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Research Article

IR Spectrum of Oil Extract from Anise (Pimpinella Anisum L.) Dynamics

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ABSTRACT:

Fourier transform infrared spectroscopy (FTIR) is an effective method for the characterization of essential oils, including anise oil (Pimpinella anisum L.). FTIR analysis revealed the presence of functional groups characteristic of the majority of compounds, especially anethole, responsible for the aromatic and bioactive properties of the oil. The FTIR spectrum of anise oil shows the following main bands: 3400–3200 cm^{-1} (O–H vibrations due to phenolic compounds), 3000–2850 cm^{-1} (aliphatic C–H vibrations), 1640–1600 cm^{-1} (aromatic C=C vibrations), 1500–1450 cm^{-1} (C–H bending vibrations), 1260–1020 cm^{-1} (ethereal C–O–C vibrations, characteristic of anethole) and 900–700 cm^{-1} (C–H out-of-plane bending vibrations of the aromatic ring). These spectral signatures allow the identification of the main chemical composition of the oil and highlight the role of anethole as the dominant bioactive component. FTIR thus proves to be a rapid and non-invasive method for the qualitative analysis of anise oil, contributing to quality control studies and phytochemical research.

Keywords: *Oil, Pectrum, Anise, IR*

INTRODUCTION

Anise essential oil is steam distilled from the brown pods of the white-flowered Pimpinella anisum plant, which grows wild in Egypt. Not to be confused with the popular spice star anise, Pimpinella anisum is an annual plant native to Greece and Egypt and is also cultivated in India, China, Mexico and Spain. Anise essential oil is indeed very rich and effective. Anise oil has anti-inflammatory properties and has a cooling, moisturizing and regenerating effect on the skin. Emotionally and energetically, anise essential oil is a warming and energizing essential oil that can help reduce mental fatigue, improve clarity and maintain alertness. This essential oil is also welcome in times of situational melancholy, as it can help relax the nerves and inspire creativity. The oil is suitable for use in aromatherapy. The oil can be used to enrich beauty creams, for bathing or massage. It is a cosmetic product, not intended for internal use [1-5].

MATERIAL AND METHODS

The seeds of Anise (Pimpinella anisum L.) were cleaned and blended by use (Electrical mill blender), the seeds powder were kept until required. All of the chemicals were purchased from Sigma-Aldrich Co. (St. Louis, MO,USA), and the solvents were obtained from E. Merck (Darmstadt, Germany). All of the reagents were prepared in deionized distilled water to eliminate the contamination of metal ions. Infrared spectrum FT-IR spectrum was recorded with FT-IR 8400SSHIMADZU–Japan.

Fig.1. FT-IR 8400SSHIMADZU–Japan

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RESULTS AND DISCUSSION:

Figure 2 shows the IR spectrum of anise oil.

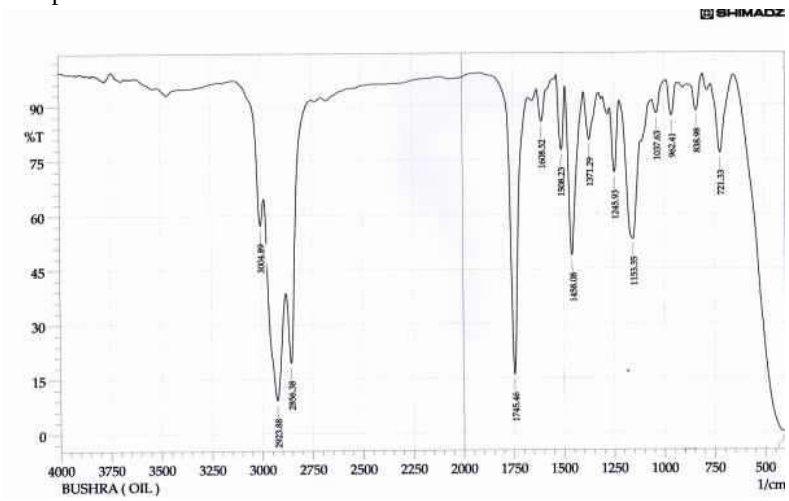

Fig. 2. IR spectrum for the oil extract of Anise (*pimpinella anisum L.*)

Table 1. Infrared absorption peaks and their related function groups for the oil extract: of Anise (*pimpinella anisum L.*)

Bond frequency (cm^{-1})	Band	Mod of vibration	Functional groups
3004.89	=CH	Strench	Aromatic -H
2923.88	OCH_3	Strench	Ether
2856.36	-CH	Strench	-CHof CH_3group
1745.4	C=O	Strench	Ester
1608.52	C=C	Strench	Aryl C=C
1371.29	C-O-C	Strench	Ether

FTIR analysis of anise oil revealed the presence of characteristic bands reflecting the chemical composition of the oil and the preponderance of anethole as the major bioactive component. The intense band observed in the 3000–2850 cm^{-1} region is attributed to the C–H stretching vibrations of the aliphatic chains, confirming the presence of the hydrocarbon structure. The aromatic C=C vibrations recorded at 1640–1600 cm^{-1} and the "out of plane" bands between 900–700 cm^{-1} indicate the presence of the aromatic nucleus, characteristic of the phenylpropanoid anethole [6-12].

The band around 1260–1020 cm^{-1}, corresponding to the ethereal C–O–C vibrations, confirms the methoxy group, essential for the aromatic and biological properties of anethole. In addition, bands around 3400–3200 cm^{-1} suggest the presence of minimal amounts of phenolic compounds or associated water, which may influence the stability and antioxidant potential of the oil.

Compared to other essential oils rich in phenylpropanoids, the FTIR spectrum of anise oil clearly reflects the predominance of anethole and confirms the relative purity of the sample, providing useful information for quality control and authenticity verification. This analysis highlights the advantages of FTIR as a rapid, non-invasive and reproducible method for the qualitative characterization of essential oils [13-19].

Conclusions

FTIR analysis of anise oil allowed the identification of the main functional groups characteristic of its chemical composition. Specific bands in the region of 3000–2850 cm^{-1} confirm the presence of aliphatic

chains, while aromatic C=C vibrations (1640–1600 cm^{-1}) and "out of plane" bands (900–700 cm^{-1}) highlight the aromatic nucleus of anethole, the dominant bioactive component. C–O–C vibrations (1260–1020 cm^{-1}) suggest the presence of methoxy groups, essential for the aroma and biological properties of the oil.

FTIR has proven to be a rapid, non-invasive and reliable method for the identification and qualitative characterization of anise oil, providing relevant information for quality control, product authentication and phytochemical research.

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