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STUDY OF THE ESSENTIAL OIL COMPOSITION OF ANISE (PIMPINELLA ANISUM L.) FRUITS GROWN IN UZBEKISTAN

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Annotation

An essential oil was obtained from anise fruits via distillation, with a yield of 3,2%. Gas chromatography-mass spectrometry (GC-MS) analysis of the fruit essential oil identified 15 different substances, with high levels of compounds such as anethole (86,20%), estragole (3,71%), and γ-himachalene (3,48%).

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Introduction. Essential oils have been known to humanity since ancient times, their composition varies depending on the plant species and may include over 200 compounds. In recent years, their application has expanded to encompass various fields. For instance, they are widely used in the pharmaceutical industry—both as components of medicinal products and as therapeutic agents themselves—as well as in aromatherapy, the food industry (as flavoring agents), and the chemical industry (for synthesis) [1]. Research indicates that they possess antimicrobial, anti-inflammatory, and antioxidant properties, among others [2, 3]. Anise (Pimpinella anisum L.) is a promising plant known for its high essential oil content. It is an annual herbaceous plant belonging to the Apiaceae family and is widely distributed across many regions of the world (including Turkey, Italy, Egypt, and Mexico). Its fruits contain up to 6% essential oil and are rich in a diverse range of biologically active substances. Examples include flavonoids (apigenin, rutin, quercetin) [4], hydroxycinnamic acids (chlorogenic and ferulic acids) [5], polysaccharides [6,7], and fatty acids (palmitic, linoleic, petroselinic and others) [8, 9]. The fruits exhibit laxative effects, while the essential oil is used in medicinal products as an expectorant. Notably, the plant's fruits are listed in numerous pharmacopoeial monographs and regulatory documents, with standardization based on essential oil content. Therefore, analyzing the composition of its essential oil is of significant importance and constituted the objective of this study.

Research results. The study found that the essential oil content in anise fruits was 3.2%. Fifteen compounds were identified, classified into the following groups: sesquiterpenes (δ-elemene, (Z)-β-farnesene, α-cuprene, germacrene D, α-zingiberene, β-bisabolene), sesquiterpenoids (α-ylangene, γ-himachalene), bicyclic monoterpenes (4-carene), phenylpropanoids (estragole, anethole), aromatic aldehydes (p-anisaldehyde), aromatic ketones (4-methoxyphenylacetone), tricyclic sesquiterpene alcohols (isospathulenol), and phenolic esters (tellungianin G). Anethole (86.20%), estragole (3.71%), and γ-himachalene (3.48%) were the predominant compounds identified (Figure 1, Table 1).

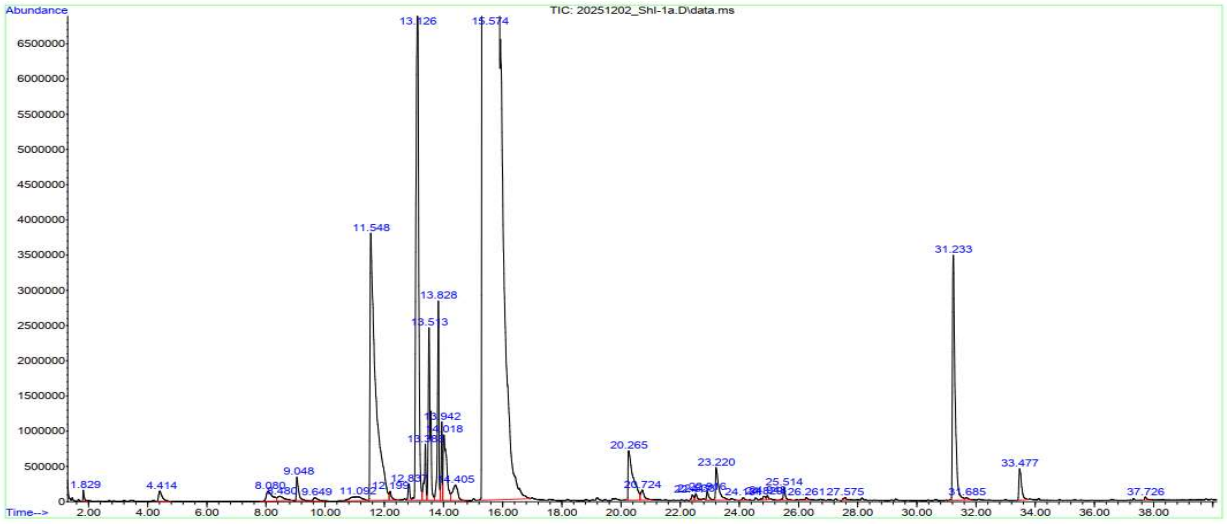


Figure 1. Chromatogram of the essential oil mixture from anise fruits.

Table 1. Composition of anise fruit essential oil.

№	Name of the compound	RI*	RT**	Classification of the substance	Amount, %
1	δ-Elemene	1420	8,083	Sesquiterpene	0,15
2	α-Elangene	1435	8,477	Sesquiterpenoid	0,08
3	4-Carene	1457	9,045	Bicyclic monoterpenes	0,14
4	Estragole	1552	11,551	Phenylpropanoids	3,71
5	(Z)-β-Farnesene	1601	12,840	Sesquiterpene	0,07
6	γ-Himachalene	1612	13,127	Sesquiterpenoid	3,48
7	α-Cuparene	1622	13,388	Sesquiterpene	0,23
8	Germacrene D	1627	13,515	Sesquiterpene	0,90
9	α-Zingiberene	1638	13,829	Sesquiterpene	0,65
10	β-Bisabolene	1643	13,943	Sesquiterpene	0,42
11	Anethole	1705	15,573	Phenylpropanoids	86,20
12	p-Anisaldehyde	1896	20,264	Aromatic aldehyde	0,63
13	4-Methoxyphenylacetone	2009	22,917	Aromatic ketones	0,05
14	Isospathulenol	2127	25,516	Tricyclic sesquiterpene alcohols	0,06
15	Tellungianin G	2523	33,407	Phenol esters	0,21
Σ					**97,98**

*Kovats index, **retention time

Experimental part. Anise fruits harvested in the Tashkent region in 2024 were used as the raw material. To extract the essential oil, 50 g of ground anise fruits were placed in a 2-liter round-bottom flask. 500 mL of purified water was added, the flask was connected to a Clevenger apparatus, and extraction was carried out for 3 hours. The essential oil was then separated from the water using n-hexane, dried over sodium sulfate, and stored in a hermetically sealed vial at 4°C until analysis. The composition of the anise fruit essential oil was analyzed using gas chromatography-mass spectrometry (GC-MS) [10, 11].

Conclusion. The study results showed that the essential oil content of the anise fruits was 3,2%. Fifteen different compounds belonging to eight different chemical groups were identified in the oil. Phenylpropanoids (estragole, anethole) and sesquiterpenoids (α-ylangene, γ-himachalene) were the predominant compounds. δ-elemene, (Z)-β-farnesene, α-cuprene, germacrene D, α-zingiberene, β-

bisabolene, 4-carene, p-anisaldehyde, 4-methoxyphenylacetone, isospathulenol, and tellungianin G were detected in amounts of up to 1%.

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