What Is a Refined Oil

Various Definitions and Classifications Evaluated and Compared

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THE subject "What is a Refined Oil" is of rather large scope, because refined oil includes all kinds of oils used for edible as well as for technical purposes. My knowledge and experience has been principally with cottonseed oil, and, therefore, I will confine my remarks to this specific oil.

To refine means to "purify." The meaning of purification varies greatly, however, depending upon not only for what purpose the oil is used but also in what country the refining is being done.

A "refined vegetable oil" may mean an oil simply purified by the method of settling, or it may mean an oil treated with acid, or it may mean an oil purified with an alkali, filtered or bleached with fuller's earth, or a similar filtering medium. It may also mean an oil which has not only been neutralized and filtered but deodorized; it may mean a winterized oil or a hydrogenated oil. Someone may insist that an oil is not properly refined if he does not agree with the flavor and odor of same. Others may say that an oil is not properly refined if it contains more than a certain amount of free fatty acid, and in this way there are many ideas of what constitutes a properly refined cottonseed oil.

Traders' Definition

On the Exchanges of this country where refined cottonseed oils are traded in and among vegetable oil chemists and traders I believe by "refined oil" is generally meant an oil which has been alkali refined and filtered.

The advancement of science has made it possible to further treat, or I might say further refine or process cottonseed oil and thereby produce oils more suitable for many purposes than the oil which has only been alkali refined. Not only color, taste or odor, but even the chemical and physical characteristics of such oils may differ to quite some extent from the characteristics of the oil which has undergone no other treatment than alkali refining, in view of which some large consumers when making their purchases of refined oils sometimes demand specifically some tests with which the refined oil must conform.

To buy according to such rigid specifications is not, however, the rule but rather the exception, most of the refined cottonseed oil today being bought either according to the grades as defined by the Interstate Cottonseed Crushers' Association, New York Produce Exchange, or New Orleans Cotton Exchange; or according to the trade names given to the refined oil by the various manufacturers.

The refining of a crude oil is done in many steps. The first process is elimination of substances held in suspension or emulsion, coagulating the albuminous matters, saponifying the fatty acid and resinous matters, destroying enzymes, removing to a certain extent the coloring matters, etc.

The first step in the refining process can be carried out in several ways, however, in this country still today is probably universally done by means of adding caustic soda to the crude oil under agitation and heating, later decanting the refined oil, settling, and finally filtering it with a filter medium, usually fuller's earth.

The refined cottonseed oil thus produced was years ago used not only for technical purposes, but very largely also for edible purposes. Today, however, comparatively little cottonseed oil of this quality (that is not further treated) is used for edible purposes.

However, the trade rules as adopted by the New York Produce Exchange, Interstate Cottonseed Crushers' Association and New Orleans Cotton Exchange evidently still refer principally to cottonseed oil not further treated, and in fact the New Orleans Cotton Exchange specifically prohibits the tendering of deodorized refined cottonseed oil.

Lack of Uniformity in Rules

The Interstate Cottonseed Crushers' Association and New York Produce Exchange clearly specifiy that caustic soda shall be used for making laboratory analyses of crude cottonseed oil, but nothing is mentioned about how a refined oil should be produced on a commercial scale, and it is evidently left to the individual refiner to apply whatever refining method he desires.

The rules do not specifiy what makes an oil a "refined" oil, but in defining the various grades of refined oil, however, certain limitations as to color and percentage of free fatty acid are mentioned; further, it is in most cases positively stated that the oil shall be free from water and settlings.

I have tabulated the specifications for the various grades of refined cottonseed oil according to the trading rules of the Interstate Cottonseed Crushers' Association, New York Produce Exchange and New Orleans Cotton Exchange, and it is apparent from the table that some of the grades mean different things, according to under what rule the grading is done; for instance, the grade "Prime Summer Yellow" means different qualities according to the Interstate, Produce Exchange or New Orleans Cotton Exchange rules, and in the same way the grade "Bleachable Prime Summer Yellow" does not necessarily mean the same according to Interstate's rules and New Orleans Cotton Exchange Rules as compared with Produce Exchange rules.

The grade "Good Off Summer Yellow" means the same according to Interstate's rules and Produce Exchange rules, but does not necessarily mean "Good Off Summer Yellow" according to New Orleans Cotton Exchange rules.

The difference in the meaning of the same grade is visible from the tabulated statement on page 302.

Interstate Cottonseed Crushers' Association and New York Produce Exchange rules further specify that the refined oil produced from extracted crude oil is not a good tender unless the nature of the oil is declared at the time of sale.

We are often inclined to consider the expression "Refined Oil" synonymous with a "neutral oil" so far as free fatty acid is concerned. The trade rules, as you know, however, tolerate an appreciable amount of free fatty acid even as high as three-quarters of one percent in reddish off oil.

