

## PROCEEDINGS OF THE SOCIETY OF PUBLIC ANALYSTS.

## NOTE ON HORSE FAT AND "ANIMAL" OIL.

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*(Read at the Meeting, June 5, 1907.)*

WHILE testing samples of tallow or "animal" oil suspected of adulteration with seed and fish oils, I had occasion to examine a number of animal fats, more particularly horse fat, in order to ascertain how far the iodine value could be relied upon to detect such adulteration. The fats examined were rendered in the laboratory, their genuineness being thereby assured.

The more important "constants" and "variables" obtained in the examination of five samples of horse fat taken from different animals are embodied in the table on p. 318, which also includes neat's-foot oil and marrow fat.

The high iodine value of horse fat is remarkable, as also the high specific gravity, the former being considerably higher than that recorded by various observers (71.4 to 86.3). It is curious to note that the fat taken from the kidney bed, which in most animals gives a low iodine value, should in this case give the highest figure yet recorded for horse fat.

As will be seen from the table, the amount of unsaponifiable matter in horse fat ranges from 0.42 to 0.68 per cent., which is somewhat higher than that usually found in lard, tallow, etc. The intense yellow colour of ethereal solutions of the unsaponifiable matter appears to be also characteristic of this fat.

Lewkowitsch ("Oil, Fats, and Waxes," p. 685) refers to a sample of genuine horses' foot oil, which gave several colour reactions characteristic of marine animal oils; this has also been my experience with one sample (No. 4), which gave a dis-

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tinct red coloration with sulphuric acid, such as is often given by partially oxidised liver oils.

	Colour and Consistence.	Iodine Value (Wijs).	Zeiss Refractometer at 25° C.	Saponification Value, Per Cent.	Unsaturation Matter, Per Cent.	Specific Gravity at (15.5° C.).	Free Acid Per Cent.	Reichert Wolny Number.
1. Horse fat from belly.	Orange yellow, butter-like.	85.66	59.8*	19.84	0.54	—	8.80	—
2. { Horse fat from neck ("mane").	Light yellow, part liquid.	86.70	61.2	19.91	—	—	0.56	—
2. { Horse oil after filtration at 12.2° C.	Lemon yellow oil.	90.10	61.8	—	0.46	0.9182	—	0.30
3. { Horse fat from neck ("mane").	Light yellow, part liquid.	90.07	61.2	—	—	—	—	—
3. { Horse oil after filtration at 8.9° C.	Lemon yellow oil.	93.11	61.8	19.56	0.50	0.9184	1.20	0.20
4. { Horse fat from kidney bed.	Orange yellow, part liquid.	110.65	66.0	—	—	—	—	—
4. { Horse oil after filtration at 13.3° C.	Orange yellow oil.	114.85	66.7	19.63	0.68	0.9212	—	0.35
5. Horse oil from neck fat.	Lemon yellow oil.	112.85	66.0	19.63	0.42	0.9211	0.46	—
6. { Neat's-foot fat as extracted from calves' feet.	White, like soft lard.	71.80	59.0	—	—	—	—	—
6. { Neat's-foot oil after filtration at 13.3° C.	Pale straw colour.	74.07	59.5 (calculated)	19.70	0.42	0.9164	0.78	—
7. Marrow fat from ox bones.	Light yellow, like hard lard.	52.04	55.3	19.63	—	—	0.22	—

The drying properties of horse fat are very marked, especially at high temperatures. For example, oils Nos. 4 and 5, when exposed in thin layers on glass to a temperature of 95° to 97° C., after two hours gave sticky films, whilst, after four hours the oils became solid.

