INTERNATIONAL JOURNAL OF RESEARCH CULTURE SOCIETY
Monthly Peer-Reviewed, Refereed, Indexed Journal
Volume - 7, Issue - 11, November - 2023

ISSN(O): 2456-6683
[Impact Factor: 6.834]
Publication Date: 20/11/2023

IJRCS

DOIs:10.2017/IJRCS/202311013 --:-- Research Paper / Article / Review

Gas Chromatographic Analysis of seed oil of Ricinus Communis of Euphorbiaceae family to ascertain the significance of the fatty acids in health perspectives

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Abstract: *Ricinus communis, better known as the castor bean plant, is a member of the Euphorbiaceae family. Castor oil, the seed oil of this plant that is widely cultivated, is an important source of Ricinolein acid, a monounsaturated fatty acid that is identified by the presence of a hydroxyl group on its 12th carbon atom. It comes to identifying and describing chemical constituents in mixtures, gas chromatographic analysis (GC) is a crucial technique that has proven invaluable in closely examining the fatty acid composition of oils. While oleic acid is a monounsaturated fatty acid linked to heart health, linoleic acid is an important omega-6 fatty acid crucial for many physiological functions. As a potential source of critical fatty acids in arid locations, these oils hold promise for improving health outcomes. Because of their high calorie content, they should only be consumed in moderation. Additionally, people who have allergies should take extra care and seek medical attention if they have any negative side effects.Because they lower cholesterol and lower the risk of heart disease, oleic and linoleic acids are essential for human health. These oils' anti-inflammatory qualities can improve blood sugar regulation and reduce inflammation.*

Key words: *Ricinus communis plant, Gas chromatographic, Omega-6 fatty acid, Osteoporosis, HDL and lower LDL cholesterol.*

1. INTRODUCTION:

Ricinus communis, also known as the Castor Bean or Castor Oil Plant, is a large, fast-growing shrub or tree native to tropical East Africa. Ricinus communis plant is used in various industrial and medical applications. The seeds are also used to make biodiesel fuel. The Ricinus communis plant seed oilis used in traditional medicine. However, the seeds are the most toxic, containing ricin, a highly toxic protein. The plant is a popular ornamental plant and food source for some insects. Ricinus communis plant seed oil derived from the seeds of the castor, is a thick, pale-yellow liquid with a distinct Odor and taste. It is composed of approximately 90% ricinolein acid, a unique fatty acid with a double bond in its carbon chain. Ricinus communis plant seed oil has unique properties such as high viscosity, low melting point, soluble in alcohol but not in water, and antimicrobial properties. It has been used for centuries as a laxative, emollient, and topical treatment for various skin conditions. It is also used in industrial applications like lubricants, soaps, and coatings. However, it can cause irritation and diarrhoea if taken orally and is not safe for pregnant or breastfeeding women. These oils contain other fatty acids, such as behenic acid (C22:0), erucic acid (C22:1), stearic acid (C18:0), arachidic acid (C20:0), eicosanoid acid (C20:1), and palmitic acid (C16:0), all of which support a number of health benefits, such as lowering blood sugar levels, lowering inflammation, and promoting brain health.

2. Indentations and Equations:

The Ricinus communis plant seed oil health benefits are attributed to its richness in unsaturated fatty acids, as indicated by its active and iodine levels. The refractive index of the Ricinus communis plant seed oil is within the normal range, indicating that it has standard light-bending characteristics. 85–95% of the content of ricinoleic acid, a triglyceride made of three fatty acids connected to a glycerol molecule, is found in Ricinus communis plant seed oil. With a high smoke point that prevents burning even at high temperatures, this light yellow to amber oil has a viscosity similar to honey.

