. *Environmental Earth Sciences* 60: 45-56.
- **Znidarsic P, Komel R and Pauko A. 2002.** Infl uence of some environment factors of Rhizopus nigricans. World journel of microbiology and biotechnology. 16: 589-593
- **Zuccarini paolo .2009.** Camphor : risks and benefits of a widely Used Natural product. J.Appl.Sci. Environ. Manage. 3 (2) : 69-74.