

EFFECT OF OAK ACORN EXTRACTS ON LIPIDE OXIDATION KINETICS

S. Rakić*

Abstract: This work investigates different extraction techniques by utilizing 95% ethanol and refined sunflower oil as well as the effects of thermal pretreatments on the extraction of antioxidants from oak acorns. Experiments were conducted using oak acorn from *Quercus cerris* and *Quercus robur*. Peroxide values measurements and TBA test were used for oxidation rate monitoring. Two types of extracts were prepared:

1. Using dried acorns
2. Using heat-treated acorns - 15 min 210 °C.

The results indicate that both oil and ethanol extracts have antioxidative properties. Heat treatment did not have adverse effect on antioxidative properties of oak acorn extract.

Key words: acorn, antioxidative activity, extract, oil.

Introduction

In the past, oak acorns were used for food and beverage preparation as well as in traditional medicine as tannin additives. Oak acorn "coffee" is recommended as a remedy for digestion problems (Petrović, 1983). Thermal treatment converts a portion of starch into dextrin and concentration of tannins is reduced yielding acorns of lesser bitterness and astringency (Tucakov, 1996).

The application of antioxidants for stabilization of lipids and different foods have been commercialized not only because they are a high-energy source but also

*Svetlo Rakić, M.Sc., Research Associate, Faculty of Agriculture, 11081 Belgrade-Zemun, Nema-njina 6, FR Yugoslavia

because they contain biologically active substances. Hence it is very important that lipids and lipid-rich foods remain stable during storage.

Antioxidants can be natural and synthetic. Synthetic antioxidants, when compared to natural, exhibit higher risk of toxicity. Therefore further research has been focused on naturally occurring antioxidants and their sources. Some research papers pointed out that oak acorns are potentially viable source of antioxidants.

The aim of this work is to investigate the potential usage of oak acorn as a natural source of antioxidative substances.

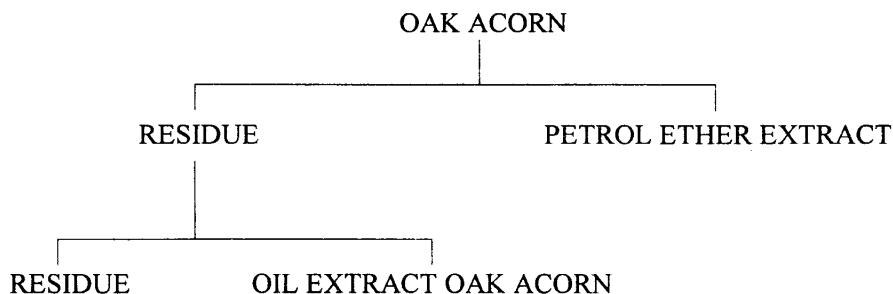
Materials and Methods

Oak acorns used in this work were collected from two different locations. *Quercus cerris* acorns were collected at Zaglavak nearby Bajina Bašta, while *Quercus robur* samples were collected from Zemun Park - Belgrade. All the samples were collected at the stage of technological ripeness. Acorns used in this study were free of any decay. Medium used for monitoring antioxidative properties of oak acorn extract was lard manufactured by Alfa - Laval method (*wet melting*).

To determine Peroxide value, we used Wheeler method (1932) modified by Hadorn et al. (1956). Determination of oxidative stability of lipids at 60 °C was monitored by using an Schaai test. Lard samples were placed in glass cups 45 mm in diameter and 55 mm high, partially covered by a petri box and heated to 60 °C in dark.

Every 24 hours a sample was taken to determine peroxide value. *Thiobarbiturate* (TBA) test is simple to use and is quite useful in measuring the rate of secondary reactions of lipid oxidation. Oxidation of unsaturated fatty acids, mainly linoleic, results in the development of pigment with thiobarbiturate acid (Bemheim et al. 1948).

Extraction of naturally occurring antioxidants with oil (UeJ - oil extract of oak acorn) is a simple method and results are obtained quickly.



The ratio between oak acorn and oil is 1:6; the temperature of oil is 22 °C, thermoisolation for 30 min.

Extraction of natural antioxidants by using ethanol (EtJ Etanol extract of oak

acorn and EeTtJ Ethanol extract of heat treated oak acorn) was accepted by the previous research of Rakić et al. (1996); Mi Hyun Leew (1992).

Results and Discussion

Oak acorns of *Quercus cerris* are of square oval shape with smooth outer husk, light brown or brown in color with no gloss oak acorns of *Quercus robur* are quite oval in shape with pointing tops, light brown in color. When fresh they are green with dark strips, smooth and glossy.

Chemical composition of oak acorn *Quercus robur* and *Quercus cerris* is shown in table 1.

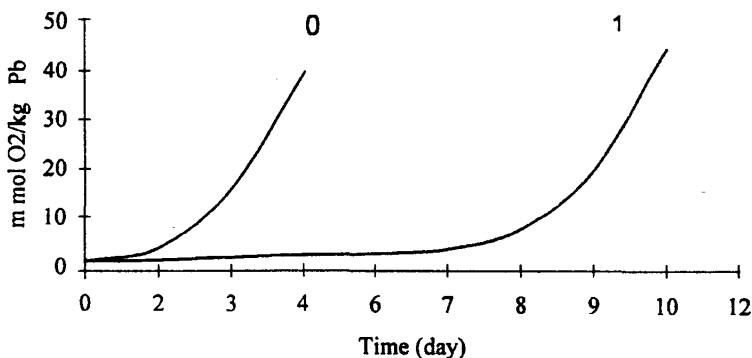
Tab. 1. - Chemical composition of oak acorn

Component	<i>Quercus robur</i>	<i>Quercus serris</i>
Dry matter	70.34	71.69
Ash	2.42	2.52
Lipids	5.79	5.47
Raw Cellulose	8.61	9.11
Raw Proteins	10.44	10.49
B.E.M	42.90	44.10

B.E.M nitrogen free matter contained in extract

From table 1, we can see that oak acorn has satisfying caloric value and has a complex composition comprising of: materials essential for growth, protective materials and energy-rich materials. The difference between two species is negligible.

