CHAPTER 3

DIRECT ANALYSIS OF FATS THAT ARE PRIMARILY COMPOSED OF STEARIN AND OLEIN AND PREPARATION OF THOSE SUBSTANCES

710. The fats that I will be discussing in this chapter are human fat, lard, jaguar and goose fat and beef and mutton tallow.

711. To analyze the last five of these, they are treated in a long-necked flask with boiling alcohol. Assuming that the latter is not present in a sufficient quantity to dissolve the totality of the fat, the following can be observed: both olein and stearin dissolve but in the solution, the ratio of the former to the latter is larger than in the fat being treated and consequently, in the undissolved residue of stearin and olein, the ratio of the stearin to the olein is greater than in the fat. On cooling, the undissolved material solidifies and coats the bottom of the flask. After several hours, the solute splits into two different materials, one with an excess of olein which stays in the alcohol, and another with an excess of stearin which forms a precipitate. After twenty-four hours, some alcohol is added to suspend this precipitate in the liquid, which is then rapidly poured onto a filter. The undissolved, solidified material on the bottom of the flaks remains where it is. This is then repeatedly treated with alcohol until everything has dissolved, whereby after each treatment, the alcohol suspension is cooled, agitated and poured onto a filter. This method results in: 1. cooled alcoholic liquids; 2. stearin retaining the olein that was deposited from the boiling alcohol on cooling.

Cooled and filtered alcoholic washing liquors

712. They are evaporated gently and water is added when about 7/8 of the alcohol has evaporated. This yields *an aqueous liquid* and *olein containing stearin*.

713. After having separated the olein from the aqueous liquid, it is stirred with a large quantity of water to wash it, then collected in a small flask that is exposed to a temperature that is sufficiently low to ensure the solidification of part of the material, which consists mainly of stearin. This solid part is then separated from the fluid part by passing it through filter paper. The liquid fraction is exposed successively to lower and lower temperatures and filtered after each exposure. Finally, an olein is obtained that is still fluid at – 4°C and even lower.

Stearin retaining olein deposited from alcohol by cooling

714. To obtain this in a more or less pure state, it must be dissolved again in hot alcohol; the liquor must then be cooled and filtered, and the

precipitate collected and subjected to repeated treatment until a stearin has been obtained with constant melting point.

715. The analysis of human fat and fats that have more or less the same melting point is carried out as follows: they are first of all exposed to the cold, whereupon stearin containing olein solidifies. This material is filtered and the filtrate is again exposed to the cold to separate further stearin. In this way, olein is obtained without recourse to alcohol[1]. The stearin is extracted by means of alcohol from the solid material left on the filter.

716. In the next Book I will investigate the properties of the oleins and stearins extracted from various fats. Here I will only report the observations I made on the *aqueous liquids* (712) originating from the analyses of these fats.

Aqueous liquid obtained from lard

717. Although it had been filtered several times, it was slightly cloudy. After having been concentrated, it had a nauseating smell and flavor that I am bound to say was reminiscent of gall. After further concentration, it was filtered and the small amount of fat that affected the transparency was removed. The filtered liquor was then gently evaporated to a syrupy consistency and in that way the nauseating smell and flavor were eliminated, from which it follows that a volatile compound caused these properties[2]. Does this compound occur in gall? The evaporation residue weighed 50 mg whereas the amount of fat analyzed was 86 g. The residue was yellow; it was neither acid nor alkaline and it had a sharp and salty taste. It was soluble in water and alcohol and it did not contain glycerin. It left a residue consisting of sodium chloride, sodium carbonate and traces of calcium carbonate and iron oxide.

Aqueous liquid from human fat

718. It exuded an odor of gall like the previous fat. It yielded a yellow, bitter extract. The extract obtained from the first washing of the fat with alcohol was alkaline; that obtained from the last wash was acid. It also contained a trace of empyreumatic oil.

Aqueous liquid from jaguar fat

719. It had a disagreeable smell. It contained a yellow, bitter, oily material that appeared to me to contain some acetic acid.

Aqueous liquid from goose fat

720. It was totally odorless and contained only a trace of material that dissolved in water.

Aqueous liquid from mutton tallow

721. It did not smell of gall but it yielded an extract similar to the one obtained from the last alcoholic wash of human fat (718).

Aqueous liquid from beef tallow

722. It was reddish, alkaline and contained some potassium chloride and sodium chloride.

723. I distilled the alcohol that had been used in the analyses of the fats I have just discussed, to see if the product contained some particularly smelly substance but I obtained nothing remarkable except from the alcohol used in the analysis of mutton tallow. This liquid yielded a product that smelled slightly of tallow candles because the air had acted on the stearin.

724. I have had occasion to treat mutton and beef tallow that colored alcohol blue. They must have contained a substance that is foreign to the stearin and the olein constituting those fats.

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[1] This is dry fractionation *versus* solvent fractionation and including multi-stage fractionation.

[2] The author arrives at this conclusion because they disappear by evaporation. To what extent it was realised at that time that a substance had to be volatile to be smelled is not clear.

FORMULA

FOR SEPARATING THE VARIOUS PRODUCTS ARISING DURING THE TREATMENT OF FATTY MATERIAL THAT CAN BE SAPONIFIED BY POTASSIUM HYDROXIDE

100 fatty material
60 pure potassium hydroxide that has been calcined
400 water
Boilling or digesting for 12 hours at the most if the saponification goes well, and at least 60 hours if it proceeds with difficulty

Treat the soapy mass with tartaric or phosphoric acid; heat just to form a single fluid mass from the fatty matter. This gives an *aqueous liquid* and a *fatty material*. Wash the latter until the water no longer removes any acid.

1. *Aqueous liquid* — Distill

1. If there is a *volatile acid* product

Neutralize with baryta water.
Evaporate to dryness; weigh the dry residue. Treat with solvents using method described in Book IV, section 3 to see if residue consists of one or more compounds.
Decompose pure compound with phosphoric acid or each compound if there are several; if no *oily acids* are separated, distill material over gentle heat to yield aqueous solution of *volatile acid.*

2. *Residue*

Evaporate to dryness in a dish on a water bath; treat the residue with alcohol of 0.800; filter; evaporate to syrupy consistency on water bath; dissolve in very dry alcohol; evaporate again; dry under vacuum; weigh: *glycerin* or *tasteless material*

2. *Fatty matter.* Weigh

Treat it with baryta water. Dry the soap obtained. Treat barium soap with alcohol (0.791) or ether.

1.*Alcoholic or ether solution*

Evaporate.
The residue is a *non-acid material* if the fatty matter is of the spermaceti genus; weigh.

3.*Soapy residue*

Decompose with hydrochloric acid. Weigh *acid fatty matter,* neutralize with potash water when sure that it is totally soluble in weak caustic potash. Dry the potassium stearate, palmitate and oleate soap that will have formed.

1. Treat with cold, absolute alcohol, which dissolves most of the potassium oleate with a small amount of stearate and palmitate (*Cf.* Book III, Chapter 1.)

2. Treat residue with boiling alcohol to separate the stearate and the palmitate. On cooling, a deposit is formed with a higher stearate/palmitate ratio and certainly a higher stearate to oleate ratio than in the residue before the treatment with boiling alcohol. (*Cf.* Book III, Chapter 1)