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The Stabilizing Effect of Dill Extract on Sunflower Seed Oil

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ABSTRACT: The commercial development of food products originated from the plants as sources of antioxidants to increase the health benefit and stabilize the food is of current interest. This study was aimed at obtaining dill extract using cold solvent method by three solvents, (methanol, acetone, and hexane) and examining the antioxidant potency and determining the oxidative stability of sunflower seed oil over storage time. Dill extracts were added to sunflower seed oil at 0.5, 0.3, 0.1, and 0.05% W/W concentrations. The antioxidant activities of the extracts were evaluated by measuring the peroxide value and the induction period employing Rancimat apparatus. The results showed that the sample containing methanolic extract of dill had the lowest peroxide value and the highest oxidative induction period or oxidative stability. The results also revealed that the antioxidant activity of the extracts is concentration dependent. Therefore, 0.5% methanolic extract of dill exhibited the greatest antioxidant activity and the stability was improved in sunflower seed oil. This study also indicated that the application of dill extract as a substitute to the current synthetic antioxidants in sunflower oil might be preferred.

Keywords: *Antioxidants, Dill Extract, Oxidation, Phenolic Compound, Sunflower Seed oil.*

Introduction

Fat oxidation is one of the most important and serious problem pertaining rancidity and food spoilage. Therefore, addition of antioxidants is required to increase the shelf life and quality of foods and preventing oxidative rancidity. For industrial purposes synthetic antioxidants such as BHT, TBHQ, and BHA are applied to prevent fat oxidation while their carcinogenic effects have been approved (Demir *et al*., 2009). Nowadays, the use of herbal medicines and their effective compounds as natural sources with antioxidant activity is the concern of researchers. Different methods have been applied to extract these compounds from vegetable tissues. A suitable method might increase the concentration of the extracted antioxidants (suhaj, 2006).

Solvent extraction is among the most commonly applied methods for extraction. In this method the plant of interest and the solvent are in contact for a certain time and finally the solvent is removed after extraction (Samsan Shariat, 1994). Researchers have reported that dill contained compounds that exhibited antioxidant activities (Jinesh *et al*., 2010). Dill extract contains phenolic compounds that might retard the fat oxidation and improves the quality of food and its nutritional value (Kahkonen *et al*., 1999). Monajjemi *et al*., (2012) reported that the main phenolic compounds of dill are proto-catechuic acid and catechin. In another study, Murica *et al*.,

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(2004) stated that mint, dill, and ginger could improve the oxidation stability of sunflower, corn and olive oils as well as butter and margarine at 110˚C.

Sunflower seed oil has a mild and desirable taste preserving the natural taste of foods. It also has a mild and attractive yellow color that increases its desirability. These properties make this oil a valuable oil for salads, cooking and frying practices. Sunflower seed oil contains a considerable quantities of oleic and linoleic acids, both have health benefits and reduce blood cholesterol level. The linolenic acid content of sunflower seed oil is quite low, therefore this oil has longer shelf life than soyabean oil that contains a considerable quantity of linolenic acid (Malek, 2000). The replacement of synthetic antioxidants with the natural ones in sunflower seed oil and in general in any oils is justified for improving the quality. Dill is among indigenous plants, easily available and inexpensive, and its extract is easily obtained by organic solvent extraction. Therefore, the object of the following study was to isolate dill extract using methanol, acetone and hexane as solvents and then examine the antioxidant activities of the extracted materials on sunflower seed oil.

Materials and Methods

Dill plant was obtained from herbal medicines research center, Jahad-e-Daneshgahi, Karaj. Sunflower seed oil was donated by pars Ghoo company. The solvents and other chemicals employed in this work were obtained from Merck KGaA (Darmstadt, Germany).

- *Preparation of dill extract*

Cold solvent extraction method was applied to isolate the dill extract. Dill plant was dried, milled and then strained through sieve No. 40. Powdered form was mixed with solvent at 1:10 ratio on a shaker at room temperature for 24 h and then the mixture was filtered using filter paper and vacuum pump. The solvent was removed on a rotary evaporator under vacuum in order to minimize the loss. The remaining solvent was removed using nitrogen. The obtained extracts were refrigerated until required for further use (Su *et al*., 2007).

