Blackberry (Rudus plicates) Leaves Extract Effect on Corn Oil Oxidation (Primary and Secondary Products) At High Temperature

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***Abstract*—Rudus plicates leaves extract effects was determined in this study in corn oil by primary and secondary oxidation products. So, different concentrations of methanolic extract (0, 400, 800, 1600 and 3200 ppm) were added to corn oil and compared with TBHQ at 200 ppm. Peroxide value (PV) and carbonyl value (CV) were taken as parameters for evaluation of effectiveness of Rudus plicates leaves extract in stabilization of corn oil. Results shows that the highest efficiency of 3200 ppm of the extract followed by TBHQ and other concentrations of the extract. Results reveal the Rudus plicates leaves extract to be a potent antioxidant in edible oils.**

***Keywords*—Antioxidant activity, Corn oil, High temperature, Rudus plicates leaves extract**

I. Introduction

In food industry, lipid oxidation is accepted to bring about deleterious effects, such as deterioration, off-flavors and nutritional losses. The deteriorative changes in vegetables oils arise by reaction with atmospheric oxygen. Antioxidants are used as food additives in order to extend the lifetime of oils during storage and frying [1]. The antioxidants to be used are determined by various factors including legislation, effectiveness and cost. However, consumer preference for natural additives has encouraged the introduction of new source of natural antioxidants. Also, consumers have been more concerned about the safety of their food and the potential effect of synthetic additives on their health [2].

Blackberries (*Rubus plicatus*) have a center of origin in the Caucasus, are well distributed throughout Europe, and have been introduced into Asia, Oceania, and North and South America. Rubus plicatus has so much medicinal values due to a variety of active phytochemicals, alkaloids, phenolics, terpenoids, and glycosides [3]. The phenolic compounds in Rubus plicatus have been reported to have antioxidant, anticancer, antiinflammatory and biological properties. Moreover, Blackberry leaf extract has been reported to have relaxant effect, particularly on uterine muscles [4].

There are several studies which indicated the different natural extracts in inhibiting the oil oxidation. But the antioxidant activity of Rudus plicatus leaves extract has not been researched. So, the purpose of the present study was to clarify the antioxidative behaviour of methanolic extract of different concentrations of Rudus plicatus leaves extract (0, 400, 800, 1600, 3200 ppm) in pure corn oil as a lipid substrate at high (180˚C) temperature and compared with TBHQ.

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II. Materials and Methods

A. Materials

Corn oil (with no added antioxidants) was obtained from Behgol Company, (Nieshaboor, Iran). The leaves of Rudus plicatus were collected from the fields of Mazandaran, Iran in June. All the chemicals and reagents used were of analytical reagent grade and were provided from Sigma and Merck Company. TBHQ was purchased from Sigma Chemical Co (St. Louis, MO, USA).

B. Extraction

The leaves of Rudus plicatus were dried in the shade and sieved. The powder of dried leaves were extracted into methanol (1 : 50 wt/vol) by agitation for 24 h in a dark place at room temperature. Then, the extract was filtered and residue was again extracted. Then, removal of solvent was done in rotary evaporator at 40˚C under pressure. The extract was stored under nitrogen prior to further analyses.

C. Determination of Radical Scavenging Activity

Radical scavenging capacity was measured using DPPH (1,1-Diphenyl-2-picrylhydrazyl) method. This method described previously by Lima and coworkers (2006) [5]

D. Preparation of oil samples

Sunflower oil (with no added antioxidant) (5 g) including extract (0, 400, 800, 1600, 3200 ppm) of R. fruticosus leaves extract and 200 ppm of TBHQ as a control antioxidant were stored in a 1-mm layer in a Petri dish with a diameter of 9 cm at 180˚C. Progress of oxidation was monitored by the determination of peroxide value (PV) and carbonyl value (CV) at 180˚C [6].

E. Statistical analysis

All determinations were carried out in duplicate, and data were subjected to analysis of variance (ANOVA). ANOVA analyses were performed according to SAS software. Significant differences between means were determined by

Duncan's multiple range tests; p values less than 0.05 were considered statistically significant.

III. Results and Discussion

DPPH radical-scavenging test is one of the short methods for assessment the hydrogen donating potential of chemical substances results their antioxidant activity. When DPPH, encounters proton radical scavengers its purple color disappears quickly as a measurement of 517 nm absorption. DPPH radical scavenging of different concentration of Rudus plicatus leaves extract are presented in Figure 1.

