FISH OIL*—

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There are many kinds of fish oil and in order to save time I am going to limit my paper to some of the more important oils in use.

Whale oil is not a fish oil but is usually listed with them because of its odor and source of supply. Large quantities are hardened and used by soap makers. The drying of whale oil is too slow to make it attractive to the paint and varnish trade. Salmon and herring oils are also low in iodine absorption but are hardened and used to replace other hard fats.

Most fish oils, if properly handled, are equally potent in vitamin A and D. Cod liver oil has been used for this purpose but its value as a source of vitamins was due to careful handling and not to the superiority of the raw material. The use of vitamins from fish oils in human nutrition as well as in the nutrition of animals and fowls will no doubt reach great proportions in a very short time. The removal of vitamins from fish oils entails but little loss of oil and little, if any, change in the oil itself.

The two most useful fish oils are menhaden and sardine. Menhaden comes from the Atlantic Ocean and sardine from the Pacific.

Menhaden fish are caught and handled by the following method: The fishing boats put out to sea and endeavor to pick up a school of fish, which swim often at the surface of the water. When the fish are sighted the small boats are lowered with the purse seine and the crew surround the fish and try to draw the seine together. If they are successful, the larger boat comes up and bails out the fish into its hold. This procedure is followed until the fish disappear or the boat is loaded or the food for crew is exhausted. The boat returns to the factory and is unloaded by means of a bucket conveyor, and from the conveyor to a traveling belt, that runs over an automatic scale and into a continuous cooker to burst the oil cells and from the cooker into a continuous press, somewhat like an Anderson Expeller. This separates the water and oil from the remainder of the fish. This process works well, it the fish are fresh and firm but not nearly so well, if the fish are more or less decomposed. The residue from the press is dried in a direct heat or steam dryer and used to be sold as tankage to fertilizer manufacturers as a source of protein (usually about 60%). The oil and water flows into a system of weir tanks, that are kept hot by steam coils and gradually the oil is separated from the water and most of the gurry. The top oil is drawn off and dried, cooled and placed in storage, the bottom layer of water is drawn off into the sewer and the gurry is treated in the gurry plant with sawdust and run through a coarse filter. The gurry oil and water separate out quickly. Some plants remove the gurry with a basket centrifuge and the oil is dehydrated with centrifugal machines. Their only products are oil and tankage, or if good fish are used, stock feed.

Sardines are used as a food product but more fish are caught than can be sold as food, so all the waste from the canneries and some whole fish are worked up in a manner similar to Menhaden except that the units are smaller and material is handled quicker.

The free fatty acid of Sardine Oil is much lower than Menhaden as a rule and the color and odor is also much better. In the old days the dealers collected all kinds of waste oils, that would run as high as 50% F.F.A. and had a very dark color and an odor that was *lasting*. These were mixed with the regular crude so as to deliver an oil of 5% F.F.A., which is the accepted maximum in Menhaden Oil. This practice gave fish oils a "black eye" from which they have never fully recovered. It increased the difficulties of refining and made complete deodorization impossible. The producers for the most part do not treat their oil in any way. This is done by the refiners and dealers. Fish Oil contains about as much stearine as Cottonseed Oil. Since the iodine value of stearine is much lower than the oil, because it is a saturated body, it has to be removed, before these oils can be used as paint oils. This is done usually by running the oil through filter presses at the proper temperature. As the temperature at which the oil is pressed is lowered, the iodine value of the pressed oil is raised and, of course, the cold test is improved. The low cold test oils dry very much better than settled or racked oils or poorly pressed oils.

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All fish oils can be hardened but not so readily as many of the more common oils, such as Cottonseed oil or Peanut oil. This treatment removes the color, the odor and raises the melting point.

The deodorization of fish oil is one of the problems that has been the hardest to solve satisfactorily. If the oil is refined, there is a decided improvement in color and odor. If the temperature is raised to above 500 deg., the oil splits off fatty acids, that crystallize out after the oil cools and gives a very poor film. There is quite a little deodorized oil on the market now, that has been heat treated in various ways and is quite satisfactory for the paint and varnish trade, but the method of steaming under vacuum, such as is used for deodorizing edible oils, does not give very much improvement.

The iodine of ordinary pressed

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Menhaden is from 175 to 185 and Sardine from 180 to 195. Since the low melting point fats or stearine are non-drying, their iodine is low. Thus the iodine value of a pressed oil to some extent indicates the amount of destearinization and drying value of the oils.

From pressed oils are made various kinds of processed and refined oils, such as alkali refined oils, which process removes the free fatty acids, color and largely deodorizes the oil. Blown oils are made to any selected viscosity. Deodorized oil is made from refined and specially processed oil.

Generally speaking, the following uses are made of the different grades of processed and refined fish oils: From pressed oil is made stack paint, where heat resistance is required. In combination with Linseed or China Wood Oil it is used for barn paints, and largely in industrial maintenance paints which are exposed to sulphur fumes, salt air, etc. It is recommended in rosin and oil driers for the reason that fish oil is less apt to separate than vegetable oils.

