15th-ISSSB, Tg Mures, Romania
July,13th-18th, 2015

Comparative Study for Analysis of High-Value Essential Oils from Indigenous Oil Seeds Crops from Romania

Paula Podea, Sonia Suvar, Monica Culea, Florin Dan Irimie

"Babes-Bolyai" University, M. Kogalniceanu st., no 1, 400028-Cluj Napoca, ROMANIA
E-mail: mpaula@chem.ubbcluj.ro

Abstract

The use of essential oils as functional ingredients in foods, drinks, toiletries and cosmetics is growing interest for consumers in ingredients from natural sources. Climatic conditions, geographic position of the growth region and the extraction technique applied, influence the qualitative composition and contents of the individual components of the isolated essential oils. The Apiaceae (or *Umbelliferae*), are a family of mostly aromatic plants. We choose from this class, five aromatic plants coriander (*Coriandrum sativum*), dill (*Anethum graveolens*), fennel (*Foeniculum vulgare*), caraway (*Carum carvi*) and anise (*Pimpinella anisum*) due to the fact that there are indigenously available raw materials/oilseeds, have high concentrations of essential oils, are very aromatic and intensely used in our cuisine for their flavour, so are good potential candidates as food additives.

Materials and methods

100 g of dried and grounded coriander, dill, fennel, caraway and anise seeds were submitted to hydrodistilation in a Clevenger type apparatus for 4h. The flavor compounds in the volatile oils were identified on a Shidmazu GC-MS using a Rtx-5MS capillary column, 30 m × 0.25 mm, 0.25 µm film thickness, using a temperature program from 70 ^{o}C, 2 min, 5 ^{o}C /min at 110 ^{o}C, 10 ^{o}C /min at 290 ^{o}C, 16 ^{o}C /min at 300 ^{o}C.The flow rate of helium, the carrier gas was 1ml/min. A Identification of the constituents was based on comparison with mass fragmentation pattern and spectral comparison using NIST and Wiley mass spectra libraries of standards. The obtained essential oils were also screened for their potential uses as antioxidants and for the antimicrobial activity. The antioxidant attributes of the volatile oils were evaluated using DPPH free radical scavenging antioxidant assays and the antimicrobial activity of the essential oils were tested using Agar Diffusion Test (ADT). For testing the antibacterial activity of the obtained essential oils, five species of bacteria were chosen, two gram-positive bacteria - *Staphylococcus aureus*, *Bacillus cereus*, three gram-negative species -*Escherichia coli*, *Klebsiella pneumonia* and *Pseudomonas aeruginosa* and a fungi species *Candida albicans*. As standard antibiotic the M CFR30. Also the tyrosinase inhibitory activities of the obtained essential oils were compared.

Results and discussion

The aim of this work was to achieve a comparative study for analysis of coriander, dill, fennel, caraway and anise seeds by comparing the chemical composition, the antioxidant, antimicrobial activity and tyrosinase inhibitory activities of the obtained essential oils. The chemical compositions of the essential oil were presented in table 1. All samples of volatile oils proved to have an antimicrobial activity. Coriander essential oil proved to have a very higher antimicrobial activity on *E Coli and Klebsiella pneumonia*, fennel essential oil have a very high antimicrobial activity on *Staphylococcus aureus*, *Pseudomonas aeruginosa* and *Candida albicans* while caraway essential oils proved to be more effective on *Bacillus cereus* and on *Pseudomonas aeruginosa*. Comparing the antioxidant activity, measuring EC50%, we can conclude that anise seeds volatile oils provide a very high antioxidant activity comparable with vitamin E's activity used as standard. Testing the tyrosinase inhibitory activities of the obtained essential oils, fennel essential oil proved to be a very potent inhibitor, which makes fennel essential oil a good candidate for cosmetic use.

Chemical composition of the obtained essential oils

No.	Component	M	Rt	Coriander %	Dill %	Fennel %	Caraway %	Anise %
1	alpha-pinene	136	6.0	4,57	-	-	-	-
2	amphene	136	6.3	1.53	-	-	-	-
3	sabinene	136	6.7	1.12	-	-	-	-
4	beta-pinene	136	6.82	1.03	-	-	-	-
5	o-cymene	136	7.63	6.02	-	-	-	-
6	limonene	136	7.72	-	15.89	8.63	26.06	-
7	cis-linalool oxide	170	8.36	2.78	-	-	-	-
8	trans-linalool oxide	170	8.62	2.35	-	-	-	-
9	linalool	154	8.85	73	-	-	-	-
10	Fencona	152	9.281	-	-	1,73	-	-
11	cis, limonene oxide	152	9.46	-	-	-	0.3	-
12	trans,limonene oxide	152	9.53	-	-	-	0.19	-
13	alconfor	152	9.77	6.7	-	-	-	-
14	cis-dihydrocarvone	152	10.54	-	4.63	-	2.79	-
15	trans-dihydrocarvone	152	10.64	-	4.23	-	-	-
16	dihydrocarveol	154	10.83	-	-	-	0.6	-
17	carveol,cis	152	10.86	-	-	-	0.32	-
18	cis-dihydrocarveol	154	11.05	-	-	-	1.52	-
19	anethole	148	11.16	-	-	89.64	-	95.2
20	carvone	150	11.33	-	52.7	-	67.5	-
21	carvone oxide, cis	166	11.72	-	-	-	3.43	-
22	neryl acetate	198	12.77	0.9	-	-	-	-
23	p-anisealdehyde	136	14.33	-	-	-	-	4.8
24	caryophyllene oxide	200	15.77	-	-	-	0.72	-
25	cis-isopiolle	222	16.22	-	-	-	0.12	-
26	dillapiole	222	16.77	-	22.05	-	-	-