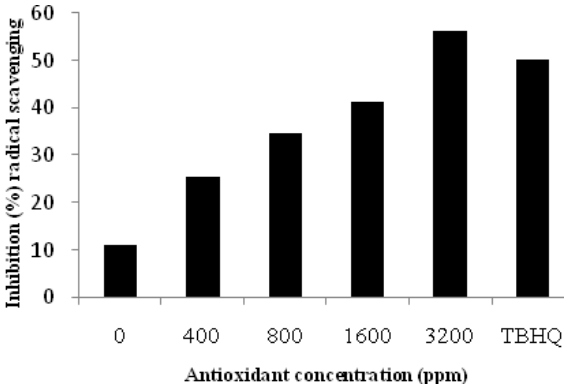

Figure 1. DPPH radical scavenging of different concentration of Rudus plicatus leaves extract

PV was used as indicators for the primary oxidation of corn oil. Hydroperoxide is the primary oxidation product produced as a result of lipid oxidation [7]. It may break down into nonvolatile and volatile secondary products, which decrease the quality of the oil. Determination of peroxides can be used as an oxidation index for the early stages of lipid oxidation [1]. A continuous increase in PV with the increase in heating period was observed in all the samples (Figure. 2). Initially, increase in PV was very slow, but it started increasing near 10 hours of heating and went on increasing further with the increase in storage period; reaching a maximum value after 24 hours. A significant difference ($P< 0.05$) in PV was observed between the control and 3200 ppm of the extract added samples, which slowed the rate of peroxides formation revealing good antioxidant efficacy in oil stabilization [8]. Highest PV was observed for control followed by samples containing 400, 800, 1600 ppm of the extract and TBHQ, respectively. Such pattern was shown by Kamkar et al. (2010) on the methanol extract and essential oil of Menthapulegium compared to the BHT when added to sunflower oils [9].

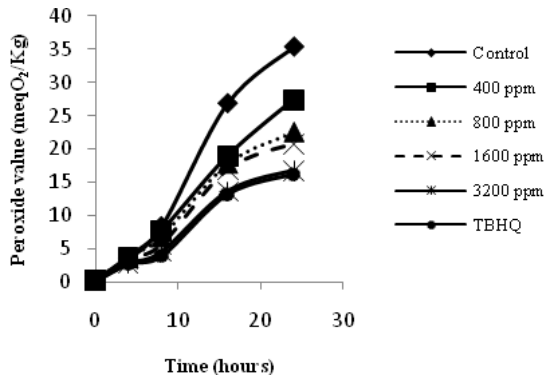

Figure 2. Peroxide value of the corn oil as affected by the different concentrations of Rudus plicates leaves extract \(0, 400, 800, 1600 and 3200 ppm) and 200 ppm of TBHQ as control antioxidant at 180°C.

According to Woyewoda et al. (1986), peroxides are transformed into secondary products that contain carbonyl groups [10]. These compounds are more stable than peroxides and the CV is considered to be a good index of oxidative changes in lipids. A similar trend was also observed about CV in all treatments (Figure 3). Thus, the lowest PV and CV were observed in samples containing 3200 ppm of the extract. It may be attributed as a higher antioxidant ability of Rudus plicatus leaves extract. These results are in agreement with the other [11], [12].

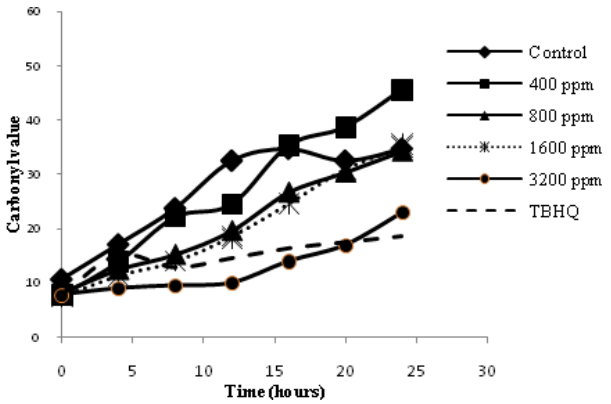

Figure 3. Carbonyl value of the corn oil as affected by the different concentrations of Rudus plicates leaves extract \(0, 400, 800, 1600 and 3200 ppm) and 200 ppm of TBHQ as control antioxidant at 180°C.

IV. Conclusion

Generally, the results of the present study apparently indicated that Rudus plicates leaves extract had high DPPH radical scavenging ability. Moreover, Rudus plicates leaves extract exhibited strong antioxidant activity in stabilizing corn oil during heating or frying, which was almost more effective than the antioxidant activity of synthetic antioxidants (TBHQ). Therefore, it is suggested that the Rudus plicates leaves extract could be safely used for the stabilization of food systems instead of synthetic antioxidant.

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