

**The Knowledge Bank at The Ohio State University**  
**Ohio State Engineer**

**Title:** Synthetic Lard

**Creators:** Fisher, Clarence N.

**Issue Date:** Feb-1931

**Publisher:** Ohio State University, College of Engineering

**Citation:** Ohio State Engineer, vol. 14, no. 4 (February, 1931), 6, 16-17.

**URI:** <http://hdl.handle.net/1811/34747>

**Appears in Collections:** [Ohio State Engineer: Volume 14, no. 4 \(February, 1931\)](#)

# SYNTHETIC LARD

By CLARENCE N. FISHER, Che.E. 1

Crisco, an artificial substitute for lard, is manufactured by the Procter & Gamble Company whose home offices are located in Cincinnati, Ohio. How this company, whose chief product is soap, came to be the first soap concern in the United States to manufacture a lard substitute is most interesting.

Up to the early part of the century the Crossfield and Sons, Ltd., an English firm, were making a lard substitute by using the process of hydrogenation. Edwin Cuno Kayser was responsible for the development of the hydrogenation process. In the fall of 1907 Kayser left the employment of this company and started for America, bringing with him samples of the lard substitute which he had developed. While he was at sea he radioed several companies in this country which were engaged in the manufacture of soap, stating that his process would be most valuable to soap manufacturers. The Procter & Gamble Company notified him to come on to Cincinnati.

Negotiations were made between Kayser and the company, and during the autumn and winter of 1907-1908, he was allowed by the general manager of the company, Burchenal, to set up an experimental plant at Ivorydale. During that winter the first samples of a lard substitute were made in this country. The first product was called Flake White and is still manufactured by the company. It is a harder compound than Crisco. Crisco was not placed on the market until 1911. After Kayser developed the process here, he returned to his own company. Why he left his own company and came to the Procter & Gamble Company and then returned to England has been an unsolved mystery to everyone including the District Courts of the United States, except the managers of the Procter & Gamble Company.

During the year 1911 to 1915 a bitter contest was fought in the District Courts concerning the manufacture of an edible product such as Crisco, using the hydrogenation process. The Tallow Bleach Company of New York argued that they had the right to manufacture a product very similar to Crisco. As both companies used different chemical methods in the control of the manufactured product and as certain tests were very delicate, more time was wasted in discussing the chemical methods of analysis than was actually used in arguing the case.

Crisco is manufactured from refined, bleached, hardened, and deodorized cottonseed oil. Its chemical composition varies slightly, containing from 26 to 27.3 per cent stearin, 52.9 to 57.8 per cent olein, and 16.2 to 19.8 per cent linolein. As the cottonseed oil goes through many processes before it reaches the packing department as a finished product, the different steps of manufacture will be described in order, namely, the refining process, bleaching process, hardening process, gas plant operation, deodorizing process, mixing operation, packing operation, and laboratory control work.

The cottonseed oil which has been extracted from cottonseed in the Buckeye Cottonseed Mills,

owned and operated by the Procter & Gamble Company, is shipped to Ivorydale in the company's tank cars. Upon arrival at Ivorydale the crude cottonseed oil is pumped from the tank cars to the Oil Refinery building. A sample of the oil is taken at this time and sent to the laboratory for tests of color, free fatty acid, bleach and refining, and deodorization. The oil is then refined by pumping it into the refining tanks and mixing it with the required amount of caustic soda lye. The caustic soda reacts with the free fatty acids to form cottonseed oil foats, or soap, which settle to the bottom of the refining tank and are later removed and shipped to the soap department of the plant. The refining tank consists of a large cylindrical tank with a conical bottom containing a steam heating unit resembling a spider web. This unit supplies the heat necessary for the refining operation. A swing pipe is used to pump off the refined oil after the foats have settled to the bottom of the tank.

After the oil is refined, it is pumped into another tank containing a steam heating unit very similar to the one in the refining tank, and mixed by means of an agitator with Carlton Earth, or carbon, or both, until the color drops to the required standard. The oil must now be filtered through large filter presses in order to remove the carbon and earth bleaches.

From the bleaching tanks the cottonseed oil is pumped to another building called the Hardening Plant. In this building is located the hydrogenation equipment which plays the main part in the manufacture of Crisco. The oil is pumped into the hydrogenation tanks, which are very similar to the refining tanks, and mixed by means of a tank agitator with the nickel catalyst. This mixture is then heated by the steam coil, or by means of hot circulating oil in the bottom of the tank to the desired temperature of about 130°C. All of the hydrogenation tanks are equipped with automatic temperature recorders so that the operator can readily read off the temperature of any tank. When the temperature has risen to 130°C., hydrogen is allowed to bubble up through the hot mixture of oil and catalyst, converting the triolein into solid tristearin. The longer this operation is continued the harder will the cottonseed oil become until a point of saturation of the triolein molecule occurs. By experience the operators know how long to continue the operation to produce the required hardness, otherwise samples from the hydrogenation tank would have to be taken every one-half hour to determine the iodine number and congealing point of the oil. This latter method of control is used in the manufacture of B and C Crisco, which is manufactured for certain large baking companies.

As hydrogen will not saturate the triolein molecule found in cottonseed oil in the absence of a catalyst, it is necessary to use some substance that will bring about the chemical reaction. In the manufacturing process of Crisco a nickel and

(Continued on Page 16)

---

## SYNTHETIC LARD

(Continued from Page 6)

copper catalyst suspended in oil is used. It is readily seen that the use of a catalyst increases the operating costs, but no method has been found whereby hydrogen alone will bring about the chemical reaction.

After the oil has been hardened to the manufacturing standard, it is pumped through the large filter presses removing the nickel catalyst. The oil runs into large supply tanks. The catalyst mixed with various bleaching and filtering substances is removed from the filter presses and shipped to the catalyst recovery department where the nickel and copper are recovered and used over again in the manufacture of new catalyst.

