Journal of Chemistry of Goods and Traditional Medicine

J Chem Good Trad Med, Volume 4, Issue 4, 2025 Traditional Medicine

CHEMICAL COMPOSITION AND MEDICINAL PROPERTIES OF CUMINUM CYMINUM

Nilufar M. Isroilova
Andijan State University Faculty of Natural Sciences, 2nd year master's student, Department of Chemistry
https://orcid.org/0009-0007-5746-6871

Ibrohimjon Rahmonovich Askarov
Andijan State University Professor of the Department of Chemistry, Doctor of Chemistry, Honored Inventor of Uzbekistan, Chairman of the TABOBAT Academy of Uzbekistan
https://orcid.org/0000-0003-2289-1273

Obidjon Shaxabidinovich Abdulloyev
Andijan State University Acting Professor of the Department of Chemistry,Doctor of Chemistry (DSC), Member of the Academy of Medicine of Uzbekistan
https://orcid.org/0000-0003-2289-1273

DOI: https://doi.org/10.55475/jcgtm/vol4.iss4.2025.552

Keywords:
Cumin, Cuminum cyminum, Essential oil, GC-MS, antioxidant activity, Total phenolics, Spices, Flavonoids, Vitamins, macro- and microelements

Annotation
Cumin (Cuminum cyminum) has been widely used since ancient times, and its seeds are used not only as food, but also in traditional and modern medicine. Cumin seeds contain many biochemical substances, including essential oils, flavonoids, vitamins, makro- and microelements. This article provides a brief overview of studies conducted to analyze the chemical composition of cumin seeds, as well as its significance in modern and folk medicine.

How to Cite
Isroilova, N. M., Askarov, I. R., & Abdulloyev, O. S. (2025). CHEMICAL COMPOSITION AND MEDICINAL PROPERTIES OF CUMINUM CYMINUM. Journal of Chemistry of Goods and Traditional Medicine, 4(4), 191-208. https://doi.org/10.55475/jcgtm/vol4.iss4.2025.552

Introduction. The decisions of the World Health Organization (WHO) identify the study of the experience, methods, and tools of traditional medicine as one of the priority directions for the development of 21st-century medicine.[1-5] Uzbekistan's special attention to integrating modern medicine with traditional medicine fosters increased interest in development and innovations in this field, as well as contributes to improving the efficiency of the national healthcare system. The development of traditional medicine in Uzbekistan is reflected in the Presidential decrees of the Republic of Uzbekistan: No. PP-3968 dated October 12, 2018, "On measures to regulate the field of traditional medicine in the Republic of Uzbekistan," and No. PP-4668 dated April 10, 2020, "On additional measures for the development of traditional medicine in the Republic of Uzbekistan," as well as in the actions undertaken to implement these decisions, which indicates the rapid growth of this sector in the country.[6]

Cuminum cyminum is the seed of a small umbelliferous plant belongs to family Apeaceae. The seeds come as paired or separate carpels, and are 3-6mm (1/8-1/4 in) long. They have a striped pattern of nine ridges and oil canals, and are hairy, brownish in colour, boat-shaped, tapering at each extremity, with tiny stalks attached. They are available dried, or ground to a brownish-green powder.

It has a spicy-sweet aroma with pungent, powerful, sharp and slightly bitter flavor. It is a herbaceous, annual and medicinal which is one of the most important export crops for countries such as India, Iran and some other Asian countries. Environmental stresses, especially drought stress, plays an important role in reduction of plant growth stages and seed yield in arid and semi arid regions. Production of this plant is limited due to several biotic stresses of which wilt diseases is the most serious. Cumin seeds are used as a spice for their distinctive aroma, popular in North African, Middle Eastern, western Chinese, Indian and Mexican cuisine.

Primary cultivation of cumin is in Europe, Asia, the Middle East, and North Africa with India and Iran as the largest cumin exporters. But, it is now widely cultivated in Iran, China, India, Morocco, South Russia, Japan, Indonesia, Algeria and Turkey; specially, in arid and semi-arid regions. Cumin seed is generally used as a spicy food in the form of powder for imparting flavor to different food preparations. It also has a variety of medicinal properties. The small boat shaped seeds of *Cuminum cyminum* . has been used for many medicinal and culinary purposes from the ancient time in the various countries. Many pharmacological effects have been reported from this spicy plant as, anti-diabetic, Immunologic, anti-epileptic, anti-tumor and antimicrobial activities. Cumin used in the medicinal preparations is supposed to be produced with high quality encompasses all the properties of the final product which makes it optimal suitable for use.

