

Castor oil

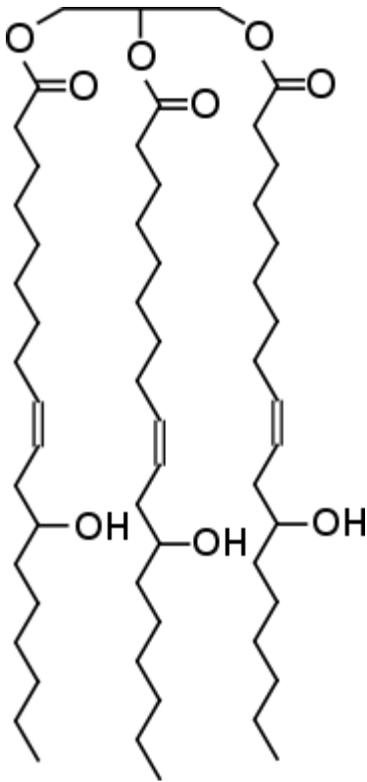
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Castor beans.

Castor oil is a [vegetable oil](#) obtained from the [castor bean](#) (technically *castor seed* as the castor plant, *Ricinus communis*, is not a member of the [bean](#) family). Castor oil ([CAS number](#) 8001-79-4) is a colorless to very pale yellow liquid with mild or no odor or taste. Its [boiling point](#) is 313 °C (595 °F) and its [density](#) is 961 $\text{kg}\cdot\text{m}^{-3}$.^[1] It is a [triglyceride](#) in which approximately ninety percent of fatty acid chains are [ricinoleic acid](#). [Oleic](#) and [linoleic acids](#) are the other significant components.^[2]

Background



 Structure of the major component of castor oil.

Ricinoleic acid, a [monounsaturated](#), 18-carbon [fatty acid](#), is unusual in that it has a [hydroxyl functional group](#) on the twelfth carbon. This functional group causes ricinoleic acid (and castor oil) to be unusually [polar](#), and also allows chemical [derivatization](#) that is not practical with most other seed oils. It is the hydroxyl group which makes castor oil and ricinoleic acid valuable as chemical feedstocks. Compared to other seed oils which lack the hydroxyl group, castor oil commands a higher price. As an example, in July 2007 Indian castor oil sold for about US\$0.90 per kilogram (US\$0.41 per pound)^[3] while U.S. [soybean](#), [sunflower](#) and [canola](#) oil sold for about US\$0.30 per kilogram (US\$0.14 per pound).^[4]

Castor oil and its derivatives have applications in the manufacturing of [soaps](#), [lubricants](#), hydraulic and [brake fluids](#), [paints](#), [dyes](#), [coatings](#), [inks](#), cold resistant [plastics](#), [waxes](#) and polishes, [nylon](#), [pharmaceuticals](#) and [perfumes](#).

Sulfonated castor oil, also called sulfated castor oil, or Turkey Red Oil, is the only oil that completely disperses in water. It is made by adding [sulfuric acid](#) to pure castor oil.^[5] This allows easy use for making bath oil products. It was the first synthetic [detergent](#) after ordinary [soap](#). It is used in formulating [lubricants](#), softeners, and [dyeing assistants](#).^[6]

The castor seed contains [ricin](#), a toxic protein removed by cold pressing and filtering.^[7] However, harvesting castor beans is not without risk.^[8] Allergenic compounds found on the plant surface can cause permanent nerve damage, making the harvest of castor beans

a human health risk. India, Brazil and China are the major crop producers and the workers suffer harmful side effects from working with these plants.^[9] These health issues, in addition to concerns about the toxic byproduct (ricin) from castor oil production, have encouraged the quest for alternative sources for hydroxy fatty acids.^{[10][11]} Alternatively, some researchers are trying to genetically modify the castor plant to prevent the synthesis of ricin.^[12]

Castor oil fatty acids

Average composition of Castor seed oil / fatty acid chains			
Acid name	Average Percentage Range		
Ricinoleic acid	85	to	95%
Oleic acid	6	to	2%
Linoleic acid	5	to	1%
Linolenic acid	1	to	0.5%
Stearic acid	1	to	0.5%
Palmitic acid	1	to	0.5%
Dihydroxystearic acid	0.5	to	0.3%
Others	0.5	to	0.2%

