composition included as products the hydrocarbons with smaller molecular weights.

(3) The nitrogen and sulphur constituents of petroleum could only have been formed directly from or through the agency of animal organic matter.

There is an attractive field for the chemical geologist to study, more intimately than has ever been done, the occurrence of petroleum in connection with its composition.

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COTTON SEED OIL INDUSTRY OF THE SOUTH.[1]

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COTTON seed oil is an oil obtained from the prolific cotton plant, which is the chief agricultural product of the South. It is obtained in the following manner:

The seed, after being freed from dirt and grit, is passed through gins to remove the greater part of adhering lint. From the gins it is passed through hullers, which cut and crack the hull of the seed. The hull is then removed from the contained meats as far as possible, by suitable machinery. The meats are then passed through rolls, and then to heaters provided with steam jackets and suitable stirring gear, where the meats are cooked, in order to allow a freer flow of oil. Finally the meats are transferred to hydraulic presses where the oil is expressed.

The products thus obtained are crude cotton seed oil and cotton seed cake, with which latter we are not here concerned.

Crude cotton seed oil is a vegetable oil, liquid at the ordinary temperature and varying in color from light red to black. It contains some moisture, often a little cotton seed meal, coloring-matter, and mucilaginous matter. It consists, aside from these impurities, of a mixture of the glycerides of chiefly oleic, palmitic and linolic acids, and small quantities of hydroxy acids, varying quantities of free fatty acids, and products entailed by hydrolytic decomposition, possibly some phosphorized fats, and the usual unsaponifiable matter.

It is seldom employed in the arts in its crude state, and its value deteriorates in this condition. For this reason it is usually refined soon after production.

Refining consists of treating crude oil with the proper quantity of caustic soda solution of suitable concentration. The caustic soda combines with the free fatty acid and other impurities above enumerated forming a crude soap stock, which on account of its

[1] Read at the New Orleans Meeting of the American Chemical Society.

greater gravity settles to the bottom of the treating tank, leaving a moist, supernatant, neutral, refined oil. This oil is transferred to other kettles, to settle, and finally to dry by gentle heating. The refining process is now complete.

This refined oil is now graded as off, prime, or choice summer yellow according to its color and flavor.

Prime summer yellow cotton seed oil must be clear, sweet in flavor and odor, free from water and settlings, and of no deeper color than 35 yellow and 7.1 red on Lovibond's equivalent color scale.

According to the rules of the Interstate Cotton Seed Crushers Association, the color examination shall be made as follows: The oil is placed in a pure white four ounce sample bottle; the depth of the oil in the bottle shall be $5\frac{1}{4}$ inches. The bottle shall be placed in a tintometer which is protected from any light except reflected white light, and the reading made at the temperature of about 70° Fahrenheit. If the oil is of deeper color than the glass standard, 35 yellow, 7.1 red, it shall not be prime.

Off oils, of course, are those that do not come up to this requirement, either in color or flavor or both, while choice oils are those considerably above prime, in color, odor and brilliancy of appearance.

The distinctive term "summer yellow" is applied to distinguish oils from "winter yellow." The latter is obtained from summer yellow by chilling and removing the separated so-called "stearine." The liquid portion is winter oil, and is generally used as a table salad oil, while the solid portion is used in lard and butter substitutes.

Aside from the distinctive differences of color and flavor of various refined oils, the latter are further classified according to their bleaching qualities. Those that bleach well are set aside for white oils and lard compounds.

The uses to which cotton seed oil has been applied have already been indicated; namely, butter substitutes, lard compounds, and salad oils. These three classes of product annually consume large quantities of cotton seed oil, and it will be readily noted that cotton seed oil is essentially an edible oil. It is, in fact, but up to a comparatively few years ago it was not in nearly as much demand for edible purposes, especially in this country, as it is to-day, and large quantities were consigned to the soap kettle on that account. While the flavor and odor of prime oil is slight and pleasant in the cold, the reverse is true when it is heated, as it must be, in cooking and frying. The disagreeable odors emitted in the kitchen created a prejudice against the use of the oil and its products.

Various deodorizing processes have eliminated this trouble,

so that to-day cotton seed oil is used in ever-increasing quantity in cooking, baking and frying, with very satisfactory results.

