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# Effect of mint and basil extracts on stability of palm oil

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**ABSTRACT**

*In this study, antioxidant activity of extracted mint and basil extracts using different solvent (methanol, acetone and hexane) was evaluated. Mint and basil extracts at different concentrations (0.05, 0.1, 0.3 and 0.5%) were added to palm oil. The results of peroxide revealed that oil samples containing the highest concentration of methanolic extract of mint showed the lowest peroxide index. This results probably because the methanol extract was able to extract higher amount of phenolic compounds compared to acetone and hexane. Therefore mint methanol extract, could be a suitable substitute for detrimental and synthetic antioxidants which usually used by factories.*

**Key words**: Antioxidant, Basil extract, Mint extract, Palm oil, peroxide test, Rancimat.

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## INTRODUCTION

One of the serious problems of food spoilage is fat oxidation. Fat oxidation results in undesirable color, taste and smell, and produces free radicals. Free radicals are the cause of many diseases such as arteriosclerosis, cancer, Alzheimer, Parkinson as well as aging. Therefore, it is necessary to add antioxidants inorder to increase shelf life, quality and benefits of foods [1].

In general, synthetic antioxidants such as BHA, BHT, and TBHQ are applied to prevent fat oxidative and rancidity while their carcinogenic effects have been approved [2].Now day's the application of these synthetic antioxidants has been declined because of their detrimental effects [3]. and substitution of them with natural antioxidants are increasing [4]. Most of vegetable foods contain effective compounds preventing from undesirable oxidative process in foodstuff [5]. Phenolic compounds are one of the most common antioxidants found in food sources.

Nowadays the use of phenolic extracts of fruits, vegetables, grains, and other vegetable foods are significant, because phenolic compounds are able to retard oxidative activity of fats and improve nutritional value of foods. Juliani and simon (2002) [6-7], evaluated the antioxidant activity of basil and reported that basil extract was contained a wide range of phenolic compounds. Prakash, (1990) [8], reported that basil extract was contained high amount of phenolics compounds (notably resmarinic and cafeic acids). Salami, (2005) [9], evaluated the antioxidant activity of 12 aromatic compounds of basil through aldehyde-carboxylic method. The results showed that all these aromatic compounds at 5 mg prevented from hexanal oxidation during 45 days.

In another study Kanatt et al., (2007), [10] reported that mint leaves are contained natural flavonoid and phenolic antioxidants. Murica et al., (2004) [11], stated that the extracts of mint, dill, and ginger may increase the stability of oils such as sunflower, corn, and olive against oxidation. Fecka et al., (2008) [12], conducted a study on phenolics of mint and basil and reported that rosmarinic acid was the most abundant phenolic compound of that.

There are various methods for extracting from vegetable tissues [13]. Solvent extraction is one of the most common methods for extraction. The applied method and type of the solvent significantly affected on the concentration of extracted antioxidants [13]. In this method the plant and solvent are in contact for a certain time and then the solvent is removed [14].

Palm oil is stable against oxidation, because it has a balanced ratio of saturated and unsaturated fatty acid [15]. It is essential to replace synthetic antioxidants by natural ones to improve stability of palm oil. Basil and mint are among Iran's indigenous plants and they are inexpensive and easy available and their extracts are easily extracted with organic solvents. The aim of this study was to extract mint and basil extracts using organic solvents methanol, acetone, and hexane and to examine and compare antioxidant activity of mint and basil extracts through evaluating of stability of palm oil.

## MATERIALS AND METHODS

### Materials

Mint and basil plants obtained from research field of medicinal herbs research center of Jahad Daneshgahi (Karaj, Iran). Antioxidant free palm oil was provided by Pars Ghoo vegetable oil company (Tehran, Iran). The used solvents and other chemicals were obtained from Merc KGaA (Darmstadt, Germany).

### Extraction

Cold solvent method was applied to extract mint and basil extract mint and basil extracts. Mint and basil plants were dried, then powdered and passed through 40 No. mesh. Then, the powdered plant and the solvents separately mixed at 1:10 ratio in a shaker at ambient temperature for 24 h. Then, they were filtered through filter paper using vacuum pump and at the next stage, the obtained extracts were distilled at vacuum by rotary apparatus to remove the solvents. Vacuum was applied at 25 mm Hg at 50-55$^{\circ}$C inorder to minimize damage phenolic compounds. Eventually the solvent was removed with the help of residual nitrogen azote and then, the obtained extracts refrigerated in dark glass containers [16].