Castor oil in food

In the food industry, castor oil (food grade) is used in food additives,^[13] flavorings, candy (e.g., chocolate),^[14] as a mold inhibitor, and in packaging. Polyoxyethylated castor oil (e.g., [Cremophor EL](#))^[15] is also used in the foodstuff industries.^[16]

Medicinal use of castor oil

The United States [Food and Drug Administration](#) (FDA) has categorized castor oil as "[generally recognized as safe and effective](#)" (GRASE) for over-the-counter use as a [laxative](#), with its major site of action the [small intestine](#).^[17] However, although it may be used for constipation, it is not a preferred treatment.^[18] [Undecylenic acid](#), a castor oil derivative, is also FDA-approved for over-the-counter use on skin disorders or skin problems.^[19]

Castor oil penetrates deep into the skin thanks to its [molecular weight](#), which is low enough to penetrate into the stratum corneum. Castor Isostearate Succinate is a [polymeric](#) mixture of [esters](#) with [Isostearic Acid](#) and [Succinic Acid](#) used for [skin conditioning](#), such as in [shampoo](#), [lipstick](#) and [lip balm](#).^[20]

[Ricinoleic acid](#) is the main component of castor oil and it exerts anti-inflammatory effects.^[21]

One study has found that castor oil decreased pain more than ultrasound gel or Vaseline during [extracorporeal shockwave](#) application.^[22]

Therapeutically, modern drugs are rarely given in a pure chemical state, so most active ingredients are combined with excipients or additives. Castor oil, or a castor oil derivative such as [Cremophor EL](#) (polyethoxylated castor oil, a nonionic [surfactant](#)), is added to many modern drugs, including:

- [Miconazole](#), an anti-fungal agent;^{[23][24]}
- [Paclitaxel](#), a mitotic inhibitor used in cancer chemotherapy;^[25]
- Sandimmune ([cyclosporine](#) injection, USP), an immunosuppressant drug widely used in connection with organ transplant to reduce the activity of the patient's immune system;^[26]
- [Nelfinavir mesylate](#), an [HIV](#) protease inhibitor;^[27]
- Saperconazole, a triazole antifungal agent (contains Emulphor EL-719P, a castor oil derivative);^[28]
- [Tacrolimus](#), an immunosuppressive drug (contains HCO-60, polyoxyl 60 [hydrogenated castor oil](#));^[citation needed]
- Xenaderm ointment, a topical treatment for skin ulcers is a combination of [Peru balsam](#), castor oil, and [trypsin](#).^{[29][30]}
- Aci-Jel (composed of ricinoleic acid from castor oil, with [acetic acid](#) and [oxyquinoline](#)), used to maintain the acidity of the vagina.^[31]

Traditional or folk medicines

The use of cold pressed castor oil in folk medicine predates government medical regulations. Cold pressed castor oil is tasteless and odorless when pure. Uses include skin problems, burns, sunburns, skin disorders, skin cuts, and abrasions. Castor oil has also been used to draw out [styes](#) in the eye by pouring a small amount into the eye and allowing it to circulate around the inside of the eyelid. Note that most bottles of castor oil indicate the oil is to be kept away from the eyes. The oil is also used as a rub or pack for various ailments, including abdominal complaints, headaches, muscle pains, inflammatory conditions, skin eruptions, lesions, and sinusitis. A castor oil pack is made by soaking a piece of flannel in castor oil, then putting it on the area of complaint and placing a heat source, such as a hot water bottle, on top of it. This remedy was often suggested by the American [psychic Edgar Cayce](#), given in many healing readings in the early mid-1900s. Castor oil has also been noted for its acne-healing abilities.^[32]

Castor oil has been used to induce [childbirth](#) in pregnant women, though it is not always effective in application. Castor oil, when ingested, triggers cramping in the bowel (making it an effective [laxative](#)). Thus, it is intended that such cramping extend to the uterus. In an overdue pregnancy in which the mother's cervix is already effacing and partially dilated, this cramping can lead to labor contractions. The irregular, painful contractions of castor-oil-induced labor can be stressful on the mother and fetus.^[citation needed] It also leaves the laboring woman quite dehydrated as a result of the vomiting and diarrhea which result when the recommended dose of castor oil for labor induction is taken—2 [oz.](#), or about 8 [tbsp.](#) This leaves her without access to the energy she could otherwise derive from food or drink throughout her labor process. Using castor oil for induction is not recommended without consulting a medical practitioner and is not recommended in a complex pregnancy.^[citation needed]

Industrial castor oil

Castor oil has numerous applications in transportation, cosmetics and pharmaceutical, and manufacturing industries, for example: [adhesives](#)^[33], [brake fluids](#)^[34], caulks, [dyes](#)^[33], electrical liquid dielectrics, [humectants](#),^[33] hydraulic fluids, [inks](#)^[33], lacquers, [leather treatments](#),^[33] lubricating greases, machining oils, [paints](#)^[33], pigments, [polyurethane adhesives](#)^[35], refrigeration lubricants, [rubbers](#)^[33], sealants, [textiles](#)^[33], washing powders, and waxes.