Therefore, a refined oil may legitimately contain even a higher percentage of free fatty acid than is found in good crude oil.

Water in the refined oil, as I have already mentioned, is not permitted, and I suppose by water is meant such water which can be detected in the form of cloudiness or drops with the naked eye, as mostly all commercially refined oils tendered on Exchange contracts contain moisture, sometimes more and sometimes less, but probably always some. Unfortunately, the official moisture test is very unsatisfactory. In rule 272 of Interstate Cottonseed Crushers' Association's rules there is given a description of how to make a test on moisture or volatile matter. The title of the rule indicates that the loss in weight may be due to not only moisture, but also to volatile matters. In spite of same the instructions are to report the loss as moisture.

Evidently what the Chemist has to report as moisture in many cases is no moisture at all. For that reason I believe that many users of refined cotton seed oil misunderstand or give too great importance to this so-called moisture test.

In the beginning of my remarks I mentioned that when different consumers talk about a properly refined oil they may have in mind entirely different qualities of oil. For instance, those still today who use refined vegetable oil as lamp oil look at the refining process not from the point of view of neutralizing the free fatty acids, but principally from the point of view of removing the impurities in suspension or emulsion, and they are especially interested in having a refined oil free from soap in solution.

Various Steps of Refining

The alkali refining process does only to a limited extent affect the constituents of the oil which are responsible for its specific flavor or odor, but the consumers of refined oil for edible purposes desire oils free from all flavors or odors if possible, and are only in special cases willing to use alkali refined oil not further treated. Even if the oil is sweet in flavor and odor, which is the expression used in the rules for prime oil, still the peculiar taste or odor which is characteristic of cottonseed oil is present and is often objectionable. Through the deodorization process, which as you know, consists of blowing super-heated steam under vacuum through the hot oil the flavor or odor of the refined oil is partially or entirely eliminated. The deodorization process can be carried out more or less successfully, and therefore when a consumer of edible oil talks about "properly" refined or "neutral" oil, he has principally in view a well-deodorized oil which either has no taste or odor at all, or if any, a pleasant one. The deodorization process does not change materially, as a rule, the principal characteristics of a cottonseed oil, nor the chemical composition of same, but nevertheless the effect is far reaching and the deodorization process I believe should be considered as part of the refining process.

Very large quantities of refined cottonseed oil are being used in the manufacture of shortening. Not only is it important that such an oil be well deodorized, but it is very important that the oil be of a light color. And "properly" refined oil for this trade therefore in addition to alkali refining and the deodorization process must as a rule be treated with a bleaching

medium such as raw or acid treated fuller's earth, or activated carbon. The effect of the bleaching medium on the refined oil has not yet been sufficiently studied. Probably some of its effects are due to the physical absorption of colors and some effect is due to chemical reaction. No doubt the bleaching should be considered part of the refining process.

When cottonseed oil is to be used by the margarin trade, an excellent flavor and odor of lasting quality is paramount, but the color of the oil also plays an important role. Some margarin manufacturers desire a very light oil, when again others desire a dark colored oil. All depending upon what color of the oil is desired, a properly refined cottonseed oil for the margarin trade may mean a well deodorized, either light or dark colored oil.

Phosphatides Lower Quality

Most all cottonseed oils which have been alkali refined, filtered and deodorized, but not further treated will develop a deposit of a light color if left standing in a bottle, especially when exposed to the light. I do not mean a deposit caused through the precipitation of the solid glycerides, but I refer to a deposit which it appears is caused by the presence of phosphatides, and we often hear complaints that an oil showing such a deposit is not properly refined. Of course, we know that in percentage such a deposit is entirely negligible and that the deposit is entirely due to the chemical nature of the oil. However, in spite of this some consumers of oil do not consider a cottonseed oil properly refined if upon standing it develops such a deposit, and the elimination of the phosphatides may sometimes become part of the refining process.

In the winterizing process some of the solid glycerides, and probably the phosphatides are separated and removed from the refined oil through a chilling and filtering process. Depending upon the length of time winterized oil will stand clear, brilliant and limpid when exposed to the so-called Winter Oil Test, an oil is more or less suitable for the trade desiring this grade of oil, salad oil and mayonnaise manufacturers, and in spite of the fact that the trade rules prescribe that such an oil does not necessarily need to stand more than five-and-a-half hours clear and brilliant, some consumers desire an oil which will stand a considerably longer time clear and brilliant, and unless it stands the test considerably longer do not consider a cottonseed oil properly refined for their purpose. No doubt the winterizing process should be considered a part of the refining process in spite of the fact that some of the characteristics of the oil, such as iodine number and titer, are materially changed in the process.

In the mind of a dough or cruller baker when he talks about a properly refined cottonseed oil is principally the smoke point. A refined oil, well deodorized with high smoke point and which does not readily give off acrolein vapors is desired. The color of the oil, however, does not seem to be of real importance.