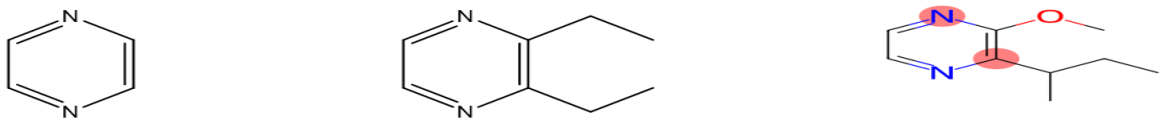
Botanical description of cumin (Cuminum cyminum). It is an annual herbaceous plant. The leaves are alternately arranged, with the lower part divided twice into three thin linear segments. The flowers are white or red, arranged in a compound umbel with an involucre present. The fruit is an elongated pod measuring 6 mm in length and 1.5 mm in width. The seeds are larger, lighter, more aromatic, and sharper than those of caraway. The stem is thin, bare, branched, and gray or dark green in color. Each shoot, 20–30 cm tall and 3–5 cm in diameter, has two to three small branches. All branches reach the same height, giving the plant a uniform crown.[8]



Fig. 1. Cumin plant (Cuminum cyminum), its stem, flower, branches with green fruits, and dried seeds.

Biologically active substances and chemical composition of cumin (Cuminum cyminum) seeds. Cumin seeds are rich in nutrients, containing a large amount of fats (especially monounsaturated fatty acids), proteins, and dietary fibers. The seeds are rich in B and E vitamins, as well as a number of minerals, particularly iron (see Table 1). Cumin has a distinctive aroma. The main volatile components of cumin are cuminaldehyde, cymene, and terpenoids. Its warming aroma is due to essential oils and aromatic compounds such as cuminaldehyde and cumin alcohol. Other important aromatic compounds in cumin include pyrazines: 2-ethoxy-3-isopropylpyrazine, 2-methoxy-3-sec-butylpyrazine, and 2-methoxy-3-methylpyrazine. Additionally, cumin contains γ-terpinene, safranal, p-cymene, and β-pinene.

Antioxidant activity: Due to the presence of monoterpenic alcohols, essential oils, flavonoids, and other polyphenolic molecules, cumin oil exhibits high antioxidant activity. [9]



Pyrazine 2-ethoxy-3-isopropylpyrazine 2-methoxy-3-sec-butylpyrazine

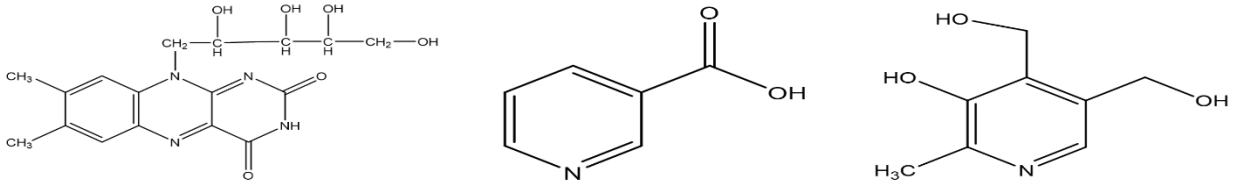


Fig. 2. Chemical formulas of vitamins contained in cumin (*Cuminum cyminum*) seeds

Table 1. Amount of minerals in 100 g of cumin (*Cuminum cyminum*) seeds

Types	Component	Content	Recommended Daily Allowance (RDA)
Minerals	Ferrum	66,36 mg	829%
	Cuprus	0.867 mg	96%
	Calcium	931 mg	93%
	Magnesium	3.3 mg	145%
	Zincum	4.8 mg	43.5%
Electrolytes	Potassium	69 mg	11%
	Sodium	1788 mg	38%

Table 2. Amount of Vitamins in 100 g of Cumin Seeds (*Cuminum cyminum*)

Types	Component	Content	Recommended Daily Allowance (RDA)
Vitamins	B group vitamins	0.628 mg	52%
	Thiamine, riboflavin	0.32 mg	24.5%
	Niacin	4.58 mg	28.5%
	Pyridoxine	0.435 mg	33%
	Folic acid	10 mkg	2.5%
	Vitamin E	3.3 mg	22%
	Vitamin A	7.7 mg	13%
	Vitamin C	1270 IU	42%
	Vitamin K	5.4 mkg	4.5%
Phytonutrients	Carotenoids	762 mkg	–
	Lutein	448 mkg	–
Other	Energy value	375 kkal	
	Carbohydrates	44,24 g	
	Proteins	17,8 g	
	Fats	22,27 g	
	Fiber	10,5 g	

Chemical Composition of Cumin (Cuminum cyminum) Seed Essential Oil.