The Ricinus communis plant seed oil chemical composition comprises various amounts of oleic acid, linoleic acid, and linolenic acid; it is soluble in alcohol but insoluble in water [1]. It offers a varied spectrum of qualities for various applications, with a fatty acid breakdown of ricinoleic acid at 85-95%, oleic acid at 3-5%, linoleic acid at 1-3%, linolenic acid at 1-2%, palmitic acid at 1%, and stearic acid at 1%. The characteristics of the oil and seeds of the Ricinus communis plant show promise. The seeds show good storage stability with a low moisture content of 0.4% [2]. Their large protein content of 21.6% indicates possible application in animal feed, while their high Ricinus communis plant seed oil content of 41.8% puts them as a valuable oil source. While a low saponification value indicates purity with few non-saponifiable components, a high saponification value denotes the presence of long-chain fatty acids. Though originally from equatorial Africa, it has adapted to thrive in temperate and subtropical climates across the world [3]. Ricinus communis plant seed oil is extracted from its seeds, has a high smoke point and a honey-like viscosity. Its color ranges from pale yellow to amber, and it is heat resistant [4]. The Ricinus communis plant seed oil fatty acid makeup, which is primarily composed of ricinoleic acid (85–95%) and is soluble in alcohol but insoluble in water, highlights its health benefits, which include antiviral, antibacterial, and anti-inflammatory qualities [5]. Carotenoids, phytosterols, and tocopherols are additional substances that have anti-inflammatory, anti-cancer, and antioxidant qualities. Because of the Ricinus communis plant seed oil toxicity, care must be taken even with its prospective uses as lubricants, moisturizers, treatments for constipation, biodiesel fuel, and conventional medicine [6]. All things considered, these qualities highlight Ricinus communis plant seed oil as an important and adaptable resource with a wide range of possible uses. The distinct and advantageous properties of Ricinus communis plant seed oil is attributed to its composition of fatty acids [7]. Compared to other fatty acids, the concentration of palmitic and stearic acids is comparatively low, despite their contribution to energy provision and cell membrane construction. There Ricinus communis plant seed oil includes a moderate amount of oleic acid, which is well-known for its heart health advantages and possible ability to lower cancer risk [8]. The immune system's health and brain function are greatly influenced by the important fatty acids linoleic and linolenic acids, which have comparatively low and moderate contents, respectively [9]. With an impressive 88.6%, Ricinoleic acid takes center stage and offers several benefits, including antiviral, anti-inflammatory, and antibacterial qualities. Ricinus communis plant seed oil is positioned as a heart-healthy option due to its impressively high total unsaturated fatty acid content (96.9%) and low total saturated fatty acid content (3.1%) [10]. However, the ricin component of the Ricinus communis plant seed oil makes it hazardous, which highlights the necessity for careful handling and avoiding consumption.Castor oil is positioned as a heart-healthy option due to its impressively high total unsaturated fatty acid content (96.9%) and low total saturated fatty acid content (3.1%) [11]. However, the ricin component of the oil makes it hazardous, which highlights the necessity for careful handling and avoiding consumption [12].The seed stands out as a great source for producing vegetable oil or biodiesel because of its high oil content of 41.8% [13]. Furthermore, the seed's notable 21.6% protein concentration makes it a significant resource for creating protein powder or other products that are enhanced with protein [14]. The oil has a low saponification value of 0.4 mg/g KOH, which suggests minimum unsaponifiable matter and makes it appropriate for a variety of applications. Its saponification value of 184.8 mg/g KOH indicates that the oil is primarily composed of long-chain fatty acids [15]. Additionally, the oil may be used to make margarine or other products high in monounsaturated and polyunsaturated fatty acids, as indicated by its high iodine value (90.2 g I2/100g) [16]. The active value of 2.3 g I2/100g of the seed indicates its antioxidant-rich nature, which provides opportunities for the development of dietary supplements and foods high in antioxidants[17]. Similar chemical structures are shown by the equal refractive indices (1.4862) of the oil and seed, guaranteeing consistency across a range of applications. All in all, this extensive data highlights the seed's adaptability and promise in a variety of industries and provides a basis for the creation of novel and nutrient-dense food products [18].

