Reminiscences of a Well-Known Oil Chemist

Historical Aspects of Vegetable Oil Refining Particularly That of Cottonseed Oil

By DAVID WESSON

I CONSIDER it a great privilege to be able, from my own personal experience, to tell of the changes which have taken place in the cottonseed oil industry during the last forty-five years.

Photo by Alman

David Wesson

I first saw cottonseed oil in the laboratory of the N. K. Fairbank Company in Chicago, where I was employed as a cub chemist to analyze soaps for the new factory which had just started. One day, W. B. Allbright brought in a quart can and poured dark colored oil into a beaker, stuck his finger into the oil, passed it through his mouth, smacked his lips and said: "That is very good oil for the season—this is cottonseed oil—Wesson, see what you can do to get the color out of it." I had hardly heard of cottonseed oil before this time. Nothing had been said about it at the Massachusetts Institute of Technology, from which I had just escaped, so I tried pretty nearly every bottle on the side shelf except the one containing caustic soda, with very little result. After a while, Allbright came back, looked at my puny efforts, filled a metal cup with the oil, poured in some caustic soda, stirred and heated it, and lo and behold, I saw a golden colored oil soon floating above a dark colored mess in the bottom of the cup. Some of the oil was poured into a beaker and stirred with a little strong sulphuric acid and then neutralized with caustic soda, leaving light colored oil. Allbright explained to me that was the kind of oil they wanted to put in some of their compounds.

The refining of cottonseed oil, was a great mystery to the outside world, and it was some time before I was allowed even to go into the factory where it was handled on a large scale. I found out afterwards, that the first oil was brought to the factory in barrels and for secrecy was called #3. The crude oil was known as #3A, yellow oil as 3B and white oil as 3C. The first white oil was made by bleaching with sulphuric acid and then chloride of lime was afterwards used with the addition of sulphuric acid as a bleach. Shortly previous to 1880, a broker in Chicago, Henry Bausher, introduced an Oriental gentleman from Morocco, I believe. He showed how they bleach olive oil by stirring it up with clay and letting it settle. The clay absorbed the color and clarified the oil. An extensive research consisting in testing of clays from all over the country finally resulted in using fullers' earth from England as a bleaching agent. The first use of fullers' earth was rather primitive. The powdered earth was agitated in the kettles with air and allowed to settle. After the clear oil was pumped off, the sludge was at first thrown away. It was then found desirable to boil it up with sulphuric acid in lead lined tanks and press the oil out of it. The oil was very dark colored and was called "plug hat."

A bright young man, named Henry Eckstein, suggested the use of the filter press to separate and clarify the oil instead of settling. With a little press two feet square, he demonstrated his idea, and received a new suit of clothes as a reward. Larger four foot filter presses were next installed, and at first the spent earth was thrown away. It was afterwards found that considerable oil could be recovered by boiling with acid and then pressing. Next, somebody evolved the idea of blowing air through the presses and then steaming them so as to get all the oil possible. This method was in operation forty-five years ago, when I first entered the industry. Needless to say, the oil had a strong flavor of fullers' earth and comparatively small amounts were used in making refined lard. Oleostearine, just coming into use as a by-product of the oleomargarine industry, was used to offset the softening influence of the oil.

At this time, the literature regarding cottonseed oil and the refining thereof was very meager. My only guide books were Allen's

Commercial Analysis, published in 1886, and Schaedler's "Die Technologie Der Fette und Oele," published about the same time. They both told about alkali refining and bleaching, but as usual, with such books, the information was of comparatively little use for factory purposes. In 1886-7, the American Cotton Oil Trust, embracing practically all the cottonseed oil mills and refineries, was organized. In order to secure the best possible methods for producing refined oil, a committee, consisting of C. C. Nichols, of the Union Oil Co., Providence, R. I., Omar T. Joslin, of the American Cotton Oil Company, Cincinnati, Jules Aldige, Jr. of Aldige Co., New Orleans, and the writer, were appointed to visit the various oil refineries of the country, report on the methods found in use, and suggest the best possible procedure.

A few extracts from the report of the committee, which I have before me, may prove interesting.

"1st, The character of the refined oil must depend upon the character of the crude. This being the case we feel we cannot call too much attention to the necessity of using the greatest care in the handling of the seed and the manufacture of the crude oil. We find great variations in the products of the different mills, not only in different localities, but in the same locality. We feel that the producers of crude oil fall far short of understanding the vital importance of making the best crude possible, as from this starting point, we must expect the greatest possible results in maintaining and improving the high reputation of American Refined Cotton Oil for edible purposes.

We cannot too strongly condemn the practice of mixing in small quantities of damaged seed with good, the smallest percentage seriously effecting the quality of the oil when refined."

"2nd, Proper settling of crude—Oil for shipment to refineries at distant points should be thoroughly settled, as the settlings have a tendency to ferment and sour the oil as well as adding to the refining loss."

"It also adds to the expense of cooperage on account of the difficulty of cleaning and loss of material. The question of the disposal of settlings is one worthy of very careful investigation; to work them over through the heaters with the seed or separate them from the oil to be refined like crude."

"Cooperage—We feel that more careful attention should be given to this matter by crude oil mills. Gluing barrels is neither desirable or necessary. Crude petroleum, lubricating oil, varnish, tar, turpentine barrels should not be used for prime crude oil."