### Palm sample preparation

To examine antioxidant property of mint and basil extracts obtained by methanol, aceton, and hexane, they were added to 100 gram of antioxidant free palm oil, at different concentrations (0.05%, 0.1%, 0.3%, and 0.5%) considering their phenolics content.

### Rancimat and peroxide tests

All samples were transferred to oven at 75$^{\circ}$C to determine peroxide value test. Peroxide value test was determined using official methods and American oil chemist society AOCS method cd 8b – 90 (Iodometric methods) [17], in triplicates at 48 h intervals for 10 days for each sample. Oxidation stability duration of all treatments was determined before incubation using Rancimat (Model 743) at 110$^{\circ}$C and 20 ml/h air flow.

### Measurement of palm oil fatty acids composition

Fatty acid composition of palm oil was identified and determined using Gas chromatography **(**GC**).** The samples were prepared as methyl ester derivatives according to the method of Christie by using 0.5 normal sodium methoxide. Then to examine the profiles of fatty acids, a Gas chromatography (model Acme 6000) equipped with flame detector and 60 m column according to AOAC standard No. Ce 1e-91 [17], was used.

### Data statistical analysis

Software Spss 16 was used to analyze data statistically. Means of concentration and different solvents were compared using Duncan mean comparison at significant level 0.01% of which the best solvent and concentration were selected.

## RESULTS AND DISCUSSION

### Fatty acid composition of palm oil

The results obtained through Gas chromatography (GC) demonstrated that palm oleic oil is one of the most saturated and stable vegetable oils. Half of fatty acids of palm oil are saturated and the rest is unsaturated. The results presented in Table 3 revealed that palmitic acid showed the highest amount among saturated fatty acids of palm oil and also oleic acid showed the highest percentage among unsaturated fatty acids of palm oil. Fatty acids profile reported in Table 1 demonstrated that palm oil could be suitable for deep frying because it has oxidation stability, it does not show any polymerization, bad odor, and gum because of having normal amount of unsaturated compounds and insignificant amount of linolenic acid.

**Table 1. Palm Oil Fatty Acid Profile using Gas chromatography (GC)**

| Type of fatty acids | Value (%) |
|---|---|
| C12:0 (Lauric acid) | 0.19 |
| C14:0 (Myristic acid) | 0.97 |
| C16:0 (palmitic acid) | 43.19 |
| C18:0 (stearic acid) | 4.49 |
| C18:1 (oleic acid) | 39.74 |
| C18:2 (linoleic acid) | 10.75 |
| C18:3 (linolenic acid) | 0.37 |
| C20:0 (arachidonic acid) | 0.26 |
| Other fatty acids | 0.04 |
| Total saturated fatty acids | 49.10 |
| Total unsaturated fatty acids | 50.86 |

**Table 2. Mean peroxide index of different treatments of palm oil containing hexanoic, acetonic and methanolic mint (meq/kg) extracts at 75°C**

| | Solvent* | Level of mint extract* | 0 hour | 48 hour | 96 hour | 144 hour | 192 hour | 240 hour |
|---|---|---|---|---|---|---|---|---|
| Palm oil | Control | 0 | 0 | 10.01 | 13.98 | 20.29 | 27.00 | 32.10 |
| | Hexane | 0/05 | 0 | 9.46 | 13.33 | 20.11 | 26.21 | 32.00 |
| | | 0/1 | 0 | 9.24 | 12.58 | 19.42 | 26.20 | 30.76 |
| | | 0/3 | 0 | 9.18 | 12.50 | 19.30 | 26.00 | 29.93 |
| | | 0/5 | 0 | 9.00 | 12.42 | 19.02 | 25.10 | 29.40 |
| | Acetone | 0/05 | 0 | 8.65 | 12.48 | 19.82 | 23.00 | 25.67 |
| | | 0/1 | 0 | 8.50 | 12.44 | 19.18 | 22.88 | 24.00 |
| | | 0/3 | 0 | 6.71 | 11.02 | 17.95 | 21.83 | 22.72 |
| | | 0/5 | 0 | 5.50 | 8.17 | 14.90 | 18.75 | 22.26 |
| | methanol | 0/05 | 0 | 7.60 | 11.67 | 20.20 | 22.90 | 26.71 |
| | | 0/1 | 0 | 5.18 | 9.78 | 17.18 | 19.22 | 23.66 |
| | | 0/3 | 0 | 3.25 | 7.99 | 9.12 | 12.80 | 15.74 |
| | | 0/5 | 0 | 3.22 | 7.00 | 7.59 | 9.07 | 10.19 |