In 2012, Pakistani researchers Asif Hanif Chaudhry, Ayesha Tanveer, and others analyzed the essential oil of cumin seeds using gas-liquid chromatography (co-injection technique) under positive

ionization conditions. The study used bacteria Escherichia coli and Salmonella typhi, which are gram-negative bacteria. The analysis was conducted on a GC-14A instrument (Shimadzu, Japan) with a glass column 3.5 meters long and 3 mm in diameter. A 10% SE-30 stationary phase was used, and the detector was a flame ionization detector. The obtained results were compared with corresponding standards and evaluated using ANOVA statistical analysis. Gas-liquid chromatography was also used to study the antimicrobial activity of the essential oil, and the results were compared using the co-injection method. The analysis identified 20 chemical components, of which 11 were identified, and the rest remained unknown. According to the data presented in Table 2, the identified components constitute 97.8718% of the total composition, while the unidentified components make up 2.1283%. The main components of the essential oil are as follows: α-pinene – 0.805%, β-pinene – 16.2876%, limonene – 0.2307%, γ-terpinene – 5.6551%, D-cymene – 15.5464%, dipentene – 0.2102%, 1,8-cineole – 2.2421%, cumin aldehyde – 25.874%, total amount – 30.023%, perillaldehyde – 0.6286%, α-terpineol – 0.1929%. [10]

In 2015, a group of scientists from Bangladesh, including Atiqur Rahman, Meherunnesa, and others, obtained yellow-colored essential oil by steam distillation of dried Cuminum cyminum seeds (yield approximately 0.79% by weight). Twenty-seven compounds were identified, accounting for 96.39% of the total essential oil composition. The oil mainly consists of a complex mixture of oxygenated mono- and sesquiterpenes, as well as mono- and sesquiterpene hydrocarbons. The main compounds identified in the seed oil include: ethanperoxycid acid, 1-cyano-1-(2-phenyl) (17.11%), benzene, 1-[(2-bromophenoxy)methyl]-3 (12.48%), 2-methylbicyclo[4.3.0]non-1(6)-ene (8.34%), limonene (7.73%), linalool (6.19%), and tritetracontane (6.03%). Additionally, secondary compounds (in smaller amounts) identified included: cartol (5.57%), γ-terpinene (4.92%), eucalyptol (4.01%), and others. These compounds were identified using gas chromatography-mass spectrometry (GC-MS). [11]

Medicinal properties of cumin seeds (Cuminum cyminum). Iron is an integral part of hemoglobin, participates in enzyme systems and metabolism, and plays an important role in ensuring the normal functioning of the immune system. [12] Cumin is rich in iron — more than 66 mg of this microelement is found in 100 grams, which is five times the daily iron requirement for adults. Therefore, cumin is an effective supplement to the daily diet, especially beneficial for people suffering from anemia. [13] Several studies by foreign authors have shown a significant reduction in lipid levels. A randomized clinical trial investigated the effect of cumin powder on the lipid profile of 88 overweight and obese women. Participants were randomly divided into two groups: the experimental group received 3 grams of cumin powder with yogurt twice daily during meals for 3 months; the control group received the same amount of yogurt without cumin. All patients were given the same dietary recommendations for weight loss. Anthropometric and biochemical indicators were measured at the beginning and end of the study. The results showed that cumin powder reduces fasting plasma cholesterol, triglycerides, and LDL levels, and increases HDL levels. The group taking cumin powder showed significant reductions in weight, body mass index (BMI), waist circumference, and fat mass. [14] In a study of the effect of cumin extract supplementation in patients with hypercholesterolemia, the levels of LDL, paraoxonase-1 activity, fasting blood glucose (FBS), total cholesterol, triglycerides, high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C), apolipoprotein A1 (Apo A1), and apolipoprotein B (Apo B) were examined. The results showed that cumin intake significantly reduces LDL levels, increases paraoxonase activity, and improves arylesterase activity in blood plasma. [15]

