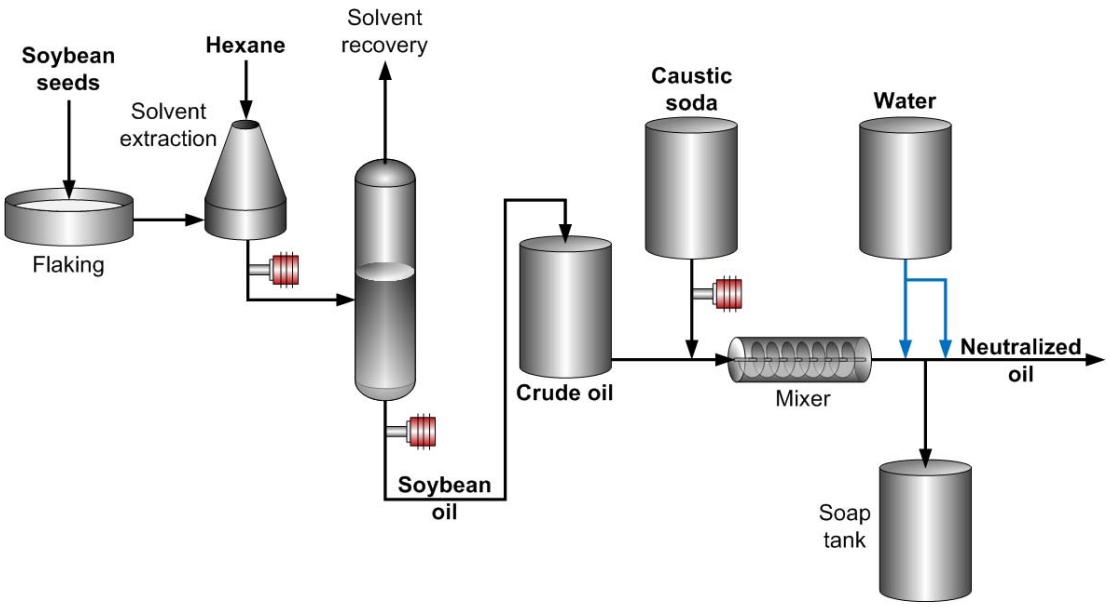
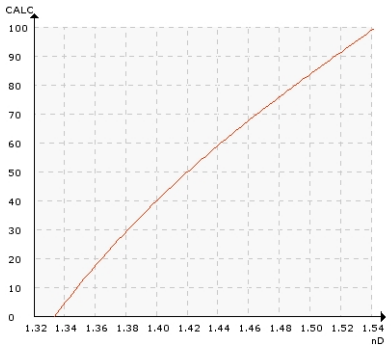


SOYBEAN OIL

Typical end products

Soybean oil for food and biodiesel

Chemical curve: R.I. per BRIX at Ref. Temp. of 20˚C



Introduction

Soybean seed contains about 19 % oil. Soybean oils, both liquid and partially hydrogenated, are sold as "vegetable oil" or are being used in a wide variety of processed foods. Soybean oil is also used as a source for biodiesel.

Application

1. Solvent Extraction

To extract soybean oil from the seeds, the soybeans are cracked and commercial hexane is used for solvent-extraction. Hexane dissolves the oil out of the seeds. Oilseeds are usually flaked to increase the exposure to hexane. This type of extractor drips the hexane down onto the flaked soybeans to dissolve the oil in a manner similar to a coffee percolator.

Ninety percent of the solvent remaining in the extracted oil simply evaporates and, as it does, it is collected for reuse. The rest is separated with a stripping column. The oil is boiled with steam, the lighter hexane floats upward and the resultant condensate is collected.

The oil is then refined and blended for different applications with some of it being hydrogenated.

2. Refining

The refining stage is designed to remove the phospholipids and free fatty acids from the crude oil.

Refining may be done in two stages. The first is degumming.

The second stage of refining is neutralization or caustic refining. This process removes the free fatty acids present in the crude oil. An alkali solution, usually sodium hydroxide, is added and it reacts with the free fatty acids to produce soap. This soap is insoluble in the oil and is easily separated with water washing. The alkali solution also neutralizes any acid remaining from the degumming stage.

The alkali will also react with the triglycerides in the oil, so the neutralization parameters (type of alkali, solution strength, temperature, agitation and time) must be optimized to minimize the yield loss. There

may be additional losses from emulsification and oil droplets suspension in the soap solution.

A by product of the caustic refining is a mixture of soap, water and oil known as soapstock. This has been considered as a low cost feedstock for biodiesel but its high water content and conversion of the soaps to methyl esters are significant obstacles for cost-effective utilization.

Instrumentation

At solvent extraction, the amount of extracted oil in hexane can be measured with the K-Patents Process Refractometer PR-23. Typically there is about 30% oil and 70% hexane. The process temperature is 60°C (140° F).

After the extraction, the solvent is recovered in the separation column. The Refractive Index of the oil after solvent removal can be monitored for quality control purpose. With in-line control, the extraction process can be controlled more effectively and extraction efficiency optimized.

The concentration of caustic soda is also monitored using a K-Patents refractometer so that the neutralization process proceeds efficiently. Appropriate equipment hazardous and intrinsic safety approvals are available for hazardous area installations.

Instrumentation	Description
	K-Patents Sanitary Compact Refractometer PR-23-AC for small pipe line sizes of 2.5 inch and smaller. The PR-23-AC sensor is installed in the pipe bend. It is angle mounted on the outer corner of the pipe bend directly, or by a flow cell using a 3A Sanitary clamp or Varivent® connection.
	K-Patents Sanitary Probe Refractometer PR-23-AP for installations in large pipes, tanks, cookers, crystallizers and kettles, and for higher temperatures up to 150°C (300 °F). Installation through a 3A Sanitary clamp.
	K-Patents Process Refractometer PR-23-GP is an industrial refractometer for large pipe sizes and tanks, cookers, crystallizers and kettles. Installation through a flange or clamp connection.
Area classification:	Intrinsic safety and hazardous area approvals available.
Measurement range:	Refractive Index (nD) 1.3200 – 1.5300, corresponding to 0-100 Brix.