Hydrogen gas is manufactured in the Gas Plant which is located some distance from the Hardening Plant. Hydrogen is prepared by passing steam over heated carbon with the formation of hydrogen and carbon monoxide. The two latter gases are then passed over a suitable catalyst forming hydrogen and carbon dioxide. The carbon dioxide is absorbed in a suitable solvent leaving the hydrogen free, which is pumped into the large gas tank. Samples of the gas are taken at different locations on the gas lines every day and analyzed.

When the hydrogenation tank of oil has been nearly all filtered, a sample of the oil is taken and sent to the laboratory for tests of free fatty acid, color, and congealing point. It is at this stage of the process that the hardened oil must meet all of the requirements of the standards of manufacture. The percentage of free fatty acid must not be over 0.10 per cent, the color must not be over 2.7 using the standard color equipment of the American Cottonseed Crushers Association, and the congealing point must be within a variable limit whose minimum and maximum fixed limits are only 1°C. apart. The congealing point is made to vary from time to time depending upon the season of the year. The oil is made harder in the summer than in the winter, so that it will not melt at summer temperatures.

If the oil meets the required standards, it is pumped to the Deodorizing Plant, which contains the equipment for removing the odor from the oil. The deodorizer is a tank very similar to the hydrogenation tank except that it is closed and has a goose-neck top. The oil from the Hardening Plant is pumped into the tank, and the vacuum pump is started, a vacuum of 28 to 29 inches being maintained throughout the operation. The oil is heated by means of the steam coils to a temperature of about 250°F., and then superheated steam is passed through the oil. This brings the temperature of the oil to about 400° to 575°F., and this temperature is maintained throughout the operation. Six hours are required for the deodorization. The substances which give

(Continued on Page 17)

**SYNTHETIC LARD**

(Continued from Page 16)

the oil its odor are volatile at the temperature of the superheated steam and are driven off.

As soon as the process is completed the deodorizers are sampled and these samples are sent to the laboratory for the same analyses that were run on the hardening plant samples; namely, free fatty acid, color, and congealing point. The cottonseed oil should now have practically the same analyses as it had before deodorization, except color. The color should rise about .1 red, but sometimes the oil is burnt in the process and the color will become darker than the maximum allowed by standard. In this case the burnt oil is used for some other purpose, or it is mixed with lighter oil to bring the color within the manufacturing limits.

After the deodorized oil is found to be satisfactory, it is pumped to the Crisco building where it is mixed by lard rolls. The Crisco building is the cleanest building found at Ivorydale. The conditions are so sanitary in this building that all Crisco manufactured is exempt from government inspection. This building contains, besides the lard rolls, the packing machinery and storage rooms.

The lard roll consists of a large roll supported in a frame which revolves at the rate of from 30 to 75 revolutions per minute against a steel scraper. The cylindrical roll is hollow and is kept cool by means of brine or ammonia. The hot cottonseed oil is run into the lard roll and becomes cool by the time it revolves around to the scrapers and drops down into the conveyor trough located below the cylinder. The conveyor screw revolves at the rate of about 90 revolutions per minute which beats the hardened oil up so that from 12 to 15 per cent of air is incorporated into the Crisco. This gives the Crisco its pearl white color. From the conveyor the semi-solid Crisco is pumped to the packing machines which fill and weigh the tin cans automatically, or it is pumped into wooden barrels.

The plant is not allowed to carry out any process in the manufacture without the laboratory approval. When the cottonseed oil is pumped from one plant to another, samples are always taken and analyzed. In this way one plant can check against another plant carrying on a different operation. A long process of manufacture like this is impossible without laboratory control and the uniformity of the product indicates its efficiency.

**HILL TAILORING CO.**

*Fine Custom Tailored*

SUITS \$25<sup>.00</sup> O'COATS  
UP

*Tailors to Young Men*

1899 N. High St.  
at 16th  
UN. 2864

972 Mt. Vernon Ave.  
Corner Denmead  
FA. 6416



Long's Book Store  
Introduces  
Famous  
Campus Leaders

**FOY D. KOHLER**

President  
Student Council

As President of the Student Senate, Kohler is recognized as being the first of all campus leaders. By right of this office, he is a member of almost every important board and committee on the campus. He is well qualified for his position, having been secretary of the Senate last year. He is also business manager of the Alumni Monthly. He is a member of Bucket and Dipper, Sphinx, and Delta Upsilon Fraternity.

"I Saved Money at Long's . . ."—Says Foy D. Kohler

I have saved money by purchasing my books at Long's almost every year since I started at Ohio State. I usually save more by getting used books, but Long's price list also shows a saving on new ones. Another thing that I like about Long's is the service. They have the books, and if they do run short, they get a new supply as soon as possible.

Foy D. Kohler.

**LONG'S BOOK STORE**

Fifteenth Avenue at High Street

**LUFKIN**

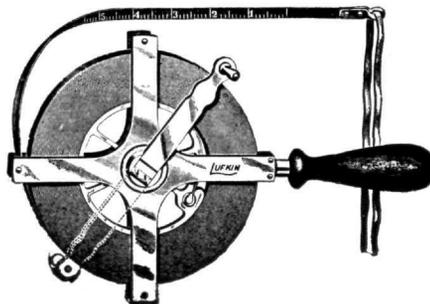
**TAPES AND RULES**

In your Profession the fellows already out on the job find Lufkin products unsurpassed for

**ACCURACY, DURABILITY, AND CONVENIENCE**

You would do well to profit by their experience.

Send for Catalog



**THE LUFKIN RULE CO.**

SAGINAW, MICHIGAN  
New York Windsor, Canada