*[a]The values are given as mean of triplicate.*
** Significant (p< 0.01).*

**Table 3. Mean peroxide index of different treatments of palm oil containing hexanoic, acetonic and methanolic basil (meq/kg) extracts at 75°C**

| | Solvent* | Level of basil extract* | 0 hour | 48 hour | 96 hour | 144 hour | 192 hour | 240 hour |
|---|---|---|---|---|---|---|---|---|
| Palm oil | Control | 0 | 0 | 10.01 | 13.98 | 20.29 | 27.00 | 32.10 |
| | Hexane | 0/05 | 0 | 9.37 | 13.90 | 19.60 | 27.00 | 32.05 |
| | | 0/1 | 0 | 9.27 | 13.05 | 20.41 | 26.50 | 31.95 |
| | | 0/3 | 0 | 9.19 | 13.00 | 19.64 | 26.00 | 31.50 |
| | | 0/5 | 0 | 9.10 | 12.52 | 19.60 | 25.20 | 31.00 |
| | Acetone | 0/05 | 0 | 9.41 | 13.22 | 17.92 | 23.01 | 32.13 |
| | | 0/1 | 0 | 9.03 | 12.40 | 17.75 | 22.56 | 32.00 |
| | | 0/3 | 0 | 6.90 | 10.59 | 15.68 | 20.00 | 28.46 |
| | | 0/5 | 0 | 5.67 | 8.21 | 15.30 | 19.00 | 25.60 |
| | methanol | 0/05 | 0 | 9.91 | 12.55 | 16.68 | 21.23 | 25.43 |
| | | 0/1 | 0 | 9.67 | 10.98 | 16.00 | 21.15 | 24.17 |
| | | 0/3 | 0 | 7.57 | 10.00 | 15.45 | 20.00 | 24.00 |
| | | 0/5 | 0 | 4.83 | 9.55 | 13.55 | 18.84 | 23.14 |

*[a]The values are given as mean of triplicate.*
** Significant (p< 0.01).*

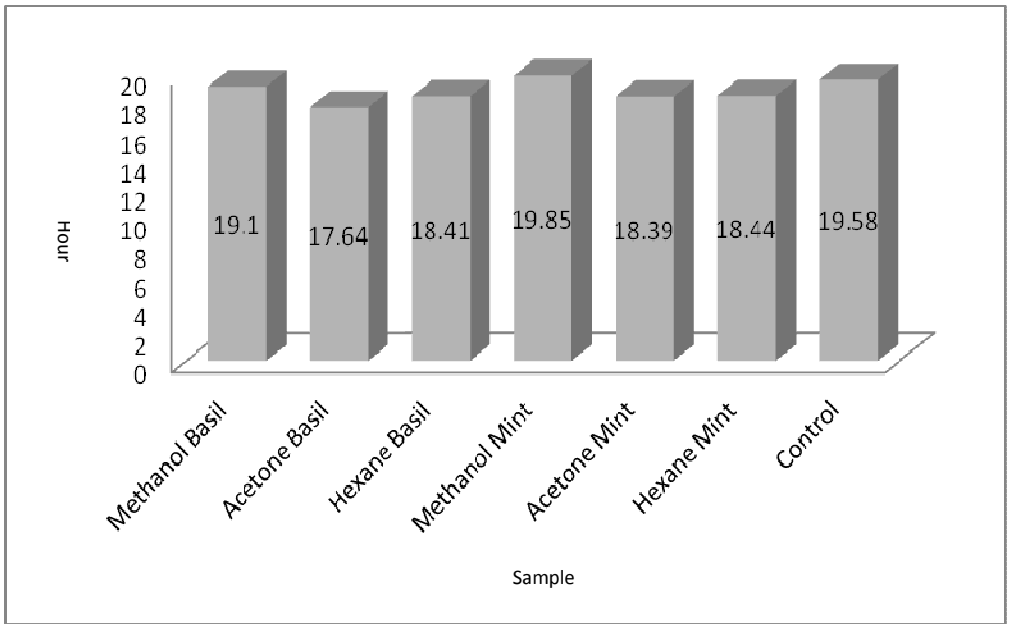


**Figure 1. Comparison of oxidation stability duration of control sample with different samples of palm oil contained 0.5% natural mint and basil extracts extracted by solvents methanol, acetone and hexane at 110°C**