Among high-grade cooking oils must be mentioned "Wesson oils" which have a remarkably fine flavor and are absolutely odorless. The manufacture of these oils has undoubtedly increased the consumption of cotton seed oil for edible purposes in this country and abroad. The process is due to the ingenuity of Mr. David Wesson, of New York. We have to-day Wesson butter oils, lard oils, salad oils and cooking oils, the distinctive feature of which is the flavor.

The low grades of off oils are used for soap-making, and miner's oil principally. We have therefore the following uses for cotton seed oil:

(1) Butter substitutes.
(2) Lard substitutes.
(3) Salad oil and canning oil.
(4) Cooking oil.
(5) Soap oil.
(6) Miner's oil.

Crude soap stock, the waste product of refining, is the true source of soap produced from cotton seed oil. This soap stock contains from 30 to 55 per cent. of cotton seed oil fatty acids, besides the impurities removed from crude oil, free and combined soda and water. It is very dark in color.

It is treated in various ways. The most common method is to thoroughly saponify all fats, which operation is known as "killing foots." The impurities are then washed out, and a yellow cotton seed oil soap remains. This is used as a fulling soap, or as a mixture with other soap materials to make laundry soap. Soap powders are also obtained from the material by mixing and grinding with soda ash.

Another method of treating is to separate all fatty matter with sulphuric acid, when a black grease is obtained known as pancoline. Pancoline contains from 90 to 92 per cent. of fatty acid, and a little water, some glycerine, some coloring-matter and some insoluble matter.

This black grease is usually distilled. The products of distillation are light colored fatty acids, red oils and pitch. Light colored fatty acids are used for soap stock. The pitch is an excellent roofing and insulating material.

It is hard to say how much of cotton seed oil is used for each of the above purposes. The demand abroad varies with the oil crops of European countries; and the amount of cotton seed oil that will be used for soap purposes depends a great deal on the relative cost of tallow and oil. Probably 75 per cent. of the total crop is used for edible purposes.

In regard to the production of oil in this country we can assume that for every two bales of cotton there is produced one ton of cotton seed. With a 10,000,000 bale crop, we would therefore have in round numbers 5,000,000 tons of seed of which about 60

per cent. is crushed. The balance is retained on the farms for foodstuffs, seed and fertilizer. Assuming that one ton of seed yields on the average 40 gallons of oil, we have an annual production of 120,000,000 gallons.

For the year ending September 1, 1905, there were exported from all parts of the United States 957,984 barrels of cotton seed oil, or about 51,600,000 gallons. The balance was consumed in this country, mainly for edible purposes.

THE SOUTHERN COTTON OIL CO.,
NEW ORLEANS, LA.

NEW BOOKS.

REPORT OF THE ROYAL HIGH SCHOOL OF AGRICULTURE AT PORTICI.

This work comprises the second series of the reports of this school, and includes Volume I, covering the year 1899, Volume II, for 1901, and Volume III, for 1902. Volume I, for 1899, contains a list of all the scientific papers which have been published by professors in the school. It does not contain any monographs of a strictly chemical nature. The most interesting report in the volume, for chemists, is written by Professor Eugenio Casoria, on Enology (pages 249–265). This paper contains the methods of analysis of wines as practiced in the Agricultural High Schools of Italy.

An interesting kind of wine is produced in Torre del Greco, near Naples, called *Lambiccato*. This is a kind of sweet wine, which is made by filtering the half-fermented must in order to remove the fermenting germs, and thus arresting fermentation. This half-fermented wine is used in the north of Italy for adding to the local musts for producing very delicate and highly esteemed beverages. The composition, shown by analysis, of this species of wine, gives the alcohol content as ranging from 3.42 to 9.45 per cent.

The second volume, covering the period of 1901, contains a number of articles of interest to chemists, the most important of which deals with the waters of the Vesuvian region, giving their incrusting properties and the method of purifying. A number of analyses of Vesuvian waters is given, and methods for diminishing their incrustations on boilers are discussed.

From the data of the analyses, and from the considerations set forth, it is concluded:

(1) That the encrusting power of water is decreased, or nearly