Effects of Hydrogenation

In the hydrogenation process some of the unsaturated glycerides are converted into less unsaturated or entirely saturated glycerides, with the result that different qualities of the original oil are developed. For the cracker baker a hy-

Comparison of Cottonseed Oil Specifications of the Three Trading Exchanges

GRADING			Free From		Color		Bleaching	Max.	
Interstate C. S. C. Assn.	N. Y. Produce Exchange	New Orleans Cotton Exchange	Water and Settlings	Flavor and Odor	Not Darker Than	Not Lighter Than	Not Darker Than	Free Fatty Acid	Cold Test
C.S.Y.			" cl b	Sweet	35Y–7.6R			⅛	
P.S.Y.			" cl	Sweet	35Y–7.6R			¼	
	P.S.Y.		" cl	Sweet	35Y–7.6R	35Y–3.5R		¼	
		P.S.Y.	" cl	Sweet	35Y–7.6R		35Y–3.5R	¼	
	Bl.P.S.Y.		" cl	Sweet	35Y–7.6R	35Y–3.5R	20Y–2.5R	¼	
Bl.P.S.Y.		Bl.P.S.Y.	" cl	Sweet	35Y–7.6R		20Y–2.5R	¼	
P. Winter Y.			" cl b	Sweet	35Y–7.6R			¼	Must pass
	P. Winter Y.		" cl b	Sweet	35Y–7.6R	35Y–3.5R		¼	Must pass
	Light Colored P.S.Y.		" cl	Sweet	35Y–3.5R	35Y–2.5R		¼	
P.S. White	P.S. White		" cl	Sweet	20Y–2.5R			¼	
P. Winter White	P. Winter White		" cl b	Sweet	20Y–2.5R			¼	Must pass
G.O.S.Y.			"	Off	35Y–7.6R			¼	
	G.O.S.Y.		" cl	Inferior	35Y–7.6R	35Y–3.5R		¼	
		G.O.S.Y.	" cl	Off	35Y–7.6R		20Y–3.5R	¼	
O.S.Y.			" cl	Off	35Y–12R			½	
	O.S.Y.			Inferior	35Y–12R			½	
Reddish O.S.Y.			"	Inferior	35Y–20R			¾	
	Reddish O.S.Y.			Inferior	35Y–20R			¾	

C —Choice
P —Prime
S —Summer
Y —Yellow
Bl—Bleachable

G —Good
O —Off
cl —Clear
b —Brilliant

drogenated oil of a comparatively low melting point and with only a small amount of highly unsaturated glycerides is desired.

On the other hand a cake baker when using hydrogenated oil in the baking of his cake is interested in receiving a hydrogenated oil which will cream well and which has high water-absorption qualities.

Hydrogenated oils naturally show entirely different chemical and physical characteristics from simply alkali-refined oil. In spite of this the hydrogenation process can, I believe, be justly considered as part of the refining process, eliminating or reducing the undesirable constituents of the oil and increasing or creating new desirable components.

Rancidity

Under certain conditions, and especially if refined cottonseed oil is exposed to the light, it will develop a rancid or unpleasant taste. What chemical constituents or what action causes the development of rancidity I believe has not been fully determined. Probably sometimes it is caused by the presence of ketones or aldehydes, and only very seldom is it directly related to the presence of free fatty acids.

It has been found that sometimes oil with a rancid taste will give the so-called Kreis test reaction, and the consumer not fully acquainted with the chemistry of oil has generalized this experience and thinks that all oils showing the Kreis test reaction must naturally be rancid. Such a conclusion is very unwarranted. Perfectly sweet oil, absolutely free from rancidity, may show the Kreis test reaction, and in many cases neither alkali refining nor deodorization nor hydrogenation will eliminate the Kreis test reaction.

I have tried to show with my arguments that from the manufacturer's or consumer's point of view the expression "Refined Oil" is a rather broad definition, and today probably means quite different qualities from those it represented twenty or forty years ago. This is due to the continuous development of the industry, for which we to a great extent have to thank the Chemist.

It is also to the Chemist that we look for new discoveries concerning the properties of cottonseed oil and for new methods of refining, so that the so-called refining loss, which is now actually an enormous economic waste, can be materially decreased, so that new qualities can be produced to increase the value to present users, and further, so that new channels for its use can be developed, thus creating a still greater consuming demand for the commodity.

Postum Buys Hellman

Cereal and Health Drink Line Augmented by Mayonnaise

THE Postum Company announces that it has made a contract to purchase the entire business of Richard Hellman, Inc., mayonnaise manufacturers.

Common stockholders of Hellman will receive one share of Postum stock for each 3.7 shares of Hellman stock.

Referee Applicants

APPLICANTS for Referee Chemist Certificates are Herbert M. Shilstone, New Orleans, (second publication), and Herman A. Nester, San Antonio Texas, (first publication).