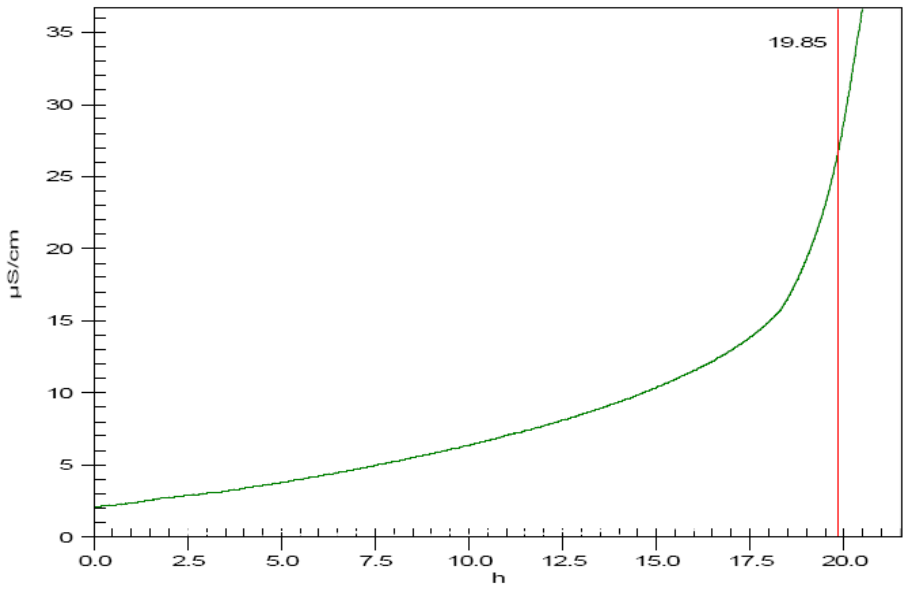


**Figure 2. Typical chromatogram of oxidation stability of methanolic mint extract in palm oil evaluated by Rancimat at 110°C**

**Examination of antioxidant effect of mint and basil extracts on palm oil**

Mean peroxide value of palm oil samples containing different concentrations of methanol, aceton and hexane extracts of mint and basil kept at 75˚C for 240 h represented in Tables 2 and 3 and compared them with the control sample (Palm oil without any antioxidants). The results revealed that type and concentration of solvent and storage period had a significant ($P<0.01$) effect on peroxide value variations. The results from Tables 2 and 3 demonstrated that the peroxide value increased with time for all samples. The results from this study showed that by increase of the extracted concentration from the mint and basil resulted in increased antioxidant activity followed by peroxide index declined. The results suggested that control samples without any antioxidants showed the highest peroxide index.

Aforementioned results demonstrated the antioxidant activity of min and basil extracted. The results of peroxide test revealed that oil samples containing the highest amount of methanol extract of mint (0.5%) showed the lowest peroxide index because methanol extract was able to extract more phenolic compounds compared to the other solvents and also phenolics of mint extract could inhibition of the primary products of oxidation which this ability increased with increasing concentrations of mint extract.

Oxidation stability of control sample and different samples of palm oil contained 0.5% natural extract of mint and basil which extracted using different solvents at 110$^{\circ C}$ evaluated through Rancimat test and the results are shown in figure 1. The results demonstrated that the palm oil which contained of 0.5% methanol extract of mint showed the highest stability (19.85 hour) among palm oil treatments. Figure 2 are shown the chromatogram of Rancimat for the palm oil sample with highest stability. The results obtained from Rancimat tests were confirmed the results of peroxide test.

## CONCLUSION

In this study, the profile of palm oil fatty acids and antioxidant property of mint and basil extracted with different solvents (methanol, acetone, and hexane) in palm oil were evaluated by using Rancimat and peroxide tests. Considering the results obtained by GC test it could be stated that palm oil is stable against oxidation compared to the other vegetable oils because it has a balanced ratio saturated and unsaturated fatty acids and stability could be increased easily by natural antioxidants. The results from this study showed that methanol was the most effective solvent for extracting phenolics of mint and basil. In addition, mint extract showed more potent antioxidant property compared to basil extract. The result of peroxide and Rancimat tests demonstrated that 0.5% of methanol extract of mint was a proper antioxidant and a suitable substitute for synthetic antioxidants in palm oil. This study may introduce mint extract as a natural and effective antioxidant in vegetable oils.

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