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Effect of some essential oils on oxidative stability of peanut oil

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RESUMEN

Efecto de algunos aceites esenciales sobre la estabilidad oxidativa del aceite de maní.

Se evaluó el efecto antioxidante de los aceites esenciales de *Origanum majorana, Rosmarinus officinalis, Myrcianthes cisplatensis, Acantholippia seriphioides, Eucalyptus cinerea y Tagetes filifolia* en el aceite de maní a 60°C. Las concentraciones de aceites esenciales utilizadas fueron 0.02 y 0.1%. Los aceites esenciales de O. majorana, A. *seriphioides* y *T. filifolia* exhibieron una pronunciada actividad antioxidante seguidos por *R. officinalis, E. cinerea y M. cisplatensis* en orden decreciente.

PALABRAS-CLAVE: Aceite esencial – Aceite de maní – Actividad antioxidante.

SUMMARY

Effect of some essential oils on oxidative stability of peanut oil.

Antioxidative effect of essential oils from *Origanum majorana, Rosmarinus officinalis, Myrcianthes cisplatensis, Acantholippia seriphioides, Eucalyptus cinerea* and *Tagetes filifolia*, was tested in peanut oil at 60°C. The concentrations of essential oils used were 0.02 and 0.1%. *Origanum majorana, A. seriphioides* and *T. filifolia* essential oils exhibited a pronounced antioxidative activity, followed by *R. officinalis, E. cinerea* and *M. cisplatensis* in a decreasing order.

KEY-WORDS: Antioxidant activity – Essential oil – Peanut oil.

1. INTRODUCTION

Antioxidants are major ingredients that protect the quality of oils by retarding oxidation. Currently, BHA (butylated hydroxyanisole), BHT (butylated hydroxytoluene), PG (propyl gallate) and TBHQ (tert-butylhydroquinone) are used as antioxidants in lipid-containing foods (Astill *et al.,* 1975; Branen, 1975). However, natural antioxidants are suggested as alternatives to BHA and BHT (Witting, 1975; Huang *et al.,* 1994; Koga and Terao, 1994). Therefore, extraction, characterization, and utilization of natural antioxidants is desired.

The antioxidant properties of certain herbs and spices have been known for a long time (Chipault *et al.,* 1956; Economou *et al.,* 1991; Svoboda and Deans, 1992; Kim *et al.,* 1994). Essential oils from a number of plants are known to possess antioxidant activities, including thyme, sage, mint, marjoram, clove, etc. (Tsimidou and Boskou, 1994).

The present study was undertaken to determine and compare the antioxidant properties of essential oils of some aromatic plants. These plants were: *Origanum majorana, Rosmarinus officinalis, Myrcianthes cisplatensis, Acantholippia seriphioides, Eucalyptus cinerea* and *Tagetes filifolia.*

2. MATERIALS AND METHODS

2.1. Obtainment of essential oils

Aromatic plants were collected from different sites: *Origanum majorana* L. and *Rosmarinus officinalis L.* from Río Segundo (Córdoba), *Myrcianthes cisplatensis* Cam. and *Eucalyptus cinerea F.* von Mueller from Tucumán, *Tagetes filifolia* Lag. from Alta Gracia (Córdoba) and *Acantholippia seriphioides* Mold. from San Juan. *Origanum majorana* and *Rosmarinus officinalis* were cultivated materials.

Fresh plant material was steam-distilled; a period of 2 h. proved to be sufficient for complete extraction. The essential oils were stored in amber glass vials with teflon-lined caps and kept in the dark at 2-6°C until analyzed (Verghese, 1986).

2.2. Sample preparation

A calculated quantity of the essential oils was added to peanut oil and the mixture was stirred for 10 min. at 25°C. The samples were placed in open beakers at 60°C in the dark. A control sample was

prepared, under the same conditions, without adding any antioxidant (Zygadlo *et al.,* 1995).

The peroxide value (PV) was determined by the method Cd8-53 of the Association of Official Analytical Chemists (AOAC, 1980).

2.3. Quantitation and identification of essential oils using GC-MS

Analyses were carried out on a Hewlett-Packard 5890 gas chromatograph fitted with a 30 m x 0.25 m fused silica SE-54 capillary column which was temperature programmed as follws: 70°C (5 min) and 70°-220°C (4°C/min). Nitrogen was used as carrier gas at a flow rate of 1 mL/min. The chromatograph was coupled to a HP5971A mass selective detector at 70 eV. The identification of components was based on comparison of their mass spectra with those of the authentic standards in combination with retention time and data reported in the literature (Verghese, 1986).

3. RESULTS AND DISCUSSION

The major components of the essential oils are presented in Table I. The data of peanut oil measured as PV at 60°C after the addition of essential oils are plotted in Fig. 1. The reproducibility of PVs was determined by using five samples each time during twelve days. BHT was used, for comparison, at concentrations no greater than 0.02%, because that is usually the highest level of its use in oils, fats and lipid-containing foods (Branen, 1975). Essential oil components are volatile and would have volatilized from the samples, making it impossible to determine their true effectiveness as antioxidants. To discard this possibility, samples of peanut oil with 0.02 and 0.1% essential oil concentrations were placed into closed, transparent glass bottles and stored at 60°C in the dark. No significant differences were found with respect to samples in open beakers; therefore, these data were not shown.

It was evident from Fig. 1 that the PV of the control oil was significantly higher than PVs of all treatments after 12 days of storage. The treatments containing 0.02 and 0.1% essential oils were not significantly different from each other until day 4, when the treatment containing 0.02% essential oils was lower in PVs than the other treatment. In both treatments, the induction periods (considered as the number of days needed for the PV of the sample to become 20 meq 0_2/kg oil) of peanut oil containing essential oils or BHT were longer than the induction period of the control. At a concentration of 0.02%, some essential oils (*T. filifolia, A. seriphioides* and *O. majorana)* reached the end of their induction period by the end of the storage test.