3. Results and Discussion :

The product under consideration exhibits an outstanding fatty acid profile, with unsaturated fatty acids making up a whopping 96.9% of its total amount [19]. Given that unsaturated fatty acids are generally thought to be healthier than their saturated cousins, this is a huge plus. Additionally, the product is high in important fatty acids, which the body is unable to make on its own [20]. These fatty acids include linoleic acid (C18:2) and linolenic acid (C18:3), which are required for critical biological activities like cell proliferation, brain function, and inflammation regulation. Saturated fatty acids make up only 3.1% of the total, which is a very low amount. This is especially beneficial in light of the recognized associations between high intakes of saturated fat and a number of health problems, including as type 2 diabetes, heart disease, and stroke [21].

Table 1: Physico-chemical properties of the seed oil of Ricinus Communis

Seed properties		Oil properties	
Moisture content (% by W)	0.4	Refractive index (40-degree c)	1.4862
Oil content (% by W)	41.8	Saponification value (mg/ g KOH)	184.8
		Un-Saponification value (mg/ g KOH)	0.4
Protein content (% by W)	21.6	Active value (g I_2/100g)	2.3
		Iodine value (g I_2/100g)	90.2

Table 2: Fatty acids composition (%) of Ricinus Communis seed oil by GC-MS

Fatty Acid	Obtained % by weight
Palmitic acid (C16:0)	1.4
Stearic acid (C18:0)	1.3
Oleic acid (C18:1)	2.1
Linoleic acid (C18:2)	**5.4**
Linolenic acid (C18:3)	0.8
Ricinolenic acid	**88.6**
Arachidic acid (C20:0)	0.4
Total saturated fatty acid (TSFA)	**3.1**
Total unsaturated fatty acid (TUSFA)	**96.9**

4. CONCLUSION:

The main ingredients in castor oil, Ricinoleic acid, provides several health advantages, such as anti-inflammatory, antibacterial, antifungal, moisturising, and laxative qualities. For decades, traditional medicine has employed it to address ailments such as skin problems and constipation. People with allergies should stop using them and seek medical advice if they have negative side effects.While growing plants in Rajasthan's dry zones can be difficult, it is completely possible to do so with the correct techniques and careful attention to detail. Equally important is soil preparation, which includes making sure the soil is well-drained and, in the case of thick clay soil, adding sand, gravel, or organic matter to increase fertility. For maximum growth, these sun-loving plants need to be placed in a sunny area. These plants can withstand drought, so it's important to water them enough without going overboard. However, it's best to water deeply and let the soil dry out between applications. It is advantageous to fertilise on a regular basis with a balanced, diluted fertiliser.

REFERENCES :

1. BrickelChristopher (ed.)(1996)The Royal Horticultural Society A-Z Encyclopedia of Garden Plants London: Dorling Kinderaley,884-885, ISBN 0751303035
2. Thomson N.D.(2007)Castor Oil DRUGDEX System 19 Micromedex, Ingredient List P-Z (PDF).
3. Oyewole O.I., OwoseniA.A., FaboroE.O.(2010) Studies on medicinal and toxicological properties of Cajanus cajan. Ricinus communis and Thymus vulgaris leaf extracts, Journal of Medicinal Plant Research, 4(19), 2004-2008.
4. Williamson E.MO., (ed.)(2002) Major Herbs of Ayurveda, Churchill Livingstone.
5. Omash V.,Parihar S.K., Jain N.K.Jain, Katiyar A.K.(2010) Effect of Solanum nigrum and Ricinus communis extracts on histamine and carrageenan-induced inflammation in the chicken skin, Cellular and molecular biology (Noisy-le- Grand, France), 56 Suppl (OL1239-1251)
6. Sabina E.P., Rasool M.K., Mathew L., Parameswari (2009) Studies on the protective effect of Ricinus communis leaves extract on carbon tetrachloride hepatotoxicity in albino rats Pharmacologyonline,2:905-916.

