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Chemical and Medical Castor Oil Composition

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Abstract

Castor oil is well known as a source of ricinoleic acid, a monounsaturated, 18-carbon fatty acid. Among fatty acids, ricinoleic acid is unusual in that it has a hydroxyl functional group on the 12th carbon atom. This functional group causes ricinoleic acid (and castor oil) to be more polar than most fats. Castor plant is grown in arid and semi-arid regions. In 2020-21, World major producing countries are India (16.51 lakh tonnes), Mozambique (0.72 lakh tonnes), China (0.17 lakh tonnes), Thailand (0.12 lakh tonnes) and Myanmar (0.12 lakh tonnes).

Per 100 g, the leaves are reported to contain on a zero-moisture basis, 24.8 g protein, 5.4 g fat, 57.4 g total carbohydrate, 10.3 g fiber, 12.4 g ash, 2,670 mg Ca, and 460 mg P. The seed contains 5.1–5.6% moisture, 12.0–16.0% protein, 45.0–50.6% oil, 3.1–7.0 NFE, 23.1–27.2% CF, and 2.0–2.2% ash. Seeds are high in phosphorus, 90% in the phytic form. The castor oil consists principally of ricinoleic acid with only small amounts of dihydroxystearic, linoleic, oleic, and stearic acids. The unsaponifiable matter contains b-sitosterol. The oil-cake from crushing whole seeds contain 9.0% moisture, 6.5% oil, 20.5% protein, 49.0% total carbohydrate and 15.0% ash. The manural value is 6.6% N, 2.6% P2O5, and 1.2% K2O (C.S.I.R., 1948–1976). There are 60 mg/kg uric acid and 7 ppm HCN in the seed. The seeds contain a powerful lipase, employed for commercial hydrolysis of fats, also amylase, invertase, maltase, endotrypsin, glycolic acid, oxidase, ribonuclease, and a fat-soluble zymogen. Sprouting seeds contain catalase, peroxidase and reductase.

Keywords: *castor oil, carbon fatty acid, carbon atom*

1. Introduction

Castor oil is a thick, odorless oil made from the seeds of the castor plant. Its use dates back to ancient Egypt, where it was likely used as fuel for lamps as well as for medicinal and beauty purposes. Cleopatra reportedly used it to brighten the whites of her eyes.

Castor oil is a vegetable oil obtained by pressing the seeds of the castor oil plant (*Ricinus communis* L.) mainly cultivated in India, South America, Africa, and China. Castor oil is a rich source of Ricinoleic acid, which represents up to 90% of the total castor oil content. It also consists up to 4% linoleic, 3% oleic, 1% stearic, and less than 1% linolenic fatty acids[1]. Ricinoleic acid has a hydroxyl group that provides a functional group location for various chemical reactions, making it a favourable substance in industrial applications[1]. Castor oil does not contain ricin, which is a natural poison found in the castor oil plant; the toxic lectin remains in the bean pulp following oil isolation[6]. Due to its renewability and high versatility in addition to being the only commercial source of a hydroxylated fatty acid[1], castor oil has been used as a vital raw material for the chemical industry[3]. Castor oil was mainly used in the manufacturing of soaps, lubricants, and coatings[1]. It is an FDA-approved food additive directly added to food products for human consumption. It can also be found in hard candies as a release agent and anti-sticking agent, or supplementary vitamins and mineral oral tablets as an ingredient for protective coatings. Castor oil is found in over-the-counter oral liquids as a stimulant laxative, and is also added in commercial cosmetic, hair, and skincare products Anjani 2012 and 2014. .

2. Medical Castor Oil Property

2.1. Castor oil benefits for skin

Because it's rich in fatty acids, castor oil has moisturizing effects. You can find it in many commercial beauty products. You can also use it in its natural form, which is free of perfumes and dyes. Because it can

be irritating to skin, try diluting it with another neutral oil. Some people think castor oil's antibacterial, anti-inflammatory, and moisturizing effects could help fight acne. But there's no research evidence to back this up.

2.2. Castor oil for hair growth

Castor oil is sometimes marketed as a treatment for dry scalp, hair growth, and dandruff. It may moisturize your scalp and hair. But there's no science to back up claims that it treats dandruff or promotes hair growth.

2.3. Castor Oil Packs

Some people use castor oil packs as remedies for constipation, dry skin, arthritis, or period cramps. These are pieces of fabric, usually cotton or wool, soaked in castor oil. You apply them to your skin, with or without a heating pad. You can make your own or buy them.

While a heated pad might feel soothing, there’s not much research to support the benefits of castor oil packs.

