This discussion will be concerned with those procedures which require less than five hours for the determination of fat or moisture content. The conventional ether extraction will be omitted since this technique is well-known by all those engaged in work requiring the determination of fat content.

FAT DETERMINATIONS

A paper was presented by Kelley et al. (1953) wherein several rapid methods of fat determination were discussed. The methods discussed included:

a. Methods for fat determination of ground meat without centrifuging using sulphuric acid.


d. Modified Babcock method with centrifuging using Minnesota reagent.

All of these methods depend upon the rapid digestion of the sample by the reagents indicated. The fat, having a density less than that of water is then brought up into the calibrated neck of the flask or a measuring tube by the addition of water. Thus the volume of the fat contained in the sample can be quickly and easily read.

Methods a, b, and d were unsatisfactory for various reasons, whereas the Modified Babcock method of rapid fat determination, with centrifuging of the samples after digestion with sulphuric acid, gave reliable results when compared with the ether extraction method.

Trunin (1941) used a method in which the tissue was treated with HCl and the liquified material extracted with di-ethyl ether, while being heated and stirred electrically in a special apparatus. Removal of the ether layer was effected by the gravity of water, flowing from an elevated vessel and entering the extraction flask near the bottom. An alternative procedure was suggested in which the fat was extracted while heating but without stirring, and the separation was accomplished by means of a separatory funnel. The acidic solution was then washed once with di-ethyl ether in a specially designed separating column. Both of these methods
were said to be suitable for use in the meat packing industry. Diagrams of the apparatus accompanied the paper.

Ernst (1944) presented a method said to be suitable for commercial control work with raw, pre-cooked, partly dried, or completely dried meat products. In this procedure, a sample of finely ground meat is placed in a 250 ml. separatory funnel which is fitted with a medium or fine porosity, scinted glass filter plate fused in place. A sample of 5 to 6 grams is placed in the separatory funnel and extracted twice with 50 cc portions and twice with 30 cc portions of anhydrous ether. The ether is then filtered into a weighed, 250 or 300 cc flask with a ground glass neck. The flask is then fitted with a condenser and the ether is rapidly boiled off. The flask is next placed in a vacuum oven at 100°C and 25 inches of vacuum for 30 to 45 minutes. The flask is cooled and weighed and the percentage of fat is calculated from the difference in weight. The dehydrated samples were sometimes difficult to filter. In such cases, sand was mixed with the sample and suction applied to increase the filtration rate. Raw data were presented and these indicated very good agreement between the method under discussion and the A.O.A.C. method.

Attempts have been made for several years to utilize the well-defined differences in the relative density of fatty tissue, and the remainder of body tissue as an index to the fat content. Success has been attained with this method by Kraybill et al. (1952) and Brown et al. (1951). Success with this method has been confined mostly to relatively large samples of tissue. The weight of the sample is taken in air and then while submerged in water. The difference between the two divided into the weight in air gives the specific gravity. Since the specific gravity of fat is less than that of water and the specific gravity of lean is greater than that of water, an inverse relationship exists between specific gravity and fat content of the sample.

The International Tool Corporation, National City, California has marketed a device called the Lipometer which operates on the principle of specific gravity. The instrument is designed for use with one-quarter pound samples of ground meat. No data were found in the literature to indicate the usefulness of the instrument. Results with this instrument at Illinois have, however, been disappointing.

MOISTURE DETERMINATIONS

Miller (1943) described a method of determining tissue water by a distillation process. A sample of five to ten grams is placed in a distillation flask to which is added 100 ml. of toluene (containing 4% n-amyl alcohol). The flask is then connected to a receiving tube. The receiving tube is filled with mercury from below, to a mark on the tube. Toluene is added from the tip till it is level with the opening of a side arm from the distillation flask. The receiving tube is fitted with a condenser. The length of the distillation time is not indicated, but is one hour for blood samples. As the water condenses it falls into the receiving tube. When distillation is completed, mercury is removed for weighing until the line of demarkation between the water and toluene is at the mark on the receiving tube. By means of an equation, the volume of
water distilled can be determined. Diagrams of the equipment are included in the paper.

Mitchell (1951) presented a discussion of a chemical method of moisture determination using the Karl Fischer reagent. The reagent consists of iodine, sulfur dioxide, pyridine, and methanol. The chemical reactions involved in the determination are given below.

\[ \text{C}_5\text{H}_5\text{N} \cdot \text{I}_2 + \text{C}_5\text{H}_5\text{N} \cdot \text{SO}_2 + \text{C}_5\text{H}_5\text{N} + \text{H}_2\text{O} \rightarrow 2\text{C}_5\text{H}_5\text{N} \cdot \text{HI} + \text{C}_5\text{H}_5\text{N} \cdot \text{SO}_3 \]

\[ \text{C}_5\text{H}_5\text{N} + \text{SO}_3 + \text{CH}_3\text{OH} \rightarrow \text{C}_5\text{H}_5\text{N} \cdot (\text{H}) \cdot \text{SO}_4\text{CH}_3 \]

From these equations it can be seen that 1 mole of water requires 1 mole of iodine, 1 mole of sulfur dioxide, 3 moles of pyridine, and 1 mole of methanol. It is common practice to employ an excess of sulfur dioxide, pyridine, and methanol in making up the reagent. Thus the iodine content actually determines the strength of the reagent. The excess of reagents is varied to meet different needs. These reactions have a visible end-point, but an electrometric end-point is more precise and is widely used. An adaptation of this method for use with tissue samples was devised by Cook, et al. (1952). A small piece of tissue (100 to 250 mg.) was placed on a tared slip of filter paper, rapidly weighed and placed in a flask containing the reagent. The tissue mass is crushed with a glass rod, after which the sample is titrated.

There are undoubtedly other rapid methods for the determination of both fat and moisture content. Time does not, however, permit the discussion of all possible methods at this time.

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MR. AUNAN: We will now hear from Dr. Joe Kastelic on
"Connective Tissue Determinations."

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