- *Preparation of sunflower seed oil and measurements of the antioxidant activities*

The extracts were added to 100 g of sunflower seed oil using magnetic mixer at different concentrations (0.5, 0.3, 0.1 and 0.05%). All the treatments were transferred to an oven at 75˚C. Peroxide values were measured according to AOCS standard method (cd 8b-90) in duplicate order in 48 h intervals for 10 consecutive days for each sample (Firestone, 1994).

The stability concerning the induction periods were determined by the application of Metrohm Rancimat, model 743, at 110˚C.

- *Determination of fatty acid composition*

The samples were prepared as methyl ester derivatives using sodium methoxide as catalyst according to Christie (1993). A gas chromatograph apparatus equipped with Flame Ionisation Detector and a cpsill 88 capillary column was employed to determine the fatty acid compositions, both qualitatively and quantitatively according to AOCS standard method (ce 1e-91).

- *Statistical analysis*

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

Results and Discussion

As shown in Table 1, oleic and linoleic acids are the predominant fatty acids present in sunflower seed oil. The results revealed that sunflower seed oil showed higher

stability when compared to soybean oil. This might be due partly to the lower concentrations of linolenic acid present in sunflower seed oil.

Mean peroxide values of sunflower seed oil samples containing different concentrations of dill extracts over 240 h storage times at 75˚C are shown in Table 2. As Table 2 indicates the type of solvent, extract concentration, and duration of storage have significant (p<0.01) effects on peroxide value variations. The results showed that by increasing the extract concentration, the peroxide value is decreased. Therefore it might be concluded that oxidation can be retarded by the addition of dill extract in sunflower seed oil.

The sample containing 0.5% methanolic extract of dill showed the lowest peroxide value. This might be due to methanol that has strong polarity and easily dissolves the phenolic compounds of dill. The induction periods of samples containing 0.5% natural dill extracts that were extracted by different solvents was evaluated at 110˚C using Rancimat apparatus (Figure 1) and it was concluded that the methanolic extract of dill exhibited the longest induction period among the samples examined.

Figure 2 shows a typical chromatogram concerned with the stability of sunflower seed oil containing 0.5% extract. The rancimat results confirmed the peroxide value results and the findings in this study were in agreement with the results of Ayouphi *et al*, (2009), who evaluated the antioxidant activity of dill essential oil (Anethum graveolens) in soybean oil. Dill essential oil has a high concentration of oxygenated compounds such as D-carvon, Dill opiol, trans-dihydrocarvon, and cis-di hydrocarvon as well as some other compounds namely linalool, terpineol, thymol, and carvacrol. It therefore might be concluded that dill as a natural product containing some antioxidants is able to retard or terminate the oxidation chain reactions.

Conclusion

Antioxidant activities of dill extract obtained by different solvents (methanol, acetone, and hexane) were evaluated in sunflower seed oil using peroxide value and Rancimat apparatus. The results showed that methanol was the most effective solvent to extract dill phenolics compounds. The results also revealed that there were direct relationship between sunflower seed oil stability and the concentration of extract. It was demonstrated that the addition of 0.5% methanolic extract exhibited the highest antioxidant activity and as the concentration was increased the induction period was increased as well.

Table 1. Fatty acid composition of sunflower seed oil

Type of fatty acids	Value (%)
C14:0	0.18
C16:0	6.73
C16:1	0.11
C18:0	3.49
C18:1	24.32
C18:2	63.12
C18:3	0.29
C20:0	0.24
C20:1	0.14
Other fatty acids	1.38
Total saturated fatty acids	10.64
Total unsaturated fatty acids	87.98

Table 2. Mean peroxide value (meq/kg) of different treatments of sunflower seed oil containing different concentrations of extracts (hexane, acetone and methanol) at 75°C.