Conclusion. Cumin (Cuminum cyminum) has long been widely used in traditional medicine as a remedy against numerous diseases. The plant's chemical composition determines its many pharmacological properties: hypolipidemic, antidiabetic, antioxidant, antibacterial, antifungal, anti-inflammatory, and others, making it promising for use both in traditional and modern medicine, as well as for the development of new drugs for the prevention and treatment of various diseases. Thus,

the results of this study demonstrated the strong antioxidant and radical-scavenging properties of cumin. The cleansing activity of the essential oil and seed extracts of cumin shows powerful protection against oxidative diseases. These properties ensure the effectiveness of its antioxidant action and play an important role in slowing down inflammatory processes and aging. The high antioxidant activity indicates the potential for using cumin seeds as a natural antioxidant in dietary supplements and pharmaceutical products. This also opens up opportunities for the effective use of residual oil. The study results highlight the need to consider various factors and methodologies when assessing antioxidant properties. At the same time, the conclusions emphasize the necessity for further research to fully explore the antioxidant activity and expand its applications in medicine and pharmacy.

References

1. Аскаров И.Р. Онгологик касалликларни даволаш ва олдини олишда халк табобатининг ахамияти. –Халк табобати плюс.-2022, № 3(12). 2-3 б.
2. Аскаров И.Р. Табобат комуси. Т.: “Мумтоз соз”. -2019.-Б.1142.
3. Аскаров И.Р. Сирли табобат. - Т.: Фан ва технологиялар нашриёт-матбаа уйи. 2021.-Б.1084.
4. Чен М. Вқступление на конгрессе ВОЗ по народной медицине. Практическая фитотерапия. 2008.- №1. С.43-48.
5. Барнаулов О.Д. Лекарственные растения – суррогаты чая. Фитодиетотерапия. –СПб.,2015.-448 с.
6. Всё о лекарственных растениях на ваших грядках / под ред. С. Ю. Раделова. — СПб.: СЗКЭО, 2010. — С. 109—111. — 224 с.
7. Rahman A. et al. Chemical composition, antioxidant activity and total phenolics of the seeds of Cuminum cyminum L //Journal of Characterization and Development of Novel Materials. – 2015. – Т. 7. – №. 1. – С. 1.
8. Sastry, E. V. Divakara. Cumin, Fennel and Fenugreek // Soils, Plant Growth and Crop Production / E. V. Divakara Sastry, Muthuswamy Anandaraj.
9. Колоколова А. П., Суботялов М. А. ТЕРАПЕВТИЧЕСКИЙ ПОТЕНЦИАЛ РАСТЕНИЯ CUMINUM CYMINUM //Традиционная медицина. – 2022. – №. 4 (70) 2022. – С. 27-34.
10. Chaudhry A. H. et al. Physico-chemical investigation and antimicrobial activity of essential oil of Cuminum cyminum L //World applied sciences journal. – 2012. – Т. 19. – №. 3. – С. 330-333.
11. Cumin (Cuminum cyminum L.): A review of its ethnopharmacology, phytochemistry / A.A. Allaq, N.J. Sidik, A. Abdul-Aziz, I.A. Ahmed // Biomed. Res. Ther. 2020. Vol. 7. N 9. P. 4016-4021. doi: 10.15419/bmrat. v7i9.634
12. Al-Hashemi, F.H.Y. Chromatographic separation and identification of some volatile oils, organic acids and phenols from the seeds of cyminum growing in Iraq / F.H.Y. Al-Hashemi // IJRRAS. 2014. Vol. 19. N 1. P.80–90.
13. Johri, R.K. Cuminum cyminum and Carum carvi: An update / R.K. Johri // Pharmacogn Rev. 2011. Vol. 5. N 9. P. 63-72. doi: 10.4103/0973-7847.79101.
14. Effect of cumin powder on body composition and lipid profile in overweight and obese women / R. Zare, F. Heshmati, H. Fallahzadeh, A. Nadjarzadeh // Complement Ther Clin Pract. 2014. Vol. 20. N 4. P.297–301. doi: 10.1016/j.ctcp.2014.10.001
15. Samani, K.G. Effects of cumin extract on oxLDL, paraoxanase 1 activity, FBS, total cholesterol, triglycerides, HDL-C, LDL-C, Apo A1, and Apo B in in the patients with hypercholesterolemia / K.G. Samani, E. Farrokhi // Int. J. Health Sci (Qassim). 2014. Vol. 8. N 1. P.39–43. doi: 10.12816/0006070