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Studies on the use of essential oils in processing food products

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Abstract

Essential oils are complex mixtures of natural compounds, carotenoids, especially monoterpenes and sesquiterpenes, different chemical groups of terpenes, aromatic hydrocarbons and their oxidized derivatives such as aldehydes, ketones, alcohols and esters obtained from aromatic plants. They are used in industries such as: pharmaceutical, food, cosmetics-perfume, detergents, flavors, drinks, etc. Natural extracts are safe alternative sources for replacing synthetic products with antimicrobial, antiviral and antifungal activity. Recent studies have proven that essential oils have antibacterial and antifungal properties in vitro. In vivo, essential oils have shown positive effects of reducing mycotic infections, in the case of different plant species. The characterization of oils through chemical analysis is a mandatory step both in the production flow and in the quality control laboratories. Among the most used methods for the analysis of essential oils is gas chromatography using a flame ionization detector (GC-FID). It appears that the use of these essential oils in food production presents a good opportunity for food value enhancement and food safety reasons.

Keywords: essential oils, food, plants, quality, food safety.

1.Introduction

In the food industry, the quality and safety of prepared or processed food is of prime importance. Microorganisms present in food can lead to food quality deterioration and if ingested by humans can cause infection and disease. Thus, food manufacturers try their best to reduce or eliminate microorganisms from food products. It has been estimated that approximately one-third of the world's food production is lost annually due to this microbial spoilage (Alboofetileh et al., 2014). The essential oil derived from coriander plants (seed/herb -whole plant) has exceptionally good antimicrobial effects against bacteria, yeasts, fungi and viruses. The essential oil and its various fractional distillates were particularly effective antimicrobial agents against Listeria monocytogenes, due to the presence of long-chain alcohols and aldehydes (C6 – C10).

Rattanachaikunsopon and Phumkhachorn (2010) [5] studied 12 essential oils for antimicrobial activities against several strains of Campylobacter jejuni, a pathogen that causes foodborne illness worldwide. The authors showed that the essential oil showed the strongest antimicrobial activity against all strains tested. The antimicrobial potency of coriander oil against C. Jejuni on beef and chicken at 4 and 32 °C was also studied. The oil was found to reduce bacterial cell load in a dose-dependent manner; however, meat type and temperature did not influence the antimicrobial activity of this essential oil. This study clearly indicates the potential of the essential oil to serve as a natural antimicrobial compound against C. jejuni in various foods.

For the practical-experimental part, we chose a consistent range of natural essential oils that we characterized from a structural point of view (most important components of the oil), physico-chemical properties (density, refractive index, optical rotation) respectively properties organoleptic.

2. Material and method

Gas-chormatography method. Description.

For the GC analysis of essential oils, we used the normalization method: the percentage composition

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is determined by measuring the area of each peak and dividing the individual areas by the total area. In order to be able to identify the retention times for various aromatic compounds, substances of purity above 92% (GC) 0.5 ml dissolved in 1.5 ml of pure solvent hexane 99% (example: myrcene, caryophyllene, sabinene, alpha-pinene, beta -pinene, limonene, eugenol, etc.).

Gas chromatograph, model: 7890B, Agilent technologies: Oven temperature program.

	Time (min)	Temperature (^{0}C)
Column parameters	0-3 3-40.5 40.5 – 60.5	60 60→210 210
Injection port	n/a	260
FID Detector	n/a	260

Capilary GC column: material – fused silica; dimensions: lenght - 60 m, diameter 0.320 mm; stationary phase – macrogol 20000, thin film 0.5 µm.

Carrier gas: hydrogen purity of 99.999% for GC; flow H2: 2 ml/min.