	Solvent*	Level of dill extract*	0 hour	48 hour	96 hour	144 hour	192 hour	240 hour
Sunflower oil	Control	·	0	11.25	14.25	25.26	33.80	41.81
	Hexane	0.05	0	11.00	14.00	25.00	33.50	41.50
		0.1	0	10.30	13.90	24.50	33.00	40.50
		0.3	0	10.20	12.82	24.19	29.70	36.70
		0.5	0	10.00	12.36	24.11	29.00	36.00
	Acetone	0.05	0	10.00	13.73	23.00	33.24	40.24
		0.1	0	9.14	12.96	22.50	28.90	35.90
		0.3	0	6.32	8.78	21.00	24.10	31.10
		0.5	0	4.24	7.96	20.00	22.70	29.70
	Methanol	0.05	0	9.39	13.68	21.35	31.10	38.10
		0.1	0	8.45	10.90	20.47	25.25	32.25
		0.3	0	5.00	8.21	14.00	19.90	26.90
		0.5	0	4.00	6.73	8.14	11.58	18.58

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

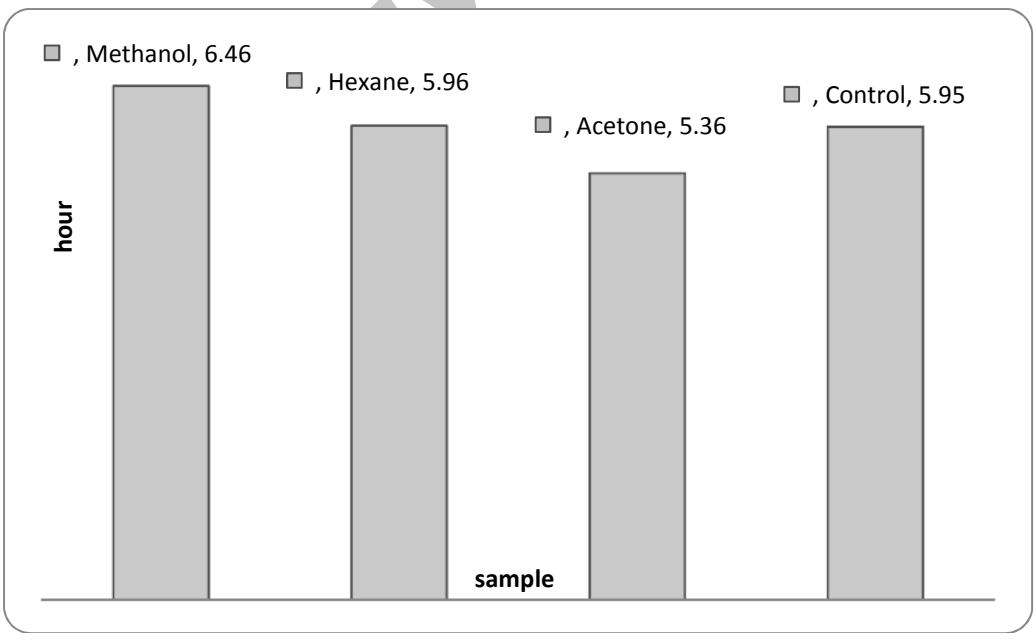

Fig. 1. Induction Periods (h) of sunflower seed oil containing 0.5% concentraion of extracts at 110°C

