

This shows conclusively that this method is well adapted to the purpose for which it has been used in this work.

The results of this investigation may be summed up as follows :

Amido compounds, of which urea, hippuric acid, and paratoluidine were taken as types, yield no oxides of nitrogen absorbed by concentrated sulphuric acid or by soda-lime. It is, therefore, not necessary to use a copper spiral when burning them.

Of the nitro substances burned, nitraniline, dinitrobenzene, and picric acid, only the last gave oxides absorbed by the reagents. Judging from the increase in weight of the absorbing tubes, the nitrogen was probably for the most part absorbed as nitrogen peroxide.

Nitric oxide may have been produced to a limited extent in any of the combustions. For, unless this oxide is further oxidized, it is not absorbed by either concentrated sulphuric acid or soda-lime, and consequently has no effect on the accuracy of the determination of carbon and hydrogen.

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## PARAFFIN AS AN ADULTERANT OF OLEOMARGARINE.<sup>1</sup>

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ONE often hears of adulterated food, but rarely are such sophistications of a nature that they may be deemed injurious to health. The recent finding of paraffin as an adulterant in a number of samples of commercial oleomargarine may therefore prove of interest.

Though paraffin has been mentioned as an adulterant of chocolates and candies<sup>2</sup>, the use of such an indigestible substance as an adulterant of oleomargarine seemed so improbable that the actual separation of the paraffin was required to convince some skeptical minds.

Its use in oleomargarine is by no means new, for I first observed it in a commercial sample in September, 1893, and reported the fact to the New York State Department of Agriculture. The general properties of the fat of the sample, its

<sup>1</sup> Read at the March meeting of the New York Section.

<sup>2</sup> U. S. Dispensatory, p. 1097.

behavior during saponification, and the abnormally low specific gravity 0.894 (at  $\frac{100^{\circ} \text{ F.}}{\text{water } 100^{\circ} \text{ F.}}$ ) indicated an irregularity and the probable presence of paraffin. Although the sample under examination amounted to only a few grams, sufficient of the unsaponifiable matter was obtained from the same to show that it was paraffin. It was impossible at the time to get more of this particular sample nor duplicates of several others in which paraffin was found between that date and March, 1894, when I was enabled to prepare an exhibit of the paraffin extracted from one of the samples. About this time experts of the Department of Agriculture, in the course of their inspections in New York and Brooklyn, found quite a number of samples of oleomargarine which, upon analysis, were found to contain paraffin. Some of these were analyzed by Drs. Love, Waller, Stillwell, and myself, and the amounts of paraffin in the various samples were found to range from 9.72 per cent. to 11.25 per cent.

The publicity given the matter at that time possibly caused a discontinuance of the use of paraffin in excessive quantities. At least I did not again observe any positive indications of paraffin in the customary analyses of any of the numerous samples examined until about six months ago and subsequently, when I found paraffin in five different samples which had been taken by the experts of the department in their regular inspections of grocery stores, restaurants, etc., in New York and Brooklyn. One of the samples, a one-pound print, and which had been sold for butter at twenty-two cents per pound, enabled me to make three exhibits of the extracted paraffin. The amounts of paraffin found in these samples ranged from 5 to 11.76 per cent.; in other words, from three to a little over six pounds per sixty-pound tub. The strip of paraffin extracted from commercial oleomargarine which I exhibit herewith, amounting to forty-three grains, is a little short of the amount actually contained in one ounce of one of these samples.

The extent of this character of adulteration it is almost impossible to determine, since much of the goods are sold secretly and in many instances palmed off for butter to unsuspecting purchasers and consumers. That much of the "oleo" in this market is sold under the guise of butter is evidenced by the tes-

timony of witnesses under oath in hundreds of cases prosecuted in the courts of this city during the past few years. The samples which the inspectors take represent only a small percentage of what goes into consumption. Finally, the samples in the hands of the chemist are, as a rule, not examined with a view of determining possible adulterants, but simply to ascertain whether the substance is butter or a butter substitute. In such examination two to three per cent. of paraffin would scarcely attract the attention of the analyst, while in exceptional cases even five per cent. might go unnoticed, as that quantity will dissolve clear in the alcoholic soap solution under the conditions of the Reichert method for butter analysis. Analysts who are not in the habit of taking the specific gravity of the fat, would in such instances be almost certain to overlook the adulterant.

The samples which would not saponify clear and which gave rise to suspicions on account of the abnormally low specific gravity of the fat, 0.9018 down to 0.8907 at 100° F. (water 100° F.) were the only ones specially examined for paraffin. The fat of one of these samples would not melt clear under 106°, and congealed at 105° F. The separated and purified paraffin from the same had a melting-point of 127°+. The photomicrographs shown herewith were prepared from the fat of this sample. The amorphous masses seen about the fat crystal are due to the presence of paraffin, and were particularly conspicuous in all the slides prepared from this sample. Plate 1 shows the microscopical appearance under polarized light with dark field (crossed Nicols), while in Plate 2 the field is illuminated, producing practically the reverse effect observed in Plate 1. Photomicrograph  $\times 100$  diam. The proportions of the Reichert method (two and five-tenths grams of fat to twenty cc. eighty per cent. alcohol containing one gram potassium hydroxide) may be used to advantage in testing for paraffin. The flask with a Liebig condenser attached should be shaken vigorously during the saponification, as this hastens and facilitates the same. After complete saponification, dilute the alcoholic soap solution with an equal volume of water. If two to three per cent. or over of paraffin is present, the solution will turn turbid and much of the separated paraffin can be collected by careful alternate heating and chilling the solution. Such separated matter must of course be examined

as to its identity. A soap solution remaining clear under the above conditions and dilutions would indicate that the fat was free from paraffin, or that it contains under three per cent.

It is pertinent to say that the object of the use of paraffin in oleomargarine is not to cheapen the article, but to make a more homogeneous fat mixture by preventing the separation of the fats and oils, and also to affect the general consistency and appearance of the mass and its behavior under the trier in sampling. One of these samples was with difficulty distinguished from butter by physical tests.

The use of paraffin under these conditions naturally gives rise to the query, What effect has it upon the system? I have been unable to find any records of researches as to the physiological effects of paraffins<sup>1</sup> which throw much light on the subject. Paraffin is generally regarded as an indigestible substance. This is undoubtedly true of paraffin taken into the system by itself. An interesting physiological question, however, presents itself in connection with the use of this substance in oleomargarine for the following reasons :

1. The paraffin is dissolved in the vegetable and animal fats constituting the oleaginous part of the compound.
2. The fat mixture in most cases melts at the normal temperature of the body.
3. The fat mixture is in a highly emulsified condition.

These conditions are so different from those presented in the occasional swallowing of small masses of paraffin that no analogies as to absorbability are presented from which to draw a fair inference. Hager<sup>1</sup> cautions against the internal use of paraffins. It would appear, however, that the symptoms there noted were caused by the lighter petroleums which at that time were commonly called paraffin, and thereby possibly misleading the translators. At the present time there are no data to warrant anyone in saying that the use of paraffin, as above, is harmless in its effects upon the system.

Although paraffin is an unsaponifiable substance, it is a question whether, under the above conditions, some of the paraffin is not absorbed in the system along with the other fats, and whether more serious disturbances may not arise than could be expected from the ordinary digestive disturbances attributable to the indigestibility of the greater part of the adulterant.

<sup>1</sup> Hager : *Pharm. Praxis*, Suppl., pp. 896, 899; *J. Pharm. Assoc.*, 34, 309.