ANALYSIS OF MARINE OILS.

By Russell W. Moore, A. M., M. Sc.

In connection with an extended examination of a large number of oils and fats, the results obtained in the case of some porpoise and blackfish oils were of so unusual a character as to deserve particular mention.

It has for some time been considered that the analysis of the various fats and oils occurring in nature would show a percentage of insoluble fatty acids amounting to some figure in the neighborhood of 95 per cent. A notable exception is butter fat, in which the insoluble fatty acids range between 87.5 and 89.5% and, in some cases, even slightly higher. The first chemical process used to distinguish butter from other fats was based solely upon this difference. Later, cocoanut oil was found to contain fatty acids soluble in large amounts of water and sufficient washing was found to reduce the per cent. of insoluble fatty acids to a figure even lower than that given by butter (*Chem. News, Dec. 5th, 1884*).

It must, however, be granted that while this opinion was founded on a very large number of analyses of butter, the number of such analyses made on other fats was extremely small when the great number and variety of fats and oils occurring in nature is taken into consideration. Oleomargarine, beef and mutton suet and lard, and a few oils, comprised nearly the whole list of fats analyzed.

An examination, however, of most of the natural fats and oils serves to establish in most cases the fact that the insoluble fatty acids amount to about 95 per cent. A notable exception is found in the case of some marine oils examined by the writer.

The oils in question are known in the market as porpoise jaw and blackfish jaw oils, and are obtained from the soft fat of the head and jaw by allowing the oil to exude from the fat. The oil thus obtained is exposed to cold and the portion remaining fluid racked off. The resulting oil, carefully skimmed and strained, is of a straw yellow color, thin and limpid, and by no means of an un-

pleasant odor. It is used for lubricating fine machinery and commands a very high price.

The oils examined were five in number, as follows:

No. 1. Porpoise jaw oil skimmed and strained.
No. 2. Porpoise jaw oil skimmed and strained.
No. 3. Porpoise jaw oil not skimmed and strained.
No. 4. Blackfish jaw oil skimmed and strained.
No. 5. Blackfish body oil.

The oils were first examined by the wash process to determine the percentages of soluble and insoluble fatty acids. The results were as follows, the figures given being the mean of duplicates agreeing closely.

	Soluble Fatty Acids.	Insoluble Fatty Acids.
No. 1	17.18%	72.05%
No. 2	21.44	68.41
No. 3	----	96.50%
No. 4	21.79	66.28
No. 5	2.46	93.07

The oils were next examined by the Reichert process with the modification suggested at the time by Dr. Waller. The distillation was continued by adding 50 c. c. of water to the flask and distilling until a practically neutral distillate was obtained adding 50 c. c. of water between distillations, titrating as in the Reichert process and calculating the acidity to butyric acid.

The results obtained were as follows:

	Reichert Figure.	Total Acidity.
No. 1	47.77 c. c.	17.18%
No. 2	56.00	20.97
No. 3	2.08	1.42
No. 4	65.92	24.31
No. 5	5.60	2.34

The saponification number was obtained by the process of Koettstorfer. Considerable difficulty was experienced in this determination in obtaining concordant results, since the combination of the alkali with the fat appeared so feeble that even very dilute standard hydrochloric acid appeared to decompose the soap and

liberate fatty acids. This was seen on diluting with water, when oily drops would appear while the liquid was still alkaline. By using large quantities of alcohol concordant results were obtained as follows :

	Mgs. K O H per Grm.
No. 1	253.7
No. 2	272.3
No. 3	143.9
No. 4	290.0
No. 5	197.3

The iodine coefficient was also determined by the Hübl method and gave the following results :

	Grms. Iodine per 100 Grms.
No. 1	49.6
No. 2	30.9
No. 3	76.8
No. 4	32.8
No. 5	99.5

It will thus be seen that the oils which had received the full treatment furnish abnormally high figures for soluble or volatile fatty acids and correspondingly low figures for the insoluble fatty acids. They constitute the most notable exception to ordinary fats in this respect. Of course the high per cent. of soluble acids is due to the treatment which the oils undergo in the refining process by which the glycerides of the lower fatty acids are concentrated in the oil that is finally strained off. This is conclusively shown by the foregoing figures, oils Numbers 1, 2 and 4, that received the full treatment, giving extraordinarily high results for soluble fatty acids and saponification equivalent and correspondingly lower iodine absorption coefficients, since the lower glycerides are of the acetic acid series and are indifferent to iodine.

The volatile acid present in these oils should be calculated to valeric acid. It was, however, calculated by butyric acid by the writer in order that the results should be comparable with other analyses.

It would be a matter of interest to conduct some experiments with butter fat by subjecting it to a similar process of freezing

and straining and examining the resulting product, and the writer proposes to conduct such a series at his earliest opportunity. Valuable information regarding the nature of the composition of the molecular groupings in butter fat in this way may be obtained.

The oils examined as above were obtained by Dr. E. Waller from the manufacturer and the analyses were made in his laboratory, New York City, and under his direction.