CASCHEM
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Castor Oil and its Chemistry

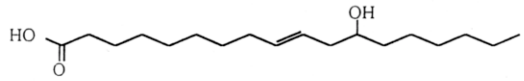
CasChem supplies a variety of castor oil grades whose uses are dictated by acid value, moisture level, color and purity. Castor Oil, also known as ricinus oil, is a triglyceride of fatty acids which occurs in the seed of the castor plant, Ricinus communis (India, Brazil).

Castor Oil is unique among all fats and oils in that:

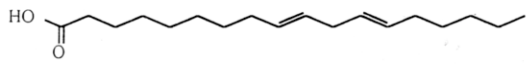
- it is the only source of an 18-carbon hydroxylated fatty acid with one double bond
- ricinoleic acid (12-Hydroxyoleic Acid) comprises approximately 90% of the fatty acid composition
- product uniformity and consistency are relatively high for a naturally occurring material
- it is a nontoxic, biodegradable, renewable resource

The remarkably constant composition of castor oil fatty acids is shown below:

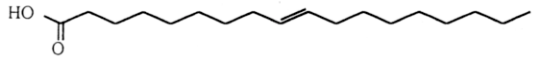
89.5 % Ricinoleic Acid



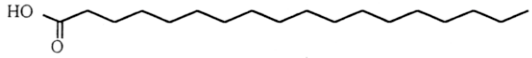
4.2% Linoleic Acid



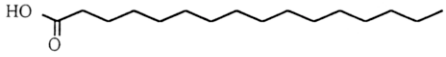
3.0% Oleic Acid



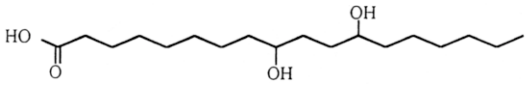
1.0% Stearic Acid



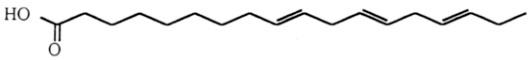
1.0% Palmitic Acid



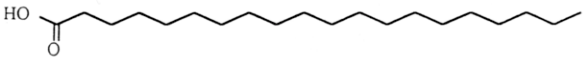
0.7 % Dihydroxystearic Acid



0.3% Linolenic Acid



0.3% Eicosanoic Acid



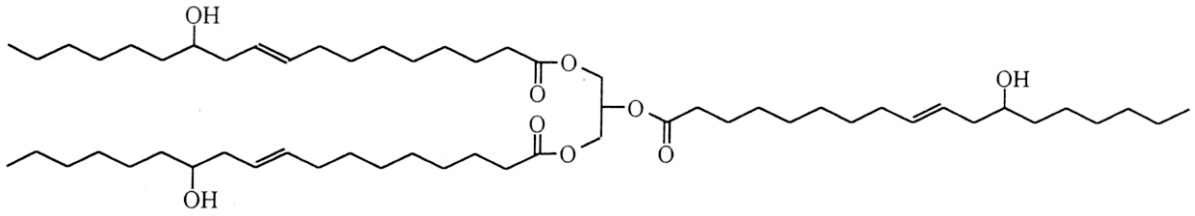
The hydroxyl groups in castor oil account for a unique combination of physical properties:

- Relatively high viscosity and specific gravity
- Solubility in alcohols in any proportion
- Limited solubility in aliphatic petroleum solvents

The uniformity and reliability of its physical properties are demonstrated by the long-term use of castor oil as an absolute standard for viscosity. Because of its higher polar hydroxyl groups, castor oil is not only compatible with but will plasticize a wide variety of natural and synthetic resins, waxes, polymers and elastomers. Castor Oil also has excellent emollient and lubricating properties as well as a marked ability to wet and disperse dyes, pigments and fillers. In the form of its chemical derivatives, castor oil's application versatility is further enhanced.

Castor Oil and its Chemistry

The ester linkages, double bonds and hydroxyl groups in castor oil provide reaction sites for the preparation of many useful derivatives. The diagram below shows the fundamental structure of castor oil and its function in these reaction.



Chemical reactions commercially used to produce a variety of derivatives are as follows:

	Nature of Reaction	Added Reactants	Type of Products
Ester Linkage	Hydrolysis	Acid, enzyme, or Twitchell reagent catalyst	Fatty acids, glycerol
	Esterification	Monohydric alcohols	Esters
	Alcoholysis	Glycerol, glycols, pentaerythritol, etc.	Mono- and diglycerides, monoglycols, etc.
	Saponification	Alkalies, alkalies plus metallic salts	Soluble soaps, insoluble soaps
	Reduction	Na reduction	Alcohols
	Amidation	Alkyl amines, alkanolamines, etc.	Amine salts, amides
	Halogenation	$SOCl_2$	Fatty Acid halogens
Double Bond	Oxidation, Polymerization	Heat, oxygen, crosslink agent	Polymerized oils
	Hydrogenation	Hydrogen (moderate pressure)	Hydroxystearates
	Epoxidation	Hydrogen peroxide	Epoxidized oils
	Halogenation	Cl_2, Br_2, I_2	Halogenated oils
	Addition Reactions	S, maleic acid	Polymerized oils
	Sulfonation	H_2SO_4	Sulfonated oils
Hydroxyl Group	Dehydration, Hydrolysis, distillation	Catalyst (plus heat)	Dehydrated castor oil, Octadecadienoic acid
	Caustic fusion	NaOH	Sebacic acid, capryl alcohol
	Pyrolysis	High heat	Undecylenic acid, heptaldehyde
	Halogenation	PCl_5, $POCl_3$	Halogenated castor oils
	Alkoxylation	Ethylene and/or propylene oxide	Alkoxylated castor oils
	Esterification	Acetic-, phosphoric-, maleic-, phthalic anhydrides	Alkyl and alkylaryl esters, phosphate esters
	Sulfation	H_2SO_4	Sulfated castor oil (Turkey red oil)
	Urethane reactions	Isocyanates	Urethane polymers