E VALUE RATIOS FOR SOME COMMERCIAL VITAMIN A OILS

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ABSTRACT

The determination of vitamin A in fish liver oil by means of ultraviolet light absorption has resulted in a considerable reduction in the lapse of time between the delivery of livers containing the oil and the receipt of payment for them by the fishermen. If the amount of light absorbed at one given wavelength is divided by the amount absorbed at another wavelength, the result will be a ratio characteristic for the substance. Each substance has its characteristic ratios just as each individual has characteristic fingerprints. There are constituents other than vitamin A which affect these ratios, and cause a variation in the assay of the oils. These variations are of practical concern and an effort is being made to gather data on them. The data available at the present time is summarized in this paper.

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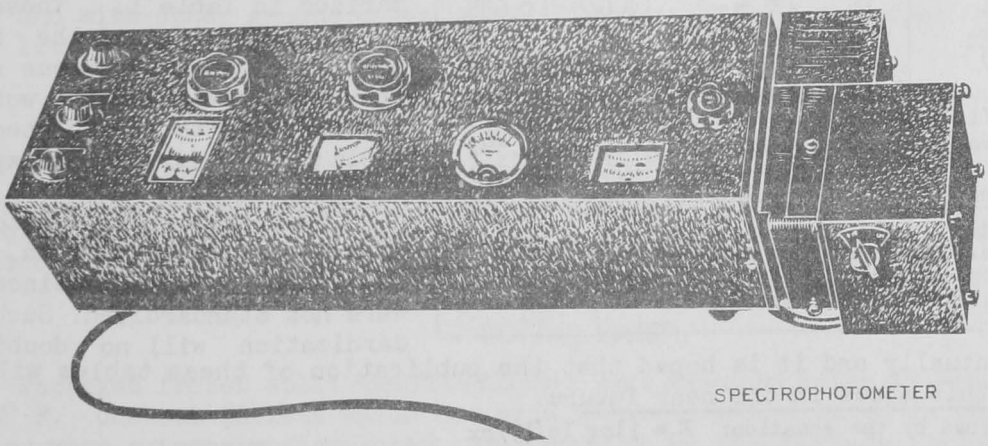
The official method for the measurement of vitamin A is impractical for everyday use. The method is based on the growth response of rats and requires several weeks to complete. Not only is the method time consuming, but it is expensive and can be used only where the material to be assayed is of considerable value. A further criticism of the official method is that it does not have the precision demanded by the trade.

The vitamin A industry would be in a chaotic state due to the inadequacies of the official method were not alternative methods of measuring vitamin A available. These alternative methods are physicochemical in nature. The most convenient is one which measures the amount of ultraviolet light absorbed by a solution of the vitamin. This method is rapid; a determination can be made in only a few minutes and, in addition, the results are closely reproducible. The spectrophotometric instrument used in this method has now been developed to such a point that independent laboratories can duplicate results to within one percent.



SPECTROPHOTOMETER

While the reproducibility of the ultraviolet method is high, its reliability is difficult to determine because substances other than vitamin A also absorb ultraviolet light. If these non-vitamin A substances are present along with vitamin A, the extra light absorbed by these materials will give an erroneously high

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measurement. It is for this reason that the ultraviolet method has not as yet been made official.

However, while the non-vitamin A substances absorb ultraviolet light, they do not absorb it in exactly the same way that vitamin A does. In fact, each substance absorbs light in a manner which is peculiar to that material and if a graph is made of the amount of light absorbed by the material at various wavelengths, a characteristic pattern will be obtained. Similarly, if the amount of light absorbed at one given wavelength is divided by the amount absorbed at another wavelength, a ratio will be obtained which is characteristic for the substance. That is, each substance has its characteristic ratios just as each individual has characteristic fingerprints.

Chemists have come to recognize that these ratios give an indication of the reliability of the vitamin A estimations made by the ultraviolet absorption method. Vitamin A dissolved in the solvents commonly used for the purpose absorbs maximally in the neighborhood of 328 mmu. and it is now customary to use the ratios of the light absorbed at 300 mmu. and 328 mmu., and at 350 mmu. and 328 mmu. These ratios can be represented symbolically as $\frac{E\ 300}{E\ 328}$ and $\frac{E\ 350}{E\ 328}$ where E 1/ is the coefficient of absorption.

In the case of a pure substance, the E value ratios determined for one sample will be the same, within the limits of experimental error, for all other samples. In the case of natural products such as soupfin shark liver oil, the oils contain constituents other than vitamin A and the proportion of these vary from one sample to another. As a result, the E value ratios are likewise variable.

Table 1 - E Value Ratios 1/

Type of Vitaminiferous Material	Number of Samples	Value	$\frac{E\ 300}{E\ 328}$	$\frac{E\ 350}{E\ 328}$
Halibut Liver Oil (Hippoglossus hippoglossus)	71	Lowest	0.570	0.576
		Highest	0.646	0.755
		Average	0.602	0.663
		Standard Deviation	0.0177	0.0272
Sablefish Liver Oil (Anoplopoma fimbria)	18	Lowest	0.585	0.574
		Highest	0.648	0.688
		Average	0.614	0.643
		Standard Deviation	0.0214	0.0274
Male Soupfin Shark Liver Oil (Galeorhinus zyopterus)	73	Lowest	0.563	0.550
		Highest	0.741	0.592
		Average	0.669	0.570
		Standard Deviation	0.0309	0.0096

1/ These data were taken by means of the Beckman spectrophotometer employing a tungsten light source. Isopropanol was the solvent.

Since this variation is a matter of practical concern, the Seattle Technological Laboratory has started to gather data on the E value ratios for various vitamin A oils found in commerce. The data available at present are summarized in Table 1. These data are a composite of the figures submitted by the various companies collaborating in the work. As further data is accumulated, the table will be revised and expanded.

Certain spectrophotometric data, such as slit width, etc., cannot be specified since these were not standardized. Such standardization will no doubt take place eventually and it is hoped that the publication of these tables will help to bring this about in the near future.

1/ E is defined by the equation: $E = (\log Io/I)/cx$
Where c is the concentration, x is the length of the absorption cell. Io is the intensity of the incident light. I is the intensity of the emergent light.