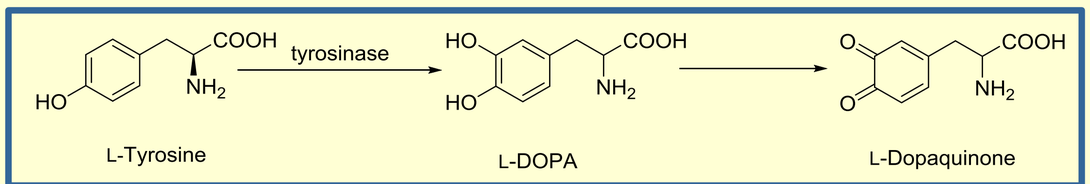
Table 1. Chemical composition of the obtained essential oils by GC-MS

Antibacterial activity of the obtained essential oils

Microbial species	Inhibition diameter (mm)					
	Anise	Fennel	Coriander	Caraway	Dill	M CFR30
Staphylococcus aureus	10	16	12	10	15	26
Bacillus cereus	6.5	10	9	12	8	15
E. coli	9	8	23	10	9	0
Klebsiella pneumoniae	7	9	13	9	9	0
Pseudomonas aeruginosa	0	12	0	9	12	0
Candida albicans	9	17	15	6	15	17

Table 2. Results of antibacterial analysis of the obtained essential oils

Tyrosinase inhibitory activities of the obtained essential oils



Scheme 1. L-Tyrosine transformation in the presence of tyrosinase

DPPH radical scavenging activity

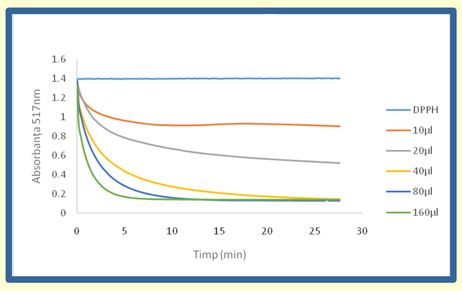


Fig. 1. DPPH concentration monitored in the presence of anise essential oil

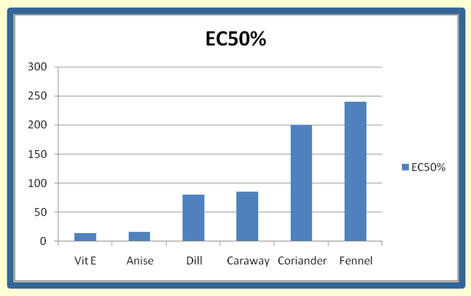


Fig. 2. EC50% for the obtained volatile oils

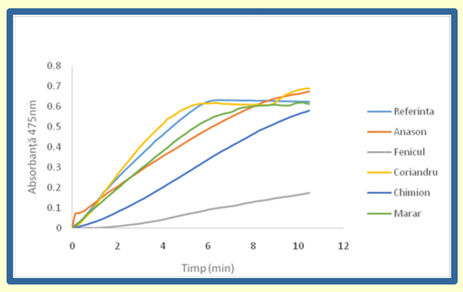


Fig. 3. Tyrosinase inhibitory activities of the obtained essential oils

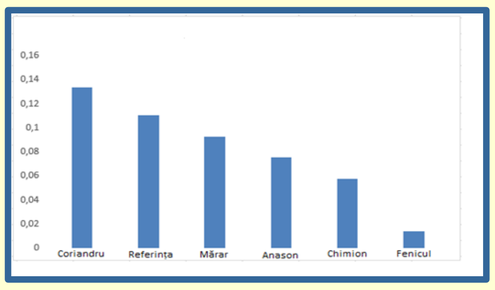


Fig 4. Comparation of the enzymatic reaction rate in the presence of the obtained essential oils

Conclusions

Anise essential oil prove to have a very high antioxidant activity, comparable with Vitamin E antioxidant activity. Coriander essential oil posses a high antimicrobial activity on a wide classes of microbial species. Fennel essential oil is a very good inhibitor of tyrosinase enzyme, which make fennel oil a potential inhibitor in melanin pigment biosynthesis. This comparative study for analysis of high-value essential oils from indigenous oil seeds from Romania, proved that the obtained essential oils can be used as potent antioxidants, efficient antimicrobial and anti-pigment component in cosmetic products.

Literature:
C.T. Chang., W.L., Chang, J.C. Hsu, Y. Shih, *Botanical Studies 54 (2013)*, 2-7;
E. Orhan, F. S. Senol, N. Ozturk, S.A. Celik, A. Pulur, Y. Kan, *Food and Chemical Toxicology (2013)*, 5-7;
G. A. Burdock , I.G. Carabin, *Food and Chemical Toxicology 47 (2009)*, 22–34;
H. Wangensteen , A. B. Samuelsen, K. E. Malterud, *Food Chemistry 88 (2004)*, 293–297;

Acknowledgement: The research was supported by Romanian National Authority for Scientific Research, CNDI– UEFISCDI, project number PN-II-PT-PCCA-2013-4-1006