Figure 1 shows us the effect that oil based extract of oak acorn (UeJ) *Quercus robur* has on keeping properties of lard at 60 °C.



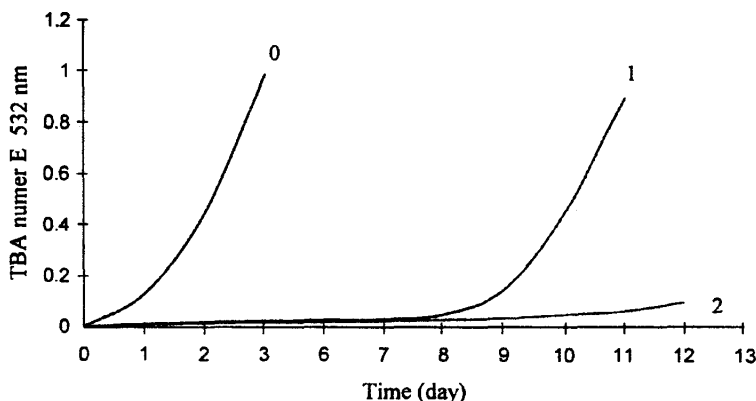
0 - control sample

1 - Lard + UeJ 1:5

Fig. 1. - The effect that oil extract of oak acorn (UeJ) *Quercus robur* has on keeping properties of lard at 60 °C

Based on the results of this experiment, we can conclude that oil extract of oak acorn has antioxidative properties in lard as a substrate. Lard with UeJ added had 3.2 times better keeping properties (stability) than the control sample.

Based on the measurement of extinsion combined with a TBA test, we have monitored the keeping of properties (stability) of lard, (produced by using Alfa Laval method) to which ethanol based oak acorn extract (*Quercus cerris*) was added.



- 0 - control samples
- 1 - Lard + 0.04% EtJ
- 2 - Lard + 0.04% EtTj

Fig. 2. - Effect that Ethanol based oak extract EtJ and EtTj *Quercus cerris* has on keeping properties of lard at 60 °C

The results of this experiment show that the extract from heat-treated oak acorns *Quercus cerris* has better antioxidative properties than extract produced from untreated acorns. Line 1 in figure 2 shows the antioxidative efficiency of EtJ and line 2 shows the rate of antioxidative activity of EtTj and EtJ.

Conclusion

The aim of this research was to examine the possible use of oak acorn extract as a natural source of antioxidants. We have used oil and ethanol based extract from both heated and non-heated acorns. We have also used two types of oak acorns *Quercus cerris* and *Quercus robur*.

The results show that all three types of oak acorn extract have antioxidative properties. The most effective being the extract from heat-treated oak acorns followed by ethanol and oil based extracts.

REFERENCES

1. Bernheim, F., Bernheim, M.L.C., and Wilbur, K. M. (1948): J. Biol. Chem, 174, 357-264.
2. Chiou, Jou-Wen (1989): The antioxidant acitivity and the chemichal structure of selected components of acorns and their potential use as inhibitors of milk oxidation, Disertation, Cornel University Michigen . USA.
3. Mi-Hyun Lee, Jae-Houg Jeong, Man-Jinoh (1992): Antioxidative Activity of Galic Acid in Acorn Extract J. Korean Soc Food Nutr. 21 (6) 693 - 700.
4. Petrović, S., (1983): Lekovito bilje u Srbiji, Srpski arhiv za celokupno lekarstvo , odeljak drugi, knjiga XVI , Kralj.-srp., Državna štamparija, Beograd.
5. Phil Coppen (1990): Antioxidants in Food USE Lipid. Technology Vol. 2 No 4 .
6. Rakić, S., Vrbaški, Ž., Žeželj, M., Miljković , B., (1996): Prirodni antioksidanti na bazi semena . Zbornik radova , 37 savetovanje Proizvodnja i prerada uljarica 34-43.
7. Tucakov, J., (1996): Lečenje biljem, Rad, Beograd.

Received September 21, 2000

Accepted October 13, 2000

EFIKASNOST EKSTRAKATA IZ HRASTOVOG ŽIRA NA
USPORAVANJE OKSIDACIJE LIPIDA**S. Rakić***

Rezime

U radu se daje prikaz različitih tehnika pripreme ekstrakata, koristeći različite rastvarače i predtretman biljnog materijala (u smislu temperature i vremena tretmana jezgra hrastovog žira kao polaznog materijala). Ispitivanja su vršena na uzorcima hrastovog žira *Quercus cerris* i *Quercus robur* . Korišćeni rastvarači su 96,5% etanol i jestivo rafinisano suncokretovo ulje. Tok oksidacije praćen je određivanjem peroksidnog broja i ekstincije TBA testom. Pripremani su ekstrakti na bazi osušenog jezgra žira kao i termički tretiran biljni materijal na temperaturi od 210 °C tokom 15 minuta. Dobijeni rezultati ukazuju da i uljni i etanolni ekstrakti ispoljavaju antioksidativno dejstvo pod datim uslovima ogleđa i da termički tretman jezgra ne dovodi do razgradnje antioksidacione supstance.

Primljeno 21. septembra 2000.

Odobreno 13. oktobra 2000.

*Mr Sveto Rakić, stručni saradnik, Poljoprivredni fakultet, 11081 Beograd - Zemun, Nemaњina 6, SR Jugoslavija