

Cottonseed Oil: Physicochemical Attribute, Health Benefits and Applications

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ABSTRACT

Cotton plant is not only a source of fibre but it also provides around 4% of the world's vegetable oil supply. Cottonseed oil is obtained from the cottonseed after using various extraction methods such as solvent extraction, mechanical pressing of seeds, microwave-assisted extraction, ultrasound extraction and enzyme assisted extraction methods. Raw cottonseed oil is refined using various processes to eliminate the gossypol, a toxic compound present in cottonseed. But after refining, bleaching and deodorization, the gossypol content of CSO gets reduced to safe limit for human consumption and also the odor, color and flavor becomes suitable for cooking. It has various properties including cardio-protection, anti-inflammatory and wound healing properties owing to high content of linoleic acid and tocopherols. Refined cottonseed oil has promising applications in food industries for frying and baking due to its high smoke point and stability. Furthermore it is considered as heart healthy oil because it contains more than 73% unsaturated fatty acids including approximately 52% linoleic acid and 21% oleic acid.

INTRODUCTION

Cottonseed oil, a by-product of cottonseed, is valuable edible oil that is obtained from the seed kernels of various species of cotton especially *Gossypium herbaceum* and *Gossypium hirsutum*. Depending on the species and seed quality, the whole cottonseed contains about 15-20% of oil. Unrefined cottonseed oil is not suitable for

human consumption due to presence of a toxic compound called gossypol and thus cottonseed oil is refined before its utilization as cooking oil and other food applications. Its fatty acid composition is unique due to the presence of oleic/linoleic groups because these two fatty acids make up approximately 73% of the total fatty acid. Cottonseed oil (CSO) is gaining popularity around the world owing to its

distinct fatty acid profile, cardio-protective, antioxidant and anti-inflammatory qualities, high fibre content, and potential applications in food industries.

2. Extraction and refining of cottonseed oil

Various extraction methods are used to extract oil from the cottonseed including aqueous/solvent extraction, enzyme-assisted extraction, subcritical water extraction, mechanical oil pressing, and microwave-assisted extraction. Various extraction and refining steps are depicted in Fig. 1. Raw CSO is toxic due to high gossypol content due to its high gossypol concentration. High levels of free fatty acids, dark color and unpleasant aroma make it further unacceptable for use as cooking oil. To increase the stability and worth of cottonseed oil, contaminants such as those that are soluble in gum, colors, and strange odors are removed by refining process. In the refining process, raw cottonseed oil is degummed and deacidified followed by decolorization and deodorization. According to studies, the gossypol level of cottonseed oil can be reduced by alkali refining and bleaching to less than 1 ppm from 0.05–0.42% in solvent-extracted oil and from 0.25–0.47% in screw-pressed oil (Riaz et al., 2021).



Figure 1. Steps involved in extraction of oil from cottonseed

3. Physicochemical properties of the refined cottonseed oil

Physical and chemical properties of all the vegetable oils are based on fatty acid composition including nature of fatty acids and their percentage in the oil, chain length, number and position of double bonds and the position of fatty acids within the glycerol moiety. Fatty acid composition of cottonseed oil is influenced by the cottonseed variety, environmental and geographical factors. Cottonseed oil is rich in polyunsaturated fatty acids (PUFA) having more than 50% linoleic acid. Specific gravity, iodine value, saponification number of CSO ranges from 0.9-0.918, 99-115 and 189-198 respectively. Unprocessed CSO contains about 1000 ppm of tocopherols, however processing can result in losses of up to one-third of that amount.

4. Health benefits of cottonseed oil

Cottonseed oil has potential biological and health benefitting properties such as anti-inflammatory, antioxidant and cardio-protective effect. High PUFA content in CSO is beneficial for heart health and enhances the level of good cholesterol. It also strengthens the immune function as it is rich in antioxidants such as tocopherols. Furthermore, CSO has therapeutic effects in wound healing and skin diseases owing to its antioxidant and anti-inflammatory properties and high linoleic acid and tocopherol content (Riaz et al., 2021; Kumar et al., 2022).

5. Food applications

CSO is an excellent oil to use in fried appetizers where texture, mouth feel, and storage stability are critical considerations. Its neutral flavor and greater smoke point (about 232 °C) compared to other cooking oils make it a preferred edible oil for baking and deep-frying meals since, unlike some other oils, it is believed to bring out the flavour of fresh foods rather than mask them. It gives nutty flavor to fried chips. The main

applications of cottonseed oil in food include baked goods, salad dressings, cereals, packaged foods, crackers, and snack bars. The oil is perfect for frying, stir-frying, and preparation of oriental meals due to its light consistency and high smoke point. It helps to achieve a creamy consistency in whipped toppings. Higher concentration of tocopherols prolongs the shelf life of CSO during frying and baking (Riaz et al., 2021).

CONCLUSION

Refined cottonseed oil is beneficial edible oil with industrial, medicinal and therapeutic value. It is rich in linoleic acid and tocopherols and thus show anti-inflammatory, antioxidant and cardio-protective effects. It has promising applications in food industries for baking and frying food.

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