As a lubricant, horse oil is certainly inferior to genuine lard and tallow oils, as the following viscosity tests made on sample No. 5 by Redwood's viscosimeter show :

At 21.1° C. ...	286 seconds
At 32.2° „ ...	180 „
At 60° „ ...	80 „

The mixed fatty acids from samples Nos. 1 and 4 were examined for stearic acid by Hehner and Mitchell's method (ANALYST, 1896, **21**, 316) with negative results, the solutions of the fatty acids remaining clear after cooling for twenty-four hours. The fatty acids from the solid fat separated by filtration from sample No. 2 were also tested, with a similar result. This is in agreement with Hehner and Mitchell, who could not detect stearic acid in a sample of horse kidney fat (*loc. cit.*).

It is hardly necessary to point out that, should this fat be employed in the scientific adulteration of butter, its detection would be a matter of very great

\* The low refraction is no doubt due to the influence of free acid.

difficulty, as the separation of stearic acid appears to be the only method of detecting animal fat.

#### COMMERCIAL "ANIMAL" OIL:

This article, which is often sold as lard or tallow oil, is prepared from the cheaper qualities of tallow, scrap fat, etc., and is largely used as a lubricating oil. Eight samples, which I had every reason to consider genuine, gave iodine values ranging from 66.3 to 77.6 and specific gravities (15.5° C.) from 0.914 to 0.9165, with viscosities at 21.1° C. of 330 to 460 seconds. Oils of this class are, however, far from common, as I have found by the examination of over forty samples of commercial animal oil, fully 50 per cent. of which gave specific gravities of from 0.9170 to 0.9215, and iodine values of from 90 to 116 per cent. Many of these oils were certainly adulterated either with seed or with fish oils, and, owing to their drying properties, were quite unsuitable for lubricating purposes, while others of lower specific gravity contained from 8 to 10 per cent. of mineral oil.

The amount of free fatty acid in thirty samples ranged from 0.70 to 22.0 per cent.

In testing "animal" oil I have found the Zeiss refractometer of considerable value as a preliminary or sorting test, a reading of over 61 at 25° C. indicating either a high iodine value or the presence of mineral oil; and, for the detection of the latter, experiments on mixtures proved Holde's test to be reliable, even with such a small proportion as 1 per cent. In the following table the refractive power and iodine value of several standard and special mineral oils are given.

(Two hours allowed for absorption and over 300 per cent. of iodine in excess.)

	Specific Gravity.	Iodine Value. (Wijs.)	Zeiss Refractometer at 25° C.
American (white oil) ... ..	0.864	8.20	66.2
" ... ..	0.850	39.35	65.5
" ... ..	0.865	43.25	87.0
Scotch ... ..	0.865	64.40	92.0
American ... ..	0.885 to 0.890	43.25	out of range
" ... ..	0.900 to 0.907	46.10	"
American (colza) ... ..	0.8245	35.1	41.2

A very simple and reliable method of testing the drying properties of "animal" oil is to expose a thin film of the oil (2 drops on a  $\frac{1}{4}$ -plate negative glass) for twenty-four hours to a temperature of 95° to 97° C., when the extent to which the oil has dried is judged by the finger. Although the above test is somewhat severe, numerous experiments proved that genuine tallow, lard, and neat's-foot oils stand the twenty-four hours' exposure without "gumming" to any appreciable extent, while many samples with specific gravities of from 0.9170 to 0.9215 gave sticky films.

For the detection of fish oils in "animal" oil, Hehner and Mitchell's hexabromide test, even when used qualitatively, gives valuable information. Tested by this method, genuine lard and tallow oils give no, or at most very small, deposits, while the

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presence of even 5 per cent. of whale or similar oil is indicated by a very distinct precipitate of the bromine compound.

As for the iodine value, some discretion must be used in drawing conclusions from this "constant," as a high absorption may well be due to horse oil. One has therefore to fall back on the phytosteryl acetate test for seed oils. In applying this test to several samples of "animal" oil, I have experienced great difficulty in obtaining correct melting-points due to the presence of small quantities of mineral oil. Attempts to eliminate the latter substance (before acetylating) by means of petroleum ether, as proposed by Polenske, were made with limited success, the alcohols being soluble to such an extent in the mineral oil solution that too little of the former is left for the subsequent operations, even when 100 grams of the oil are employed.

