Corn Oil Preparation and Usefulness

*A Historical and Descriptive Sketch Outlining the Growth and Development of the Corn Oil Industry**

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FIFTY years ago there were a number of plants grinding corn or maize for the production of starch, but the whole kernel went to the burr mills for grinding, the embryo or germ separating from the starch with the hull or fibre and the gluten after grinding. The latter constituted the cattle feeds the same as today, but considerable difficulty was encountered in the feed dryers due to the gummy material which formed on the inside from the oxidation of the oil. We are indebted to Dr. Behr of the old Chicago Starch Plant for the invention of our present system of separating the germ from the rest of the kernel. Dr. Behr was the second man to receive the Perkins Medal and these germ separators constituted one of the reasons for the award. He built the first separator at the Chicago Plant and they are built in the same form today. They were the biggest forward step in the starch industry up to that time. It remained however, for Thomas Gaunt to make the first plant installation at the Peoria Starch Plant, then operated by the Hamilton Brothers. Shortly after this all corn grinding plants installed germ separators, and the separation and pressing of the germ for oil had come to stay.

Corn Grinding Processes

THE first step in the grinding of corn is the cleaning of the shelled corn to remove all traces of cob, dust or any other foreign material. The cleansed kernels then go to large cylindrical vessels, called steeps, where they are allowed to soak or steep for thirty or forty hours in warm water slightly acidified with sulfurous acid. During this time the grain is softened and separation into its different parts is easily accomplished. The softened corn then is ground in attrition mills in which the kernel is cracked or torn to pieces without injury to the germ. From the attrition mills the cracked corn is passed through the germ separators. These are long deep troughs narrower at the bottom than at the top, having a weir at one end. They are kept full and constantly overflowing with starch milk of about 7° to 8° B. They are also equipped with spiral agitators on the bottoms and slow moving rakes on the top surfaces. The bulk of the grain settles to the bottom but the germ, owing to its oil content, floats and is carried by the rake to the end where it flows over the weir with the starch milk. The heavy particles which sink to the bottom are removed for further treatment, but we are concerned only with the germs. These, flowing from the separators, are strained from the starch milk and washed with water to free them from adhering particles of starch and gluten by passing them through revolving sieves called reels. They then are pressed in squeezers to remove as much water as possible before drying in large steam heated rotary dryers. The germs contain about 50% of oil which is about 3.5% on the corn. Originally this oil was extracted by hydraulic presses after the germs had been further prepared by being crushed between corrugated rolls, dampened and heated by vessels called germ cookers. The hydraulic presses produced a first class crude oil, but from 14% to 16% of oil was left in the cake.

Oil Expelling

LOUIS BAUER was the first to try the Anderson expeller for extracting oil from germ, but without much success. G. A. Chamberlain, late of the Staley Company at Decatur, had much faith in the expellers and for experimental purposes installed some at the Granite City Starch Plant. The expellers were there when Jefferies was made superintendent of the plant. Through his efforts,

* *Presented before the Fourth Annual Fall Meeting of American Oil Chemists' Society, Chicago, November* 14, 1930.

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about 1910-11 they were made to operate satisfactorily and the hydraulic presses were removed from the plant. Today the expeller has replaced all presses, increasing the yield of crude oil and producing a cake with an oil content as low as 7%.

The oil from the expellers is filter-pressed to remove all fine particles of germ or fibre and then allowed to cool and settle in large storage tanks from which the clear oil is drawn off and sent to the refinery. The quality of the crude oil, is as a rule, very satisfactory in regard to free fatty acid, but varies somewhat, depending upon the quality of the corn. Occasionally when the corn crop has been of poor quality, the free fatty acids in the crude will exceed 3% to 4%. I can recall one year when the average free fatty acid was around 9% and I have refined oil having a free acid content as high as 21%. While the principle of the recovery of the oil is simple, the technical steps have to be carefully supervised, as careless operation of the germ dryers and the expellers will result in an oil having not only an increased free fatty acid content, but also a color which is practically impossible to remove.

Refining Treatments

A GOOD crude corn oil readily responds to the refining treatment and produces a highly nutritious and palatable oil, excelled by none. The free fatty acids, albuminous matter and most of the non-glyceride compounds of fatty acids are removed by treatment with caustic soda liquor. All traces of soap resulting from the alkali treatment are removed by a special process, and the odor and foreign flavor by deodorizing with live steam under high vacuum. Corn oil can be used in all places where a high grade oil or fat is used. It is an excellent shortening and is used in the making of all forms of salad dressings. In the making of mayonnaise, it is easily emulsified and the emulsion is stable. Many mayonnaise makers lay their failures to the oil when it is often the other ingredients, particularly the eggs, that are at fault. A poorly refined or rancid oil will emulsify and produce a good-bodied dressing though of unsatisfactory flavor. Many mayonnaise manufacturers prefer corn oil, especially in the winter months, because of the low solidifying point. Oils of higher solidifying point tend to crystallize on chilling, the crystals piercing the egg coating of the oil particles, causing an oil separation when the dressing is again brought to the average room temperature.

Corn oil is an ideal material for the making of pie crust and the baking of cakes. It is used in the popping of corn, either by popping the corn in heated oil or coating the popcorn after popping in electric heaters. In this case it is much preferable to butter. Corn oil is an excellent medium for deep frying of doughnuts, fritters, potatoes and adds a delicate flavor to fish. In any recipe specifying lard, butter or lard compounds, corn oil can be used with equally as good and often more satisfactory results.

There is one point I want to mention particularly. Many large users of corn oil specify, it must be negative to the Kreis test for rancidity. Undoubtedly all refined corn oil when fresh is negative to the Kreis test, but care must be used in the method of applying the test. Often corn oil when shaken in a test tube with concentrated hydrochloric acid will give a pink color in the acid layer. If phloroglucin solution is then added the pink color remains for a short time leading to erroneous conclusions. On standing, however, the pink color disappears which is not the case with a positive test. There has been much controversy on the reliability of the Kreis test and in view of the above it is easily seen how one can misjudge. As a matter of fact, we put more faith in the haemoglobin test for incipient rancidity than we do in the Kreis test, as it will show a slight color on an oil at what might be called the turning point though still negative to the Kreis test and a strong color on an oil positive to the Kreis test.

I want to thank Mr. F. L. Jefferies and Dr. Otto Sjostrom for many of the points in the early history of corn oil production.

Golfers Prepare ! !

The Golf Committee for the Annual Convention of The American Oil Chemists' Society, consisting of N. C. Hamner, *Chairman,* J. J. Vollertsen and H. P. Trevithick, undaunted by snow on the greens, is already hard at work paving the way for an interesting tournament to be held at New Orleans in May, 1931. The Committee have received many entries for the tournament already and urge all members to send in their entries, accompanied by their handicaps (reasonable handicaps are preferred, and all others will be subject to censorship), at the earliest possible date. Several of the companies who supply apparatus and materials to the oil industries have already signified their intention of donating prizes for the tournament, and Chairman Hamner states that the prizes will be well worth the golfers' best efforts.