Alkali refined oil as a kettle oil bodies rapidly, holds its color well, deodorizes easily with heat and is used in combination with other oils for mixed paints. It gives good washing and brushing properties to flat wall paints. The combination of Wood Oil and Fish Oil makes an excellent exterior cement paint, is a very good vehicle for aluminum paint—its flexibility and waterproofness are especially good, and its leafing properties with aluminum are excellent.

Blown oils are used as a base for cold cut paint oils where varnish fires are not available. These oils are clear and free from haze. They are used to make colored asbestos roof coatings and are added to red, green and brown Linseed Oil paints to prevent chalking, blistering and peeling. Some blown oils of heavy body are prepared with approximately 25% light mineral oils in order to give the finished paint a fuller body than could be acquired by the use of pure blown oil cut back in the kettle with thinner.

Truly deodorized refined oils are used successfully for white enamel, flat wall paints, interior and exterior mixed paints and undercoatings. The preparation of deodorized oils in the film trades is distinctly new and just emerging from the experimental stages.

In 1929 the amount of fish oils of all kinds used was about 180,000,000 lbs., split up among the following industries:

Paint and varnish	5.6%
Linoleum, oilcloth, etc.	5.4%
Edible fat	8.0%
Soap	69.4%
Miscellaneous	11.6%
Total	100.0%

In the Paint and Varnish trade:

	(lbs.)
Linseed	340,000,000
Wood Oil	88,300,000
Fish Oil (3% of Linseed)	10,600,000
Soya	5,800,000
Perilla	2,800,000

In Oil cloth and Linoleum:

	(lbs.)
Linseed	112,850,000
Fish Oil (9% of Linseed)	10,140,000
Wood Oil	6,000,000
Soya Bean Oil	3,200,000

The following are approximate specifications for various grades of Fish Oil:

Light Pressed Fish Oil—

Iodine	175-185
Saponification Value	190-193
Acid Number	5 maximum
Color	Amber

Low Cold Test Oil: All figures are the same except that a cold test of two hours at 32° and an iodine value of 185-190.

24° Cold Test Oil: Has the same specifications except iodine of 190-195 and a cold test clear two hours at 24°.

The same grades of oil can be obtained Alkali Refined, if desired.

REPORT OF THE GLYCERIN ANALYSIS COMMITTEE—SOAP SECTION, AMERICAN OIL CHEMISTS' SOCIETY

Early in 1934 Mr. O. C. Ames, 4906 Davenport Street, Omaha, Nebraska, reported to the Society that he had devised a modification of the acetin method which he believed would yield results within 0.25% of the actual glycerin content. On being assured of our willingness to cooperate, the details of his modified method were disclosed as follows:

"Follow the Standard International Acetin Method but with these modifications: After acetylization is complete allow the reaction mixture to come nearly to room temperature before addition of water, then add the required 50 cc at a temperature of not much over 50° C. and, by giving the stand, flask and all a rotary rocking motion, bring to solution as quickly as possible and immediately on solution, surround the flask with a small ice and water bath and chill thoroughly. A liter beaker is convenient.

A rather large bath of ice and water should be at hand in which the supply of distilled water and the wash bottle have been supported and well chilled.

Support a liter conical in the bath and as soon as the triacetin solution is thoroughly cold, filter at once into this flask, using a rapid filter paper, and wash with the chilled water, rinsing the acetylization flask well and bringing the solution up to a volume of about 300 cc.

Proceed at once to the neutralization. Two burets, one 25 cc and one 100 cc, the latter with a very free flowing tip, make the most satisfactory apparatus. The approximate amount of alkali should be calculated. Ex.: If 1.3 gm. sample of glycerin has been taken and 7.5 cc of anhydride has been used, about 100 cc of normal alkali will be needed, assuming about 85% true glycerol content. The use of chilled alkali is probably not practical. The large buret should be able to discharge 90 or 95 cc in not more than 20 seconds.

With vigorous rotation of the flask add the most, 90% or better, of the neutralizing alkali rapidly, buret wide open. Proceed to the end point with the small buret and with suitable caution.

The balance of the analysis per standard method."

Mr. Ames points out that triacetin hydrolyzes slowly in acetic acid solution and that this hydrolysis is greatly affected by the temperature of the solution. Furthermore he states that the neutralization of acetic acid with NaOH is practically instantaneous, while the saponification of triacetin proceeds more slowly. From these considerations he concludes that slow neutralization is not necessarily careful neutralization and that rapid addition of 90-95% of the alkali with vigorous agitation is least favorable to accidental saponification of triacetin during neutralization.

Samples of "A.O.C.S. Standard C. P. Glycerin—1933," which were available from our work last year[1], were distributed to members of the Committee with the request that it be analyzed as follows:

A. Specific gravity by pycnometer method, at one of the temperatures covered by the Bosart and Snoddy Table.

B. % Apparent glycerol from specific gravity.

C. % Apparent glycerol by International Acetin Method (uncorrected for

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[1] Oil & Soap, Vol. II, No. 3—p. 53 (March, 1934).