2.4. Castor Oil Side Effects

While castor beans contain a poison called ricin, this toxin is removed during processing of castor oil. But there are some health risks linked its use:

2.5. Allergic reaction

If you're allergic to the castor plant, you could have itching, swelling, or rashes if you apply the oil to your skin. Test a small spot before you use it.

2.6. Gastrointestinal (GI) discomfort

Castor oil can help relieve constipation. But it can cause nausea, abdominal cramping, vomiting, bloating, and dizziness if you take too much. Always talk to your doctor before you use it.

2.7. Pregnancy concerns

If you're pregnant, avoid using it. It may induce labor. We don't have enough research to know whether it's safe to use during pregnancy or while breastfeeding. It's not clear whether it's safe for infants or children, either.

2.8. Medication interactions

When you use castor oil for constipation, take it several hours before or after you take any other medications. Laxatives can change how other drugs work. Don't combine it with any other laxatives or diuretics.

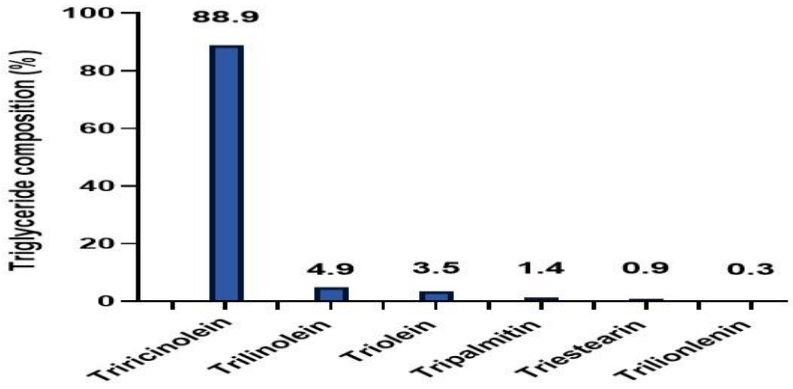

Figure 1. *Chemical composition of castor oil*

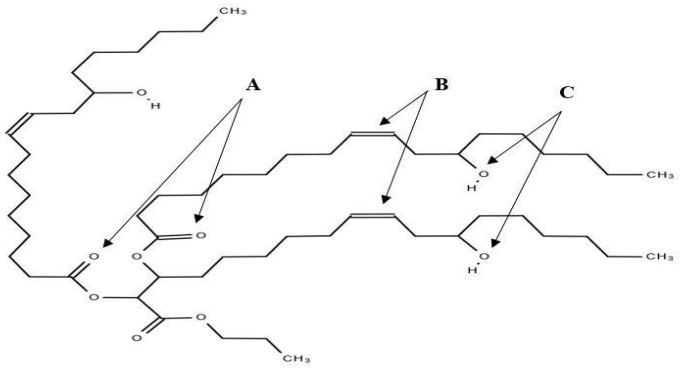

Figure 2. *Structure of castor oil molecule. (A) Indicates carboxylic groups; (B) indicates double bonds; (C) indicates hydroxyl groups*

3. RESULTS

Castor is grown in countries such as India, Brazil and China. Since the 1980's, India commands the leading market share of over 88%. China has around 6% share followed by Brazil at 3%. The remaining 3% is grown in other countries in Asia, Africa and South America.

Figure. *Cultivation of castor oil in Iran. Kheyrodin 2025.*

3.1. Plant Description

Coarse perennial, 10–13 m tall in the tropics, with the stem 7.5–15 cm in diam., but usually behaves as an annual in the temperate regions 1–3 m tall; stems succulent, herbaceous, very variable in all aspects; leaves alternate, orbicular, palmately compound, 1–6 dm broad, with 6–11 toothed lobes, glabrous; flowers numerous in long inflorescences, with male flowers at the base and female flowers at the tips; petals absent in both sexes, sepals 3–5, greenish; stamens numerous, 5–10 mm long; ovary superior, 3-celled with a short style and 3 stigmas; fruit a globose capsule 2.5 cm in diameter, on an elongated pedicel, usually spiny, green turning brown on ripening, indehiscent in modern cultivars, usually containing 3 seeds; seeds ovoid, tick-like, shiny, 0.5–1.5 cm long, carunculate, vari-color with base color white, gray, brownish, yellow, brown, red, or black, with the outer pattern gray or brown to black, the pattern varying from fine to coarse, veined or finely dotted to large splotches, poisonous and allergenic, possibly fatel, from 1,000 to 11,000 per kg, commercial varieties having 2200 to 3200 per kg (Reed, 1976).