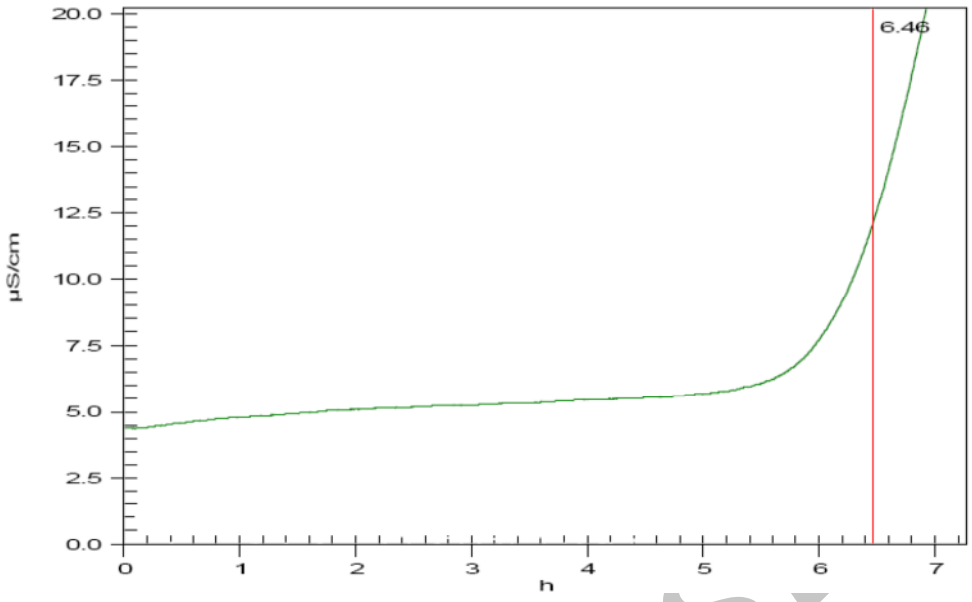

Fig. 2. A typical diagram of oxidative stability of sunflower seed oil with added 0.5% methanolic extract at 110°C using Rancimat apparatus

References

AOAC. (1997). Official Methods of Analysis. 16th edn. Association of Official Analytical Chemists (AOAC), Arlington, VA, USA.

Ayoughi, F., Barzegar, M., Sahari, M. A. & Badi, H. N. (2009). Antioxidant effect of dill (Anethum graveolens Boiss.) oil in crude soybean oil and comparison with chemical antioxidants. Journal of Medicinal Plants Research, 8 (30), 71-83.

Christie, W. W. (1993). Preparation of ester derivatives of fatty acids for chromatographic analysis. In: Christie WW (ed) Advances in lipid methodology—II. Oily Press, Dundee, p 69-111.

Firestone, D. (1994). Official methods and recommended practices of the American oil Chemist Society. 4 thed. hampaign, IL:AOCS Press: 1994.

Jinesh, V. K., Jaishree, V., Shrishailappa B. & Shyam, W. (2010). Comparative evaluation of antioxidant Properties of edible and non-edible leaves of Anethum gravelolens Linn. Indian Journal of Natural Products and Resources, 1 (2), 168-173.

Malek, F. (2000). Edible fats and oils. Farhang & ghalam press.

Monajjemi, M., llkhani, A. R., Nurul Aminin, A. L., Eghdami, A., Mollaamin, F. & Rezaei, S. (2012). Journal of Medicinal Plants Research, 6(18): 3459-3463

Murica, M. A., Egea, I., Romojaro, F., Parras, P., Jimenez, A. M. & Martinez-Tome, M. (2004). Antioxidant evaluation in dessert spices compared with common food additives. Influence of irradiation procedure. J. Agr food chem., 52,1872-1881.

Kahkonen, M. P., Hopia, A. I., Vuorela, H. J., Rauha, J. P., Pihlaja, K., Kujala, T. S. & Heinonen, M. (1999). Antioxidant activity of plant extracts containing phenolic compounds. Journal of Agricultural and Food Chemistry, 47, 3954-3962.

Samsam Shariat, H. (1992). Extraction of effective matters of medicinal herbs and their identification and evaluation methods. First edition. Mani press.

Suhaj, M. (2006). Spice antioxidant isolation and their antiradical activity: a review. Journal of Food Composition and Analysis, 19, 531-537.

Su, L., Yin, J. J., Charles, D., Zhou, K., Moore, J. & Yu, L. (2007). Total phenolic contents chelating capacities and radical scavenging properties of black peppercorn, nutmeg, rosehip, cinnamon and organo leaf. Food Chemistry, 100, 990-997.