Vegetable oils, due to their good [lubricity](#) and [biodegradability](#) are attractive alternatives to [petroleum](#)-derived [lubricants](#), but [oxidative](#) stability and low temperature performance limit their widespread use.^[36] Castor oil has better low temperature [viscosity](#) properties and high temperature lubrication than most vegetable oils, making it useful as a lubricant in [jet](#), [diesel](#), and race-car engines.^[37] However, castor oil tends to form gums in a short time, and its use is therefore restricted to engines that are regularly rebuilt, such as race engines. Biodegradability results in decreased persistence in the environment (relative to petroleum-based lubricants^[38]) in case of an accidental release. The lubricants company [Castrol](#) took its name from castor oil.

Since it has a relatively high [dielectric constant](#) (4.7), highly refined and dried castor oil is sometimes used as a dielectric fluid within high performance high voltage [capacitors](#).

Castor oil is the raw material for the production of a number of chemicals, notably [sebacic acid](#), [undecylenic acid](#), [nylon-11](#). A review listing numerous chemicals derived from castor oil is available.^[39]

Castor oil is the preferred lubricant for [bicycle pumps](#), most likely because it doesn't dissolve natural-rubber seals.^[40]

Uses in early aviation and aeromodelling

Castor oil was the preferred [lubricant](#) for the early aviation powerplant design known as the [rotary engine](#), such as the [Gnome engines](#) used in pre-World War I "pioneer aircraft", after that engine's widespread adoption for aviation in Europe in 1909, and was used almost universally by the rotary engines in [World War I](#) Allied aircraft.

The [methanol](#)-fuelled [glow plug engines](#) used for aeromodelling purposes, since their adoption in the [model airplane](#) hobby in 1948, have used castor oil as a dependable lubricant that is highly resistant to degradation when the engine has its fuel-air mixture "leaned out" for maximum engine speed. The aforementioned gummy residue problem can still be troublesome for aeromodelling powerplants lubricated with castor oil, however, usually resulting in eventual [ball bearing](#) replacement when the residue builds up too much within the engine's bearing races.

Castor [biofuel](#) farming started in 2008 in [Ethiopia](#). Families in the Waletia and Goma Gofa regions of Ethiopia began by seeding castor beans for use in [biodiesel](#). The initiative is run by energy company Global Energy Ethiopia, who are also conducting a research and development programme to create new varieties of castor with better yields. (Sub-Saharan Africa gateway, Science and Development Network website, 2008)

Use as a means of intimidation in Fascist Italy

In [Fascist Italy](#) under the regime of [Benito Mussolini](#), castor oil was one of the tools of the [blackshirts](#).^{[41][42][43]} [Political dissidents](#) were force-fed large quantities of castor oil by Fascist [paramilitary](#) groups. This technique was said to have been originated by [Gabriele D'Annunzio](#). Victims of this treatment rarely died, though often had to bear the humiliation of the laxative effects resulting from excessive consumption of the oil.^[44]

It is said that Mussolini's power was backed by "the [bludgeon](#) and castor oil". In lesser quantities, castor oil was also used as an instrument of intimidation, for example to discourage civilians or soldiers who would call in sick either in the factory or in the military. Since its healing properties were widely exaggerated, abuse could be easily masked under pretense of a doctor's prescription. It took decades after Mussolini's death before the myth of castor oil as a panacea for a wide range of diseases and medical

conditions was totally demystified, as it was also widely administered to pregnant women, elderly or mentally-ill patients in hospitals in the false belief that it had no negative side effects.

Linguistic connotations

Today the Italian terms *manganello* and *olio di ricino*, even used separately, still carry strong political connotations. These words are still used to satirize patronizing politicians, or the authors of disliked legislation. They should be used with caution in common conversation. The terms *Usare l'olio di ricino*, ("to use castor oil") and *usare il manganello* ("use the bludgeon") mean "to coerce or abuse," and can be misunderstood in the absence of proper context.

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