3.2. Plant Ecology

Ranging from Cool Temperate Moist to Wet through Tropical Desert to Wet Forest Life Zones, castor bean is reported to tolerate annual precipitation of 2.0 to 42.9 dm (mean of 68 cases = 12.7) annual temperature of 7.0 to 27.8°C (mean of 68 cases = 20.4) and pH of 4.5 to 8.3 (mean of 29 cases = 6.5). Grows best where temperatures are rather high throughout the season, but seed may fail to set if it is above 38°C for an extended period. Plant requires 140–180 day growing season and is readily killed by frost. Irrigated crops require 2–3.5 acre-feet of water to produce satisfactory yields. High humidity contributes to the development of diseases. Plants do best on fertile, well-drained soils which are neither alkaline nor saline; sandy and clayey loam being best figure 1 and 2..

3.3. Castor Cultivation

Castor is propagated entirely by seed treated to resist disease. Seeds retain their viability 2–3 years. After seedbed has been deeply cultivated, seed of the dwarf cvs in mechanized countries are planted 3.7–7.5 cm deep in rows 1 m apart; seeds about 25 cm apart in the rows; at rate of 15 kg/ha. For unmechanized societies which prefer larger cvs, seeds are planted 60 by 90 cm apart, 2–4 seeds per hole, and then thinned to one plant; this gives about 30,000 plants/ha. Cultivate shallowly until 0.6–0.9 m high. Irrigation is usual practice in the United States; in India castor is a dry land crop kheyrodin 2025. . Castor exhausts the soil quickly. In the United States 45–135 kg/ha of nitrogen is added in split applications. Leaves, stalks and seed hulls are disked into the field following harvest. In India 89 kg/ha of nitrogen gives the highest yields. Where phosphorus is deficient, 40–50 kg/ha of P2O5 is recommended. In Australia 200 kg/ha of superphosphate is applied. Furrow irrigation is preferred, but sub irrigation reduces weed problems. Normally irrigation commences after plants have 6–8 leaves; over irrigation on heavy soils should be avoided; final irrigation should be 3–4 weeks before harvest.

In the United States 1,500 to 2,000 cu m of water per hectare is applied during the growing season. In Brazil 2,400 cu m of water is applied during the 3 months between flowering and harvest, with about 400 cu m being applied at each irrigation at 15 day intervals. Seed may be planted by hand or with a corn planter with special plates, after the soil has become warm and out of danger of frost. Time varies with the locality; Illinois, early May; Venezuela, June–July; Australia, August–December; Morocco, March; Brazil (south), September–November; Brazil (north), January–March; India, July; Taiwan, August–September or April–May. For seed increase, castor should be planted on fallow land, and should not follow small grains or another castor crop. In India it is rotated with ragi, groundnuts, cotton, dryland chillies, tobacco or horsegram (Reed, 1976).

3.4. Harvesting

Non-mechanized societies prefer shattering cvs, as opposed to the non-dehiscent dwarf strains developed in the United States. Fruits are harvested when fully mature and the leaves are dry, in about 95–180 days depending on the cv. In tropics, harvest is from wild or native plants. Planting and harvesting may be done by hand methods or be completely mechanized. Harvesting should begin before rainy season in tropical regions, but in dry regions it is best to harvest when all fruits are mature. In India fruit is picked in November it is a triglyceride of unsaturated fatty acids, containing about 61% oleic acid residues, 21% linoleic acid residues, 10% linolenic acid and 8% saturated fatty acid residues

4. Conclusion

Castor oil is a vegetable oil derived from the Ricinus communis plant, which is common in the Eastern areas of the world. Although castor oil is primarily known for its laxative properties, it has been reported to have additional benefits, such as aiding uterine contraction, lipid metabolism, and antimicrobial activity. Despite its traditional use, the US Food and Drug Administration (FDA) has only approved the use of castor oil as a stimulative laxative. However, although castor oil is not recommended as a first-line treatment for constipation according to current medical guidelines, it continues to be utilized in traditional practices Abdallah et al. 2015..

As it has been reviewed here, castor oilseed has high percentage of monounsaturated fatty acid and shares higher similarities of with other vegetable oils. The fatty acids profile and triglycerides demonstrate that ricinoleic acid and triricinolein are the predominant components in the oil. Bioactive compounds including polyphenols, phytosterols, and tocopherols present in castor oilseed pose its anti-inflammatory and antioxidant properties against oxidation and these may prolong the oil shelf life. The low acid value also accounts for castor oil stability Beruk, et al. 2018.

5. Acknowledgements

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