7. Kalaiselvi P., Anuradha B., Parameswari C.S.(2003) Protective effect of Ricinus communis leaf extract against paracetamol-induced hepatotoxicity, Biomedicine, 23(1-2) 197- 105.
8. Wedin G.P., Neal J.S., Everson G.W., KrenzelokE.P.(1986) Castor bean poisoning, Am. J. Emerg. Med., 4(3), 259-61.
9. Wilson R., Van B.J., Schie, Howes D.(1998) Overview of the preparation, use and biological studies on polyglycerol polyricinoleate (PGPR), Food Chem. Toxicol, 36 (9-10), 711-18.
10. Yeboah A., Ying S., Lu J., Xie Y., Amoanimaa-Dede H.,Boateng K.G.A., Chen M., Yin X. (2020) Castor oil (Ricinus communis): a review on the chemical composition and physicochemical properties, Food Science and Technology, 41, 399-413.
11. ShekadeS.V., ShirolkarS.V., Shekade S.V., GiramP.S.(2023)"Phytochemical, Pharmacognostic, and Pharmacological Aspects of Ricinus Communis Seed Oil: An Overview", The Natural Products Journal, 13(3), 31-47.
12. SnibigerG., PittenauerF., AllmaierO. (2003)Characterisation of Castor Oil by On-line and Off-line Non-aqueous Reverse-phase High-performance Liquid Chromatography Mass Spectrometry (APCI and UV/MALDI), Phytochemical Analysis,14, 337-346.
13. ObanlaO.R., Mohammed F.U., AlebiosuO.S., OjewumiM.E., Oladimeji T.E.,Babatunde (2021) Study on the Lubricating Properties of Castor (Ricinus communis) and Hydroxylated Rubber (Hevea brasiliensis) Seed Oil, ACS omega, *6*(43), 28471-28476.
14. Chakrabarty S., Islam A.K.M.A., Yaakob Z.(2021) Castor (Ricinus communis): An underutilized oil crop in the South East Asia, Agroecosystems—Very Complex Environmental Systems; IntechOpen: London, UK,p.61.
15. Duke J.A., (1983) Ricinus communis L. Handbook of Energy Crops, 1-6. (online).
16. Puthli M.S., Rathod V.K.,Pandit A.B.(2006) Enzymatic Hydrolysis of Castor Oil: Process Intensification Studies, Biochemical Engineering, 31,31-41.
17. Roy T., Sahani S., Y.C., Sharma (2020) Green synthesis of biodiesel from Ricinus communis oil (castor seed oil) using potassium promoted lanthanum oxide catalyst: kinetic, thermodynamic and environmental studies,Fuel, 274, 117644.
18. Gebrehiwot H.,ZelelewD.(2022)Ricinus communis Seed Oils as a Source of Biodiesel; A Renewable Form of Future Energy, Journal of the Turkish Chemical Society Section A: Chemistry, 9(2), 339-354.
19. Abel S., Jule L.T., GudataL.,NagarajN., Nagaraj R., DwarampudiL.P., Stalin B.,RamaswamyK.(2022) Preparation and characterization analysis of biofuel derived through seed extracts of Ricinus communis (castor oil plant)Scientific Reports, 12(1), 11021.
20. Ahmad Jan H., ŠurinaI.,Zaman A., Al-FateshA.S., Rahim F., Al-Otaibi R.L (2022) Synthesis of Biodiesel from Ricinus communis L. Seed Oil, a Promising Non-Edible Feedstock Using Calcium Oxide Nanoparticles as a Catalyst, Energies, 15(17), 6425.
21. Liu Q., Li P., Chen J., Li C.,Jiang, Luo M., SunA.N.(2019)Optimization of aqueous enzymatic extraction of castor (Ricinus communis) seeds oil using response surface methodology, Journal of Biobased Materials and Bioenergy, 13(1), 114-122.