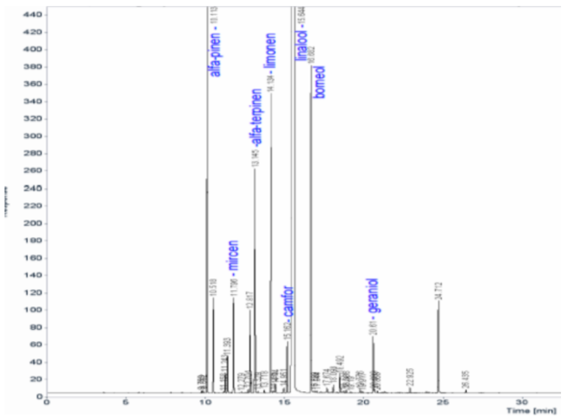
Splitt ration: 1:80

Coriander (*Coriandrum sativum*) is a medicinal and aromatic herb. It is widely cultivated in the countries of South Asia, Central Europe and the Mediterranean countries. Major commercial producers of coriander include country members: Hungary, Poland, Romania, Czech Republic, Slovakia, Morocco, Canada, India, Pakistan, Iran, Turkey, Guatemala, Mexico and Argentina. Dried coriander fruits are widely used to flavor sauces, meat products, and bakery and confectionery items. It is also a typical ingredient in several Asian curry powders. The flavor of coriander is attributed to the essential oil present in the oil glands in the mericarp. The essential oil of coriander seeds has medicinal properties. It is one of the 20 major essential oils on the world market and is obtained by steaming the dried and fully ripe fruits of C. sativum. The oil is a colorless or pale yellow liquid with a characteristic linalool odor and a mild, sweet, warm, aromatic flavor. The organoleptic characteristics of distilled oil tend to deteriorate during prolonged storage, especially if left exposed to light and air. Coriander oil is approved for food use by the FDA (Food & Drug Administration), the Flavor and Extract Manufacturers Association (FEMA) and the Council of Europe (CoE) [1-4].

3. Resultts and discussions

Coriander oil, seeds (*Coriandrum sativum l.*)

GC structure analysis of *Coriandrum sativum l.*			
Majority compound	**RT (min)**	**GC area (%)**	**Organoleptic properties/antioxidant properties, antibacterial**
Alpha-pinene	10.113	5.960	Note minthy-camphoraceous, woody, turpentine; antibacterial properties
Camphene	12.817	1.096	Note floral, fresh, herbaceous; antioxidant;antibacterial properties
Myrcene	11.796	1.205	Note balsamic, sweet-fruty; bactericide property for S. aureus
Limonene	14.134	4.2695	Note terpenic, fresh; antibacterian;antioxidant effect
Alpha-terpinene	13.145	3.170	Note woody, sweet; antioxidant effect
Para-cimene	17.357	0.122	Note aromatic, green-woody,earthy; bactericide property
Linalool	15.644	**72.757**	Note herbal, fresh, green, slighty sweet; strong antibacterial property
Camphor	15.162	0.697	Note fenolic, minthy, spicy; bactericide property, strong antifungal
Borneol	16.682	5.345	Note fenolic, minthy, spicy; bactericide property, strong antifungal
Geraniol	20.610	0.805	Note fenolic, fresh, minthy; bactericide property, antiviral;



GC chromatogram for coriander oil, seeds – FID 1 A – non-polar column

Conclusions

- It can be seen that the obtained oil has a clear antibacterial effect and shows potential for its use for preservation purposes of various preparations from the food industry. A blend of essential oils can also be used. Considering the results obtained in this direction of research, at the current stage we have the following in progress together with the research and development team of the company Solina Romania SRL.
- Testing the antioxidant potential of natural essential oils (white pepper, mace, nutmeg) and their use in injection solutions for various types of hams. Determination of the phenol content of the oils/mixes of essential oils chosen for testing.
- Characterization of flavoring preparations with smoky notes, obtained from mixtures of natural essential oils. Testing them in various products: pork sausages, smoked salami, ham, sausages to optimize the optimal dose of flavoring product.

Compliance with Ethics Requirements: Authors declare that they respect the journal's ethics requirements. Authors declare that they have no conflict of interest and all procedures involving human or animal subjects (if exist) respect the specific regulation and standards.

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