Phenolic compounds, which occur widely in plants, were considered for a long period of time to be antioxidants (Pratt and Hudson, 1990; Papadopoulos and Boskou, 1991; Tian and White, 1994). *Origanum majorana* and *A. seriphioides essential* oils, rich in phenolic compounds, protected oil appreciably at concentrations of 0.02%. Deighton *et al.* (1993) suggested that stable free radicals are formed readily in the essential oils rich in phenolic compounds and that these free radicals may act to control lipid peroxidation.

The most predominant oil component of *R. officinalis, M. cisplatensis* and *E. cinerea* was 1,8 cineole, while in *T. filifolia* anethole and methyl chavicol were the major compounds (Table I). These essential oils at concentrations of 0.02% in peanut oil, showed protection action under the conditions used (Fig. 1).

Table I

Essential oil compositions. Major components

Species	(%) Compounds
Origanum majorana L.	α-pinene (1.0), p-cymene (4.7), thymol (5.0) and carvacrol (77.0), α-terpinene (4.8)
Rosmarinus officinalis L.	α-pinene (12.0), camphene (4.0), β-pinene (8.0), limonene (1.0), 1,8 cineole (57.0), p-cymene (2.5), camphor (6.7) borneol (3.0)
Myrcianthes cisplatensis Camb.	α-pinene (10.0), camphene (1.0), β-pinene (3.0), limonene (2.3), 1,8 cineole (43.0), p-cymene (3.0), camphor (2.0) borneol (5.0)
Eucalyptus cinerea F. von Mueller	α-pinene (5.0), β-pinene (10.0), limonene (5.0), 1,8 cineole (70.0), p-cymene (5.0).
Acantholippia seriphioides Mold.	α-pinene (2.0), piperitone (3.0), p-cymene (4.0), thymol (55.0), carvacrol (10.0).
Tagetes filifolia Lag.	anethole (70.0), methyl chavicol (25.2)

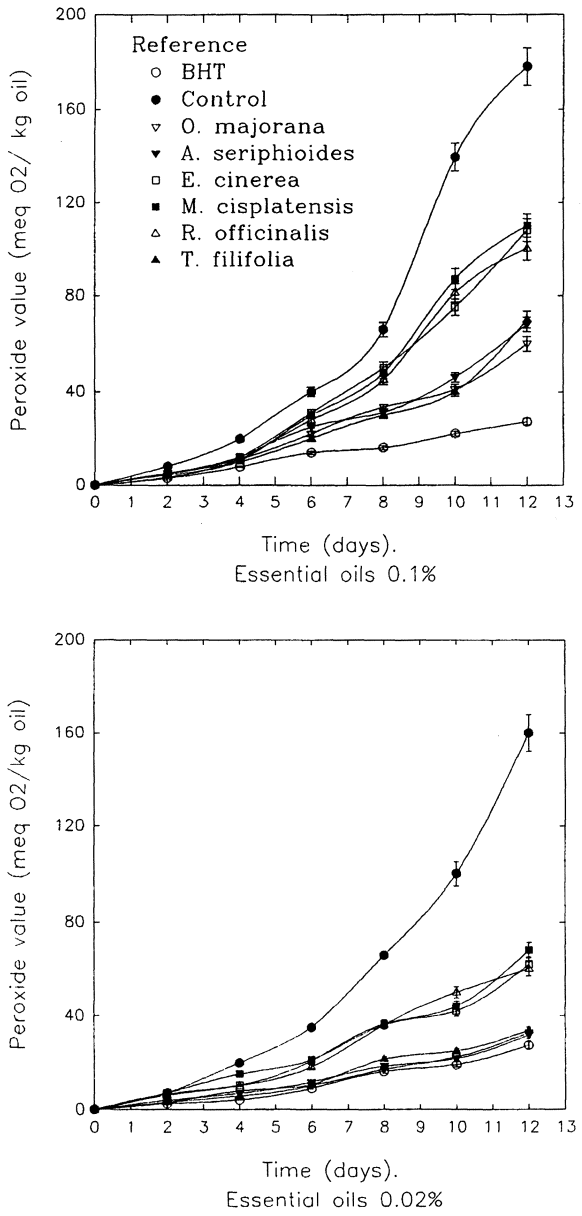

Figure 1
Autoxidation of peanut oil showing different deterioration rates

Previous works on antioxidant activity assays have demostrated that the phenomenon is concentration depended (Huang *et al.,* 1994; Tian and White, 1994; Hemeda and Klein, 1990; Wu *et al.,* 1994). In the present work, the concentration of essential oils for maximum antioxidant activity was 0.02%. As the concentration of essential oils in peanut oil increased, the antioxidant activity decreased (Fig. 1). These results agree with those reported by Pokorny (1987) and Terao and Matsushita (1986), who found that as the concentration of antioxidant was increased beyond a certain limit, the antioxidant efficiency tended to decreased.

Some of the plants employed in this study (*O. majorana, R. officinalis)* are widely used as spices or teas in popular medicine (Trease and Evans, 1988; Tsimidou and Boskou, 1994), whereas *E. cinerea* and *T. filifolia* are sources for essential oils and other valuable constituents (Abburrá *et al.,* 1990, Maestri *et al.,* 1991). The ability of these essential oils to inhibit oxidation, and the present health concerns about synthetic antioxidants indicates the possibility that these compounds could be alternative antioxidants after all toxicological data have been determined.

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