Cooperage was an important matter in those days. Almost all oil was shipped in barrels, and all kinds of barrels were used—whisky barrels, kerosene barrels, gasolene barrels, lubricating oil barrels. They came north in box cars. Those which reached New York were handled from the cars to the refineries by lighters, and a lighter-load of barrels of cottonseed oil had so many beautiful colored barrels that it looked like a huge pack of fire crackers. I remember on one occasion, a load of crude oil was emptied from the barrels in the factory of the N. K. Fairbank Co. in 14th Street, New York. By some mistake a barrel of whisky came in with the oil and the mistake was not discovered until it was emptied into the tank. It did not improve the oil any for lard purposes, and the whisky was spoiled for its customary use.

The committee found there were two distinct methods of refining, namely: agitation of the tanks by air and mechanical methods. They condemned the agitation by air, on the ground that it increased refining losses and incited a decided tendency to rancidity. Mechanical agitation was recommended as giving a minimum loss with the least exposure to air. Three styles of refining tanks were found. First, round tanks with flat bottoms, second, round tanks with conical bottoms and third, square tanks, with semi-cylindrical bottoms. The latter were provided with horizontal shafts and the oil was stirred up very much in the same manner as the water is agitated by the paddle wheels of steam boats. It was found that soap stock in some of the refineries was converted into a cheap grade of marketable soap.

The committee recommended that the strength of the lye be left to the discretion of the refiner. At one place, it was found that the refiner judged the strength of his lye by taking a few drops and rubbing them between his fingers. Methods for finishing the oil varied in different plants. The Union Oil Company used very large settling tanks about four feet deep and eighteen or twenty feet square. Some of those in the Providence refinery which were called finishing tanks were provided with steam coils and placed so as to obtain the full benefit of sunlight from the large windows. The oil was heated to about 220 degrees F. and came out a beautiful light color with a somewhat rancid flavor. This was the material from which the pure salad and the olive flavored brands of the Union Oil Company were produced. The methods of finishing found in the Memphis plant consisted in heating the oil to 120-130 degrees, and blowing air violently through it until it became brilliant. The finished oil was of course rancid. In those days large quantities of oil were sold for miners' lamps and we found that the oil for this purpose was bleached with bichromate of potash and sulphuric acid, and afterwards neutralized with caustic soda. The oil, after this treatment, was chilled in large cellars cooled by ice, and then pressed in cloth bags

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Reminiscences

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in presses such as were used for making lard oil. At the plant of the American Cotton Oil Company in Cincinnati the winter oil plant consisted of the cellars of an old wine house.

The last paragraph of the report is worthy of note. It reads as follows:

"Your committee desires to add to the above report that we find at all points of our investigation we have been continually confronted with questions requiring for their solution, careful and scientific study. In order to obtain such definite information as is necessary to carry the manufacture of the various products of the cottonseed to its highest perfection, the committee advises the establishment of a Chemical Bureau, which will be competent to cope with the many problems continually being presented."

One of the results of this report was the establishment of a laboratory at the N. K. Fairbank Company plant in Chicago.

The writer received samples of cake, meal, meats and oil from all the plants of the Cotton Oil Trust. Many of the meal samples ran as high as 18 or 20% oil. The meals ran pretty high in ammonia, as the art of incorporating the hulls had not been invented. The only test given to the hulls was the inspection for free meats. The oils were tested for free fatty acids and refining tests were made. A complaint was made to the general manager about the large amount of free fatty acid found in the oil from a certain mill. The manager replied that he had never had any free fatty acid on the place and it could not have been in his oil.

In about 1893, Henry Eckstein found out, in England, that blowing steam through refined oil would remove its odor. In conjunction with James Boyce of the N. K. Fairbank Company and with the help of the engineering department of the same company, apparatus was evolved for heating the oil very hot by means of closed steam coils and blowing the steam through the hot oil, which was afterwards cooled. The work was carried on under atmospheric pressure and was known as the Eckstein process. In 1900, the writer found that he could improve on the Eckstein process by conducting the deodorization of oil in vacuum. This was a marked improvement over the Eckstein process, and forms the basis of modern practice, each refiner working in his own manner. In addition to the use of the vacuum, various important refinements and secret details have made the so-called Wesson process maintain its pre-eminent position. In about 1908, the process of hydrogenation appeared, and what has happened since is so familiar to my readers and so recent, that it can hardly be considered historical.

Nutrition and Mayonnaise

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The appetizing refinements in the preparation, serving and appearance of food to which many have become accustomed have developed a need for them, and they determine to a large extent the desire for food and the feeling of satisfaction that results from a meal that is relished. Has not the succulent green lettuce and bright red sliced tomato salad with its billowy puff of mayonnaise contributed to the value and pleasure of a meal and thereby established for mayonnaise a position both useful and delectable?

Mayonnaise is one of our most concentrated foods, in that it consists largely of vegetable oils and protein that are almost completely assimilated. It furnishes vitamins and minerals. What is more important is that mayonnaise encourages the consumption of those essentials in which it as well as other foods we eat may be deficient. That mayonnaise has established for itself an important position in the American dietary is shown by the size and prominence of your Association, and it will maintain and improve that position if your organization will keep abreast of the developments in our energetic nation.