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Testing Dairy Products

By C. C. Totman

Cream Tests

Before any testing is done it is most important to get a representative sample. Frozen cream must be thawed. All cream must be thoroughly stirred. Remember you are licensed by the State Department of Agriculture to sample as well as to test.

Butterfat Test. Frequently cream is stirred, sampled and weighed at the time of delivery and testing is done near the end of the day. Sour and heavy cream is viscous and may "set" in the sample jar. This means that it must be well stirred or poured from one jar to another several times or may even require some heating to again become fluid enough to get a correct sample. If heated, cool again to about 70° F. after weighing into test bottle and before adding acid.

Cream test scales must be kept dry and clean and the 9-gram weight must always be scrupulously clean and dry. Never handle weight with wet hands and never allow acid to corrode it. The scales must be protected from air currents from all angles, leaving only room to work. This is important.

Procedure.

1. Balance, clean dry test bottles on the scale.
2. Transfer 9 grams of cream into plainly marked test bottles.
3. Remove 9 gram weight and place cream from the next sample in test bottle on opposite pan until a balance is obtained. Beware of over and under weights because errors may be doubled as you proceed in this cross balancing.
4. Add sulphuric acid (1.82 to 1.83 specific gravity). Use 8 to 12 cc if cream is at room temperature and slightly more if cream and acid are colder.
5. Shake well and add 8 or 10 cc of water at about 160° F. as the sample turns from a chocolate to dark brown color. This retards further action and should prevent a charred fat column.
6. Centrifuge 5 minutes; add water at about 160° F. to fill bottle to neck; centrifuge 2 minutes and add hot water to bring fat column within graduations in neck of bottle; centrifuge 1 minute.
7. Remove bottles from tester and place in deep water bath at 130° to 140° F. for 5 minutes.
8. Add a few drops of glymol or red reader in such a manner as to avoid disturbing the fat column.
9. Read and record tests at once.

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Acidity Test. The most reliable and accurate test for acidity is the 1/10 normal sodium hydroxide solution and a standard burette. This permits the operator to report quite exact acidity in 1,100 percentages as for example 0.61 percent. The rapid acid test, known as the Farrington test, requires one giant alkali tablet or pill to one pint of distilled or clean rain water. Allow to dissolve several hours before use. Occasional mixing is required for complete solution. It gives acidities in approximate ranges as: Less than 0.2 percent, less than 0.4 percent, and less than 0.6 percent when used as directed.

Standard Burette Method.
1. Weigh 9 grams of cream into a suitable white porcelain dish. (Clean cream test bottles are suggested where several tests are run at a time.)
2. Add 9 cc of water; if using an open dish you may use the pipette to mix the sample by alternately filling and emptying.
3. Add 3 to 5 drops of 1 percent phenolphthalein solution or indicator.
4. Starting from zero on the burette, add the 1/10 normal sodium hydroxide solution until a faint pink color forms and will remain for about 1/2 minute. Stir continuously while adding solution. If 6.1 cc of solution are required, the acidity is read directly as 0.61 percent.

Farrington Rapid Acidity Method. Two small dippers (about 10 to 20 cc) are used, one for cream, the other for the red testing solution. The dipper size is unimportant but both dippers must be the same size.
1. Transfer one dipper of well mixed cream to a clean receptacle.
2. Transfer one dipper of testing solution to same receptacle.
3. Mix thoroughly and if no pink color remains, the cream acidity is over 0.2 percent; if a pink color remains, the cream acidity is less than 0.2 percent.
4. If over 0.2 percent, add another dipper of testing solution to determine if the cream acidity is over or under 0.4 percent.
5. If over 0.4 percent, add another dipper of testing solution to find whether over or under 0.6 percent.
6. This concludes testing because the use of 3 dippers of solution determines whether the cream has more or less than 0.6 acidity and this is the dividing point between No. 1 and No. 2 cream from the standpoint of acidity.

Caution, In handling viscous cream, either sweet or sour, it is advisable to hold the small cream dipper in hot water momentarily to heat it, then wipe dry and proceed to dip cream. This lessens the tendency of the cream to stick to the dipper. In addition it may be necessary to wipe surplus cream from the outside of the dipper to prevent transfer of more than a dipper full.

Note: Rapid acid solution may be made with tablets as above indicated or as follows: 100 cc of 1/10 normal sodium hydroxide solution; 20 cc of 1 percent phenolphthalein indicator and 330 cc of distilled water. This makes a total of 450 cc or about 1 pint. Always keep testing solutions tightly stoppered when not in use.
Sediment Test

The same cream samples used for fat and acidity tests may also be used for sediment testing, the assumption being that the sample jars were well cleaned and had been held covered or inverted until used. Jar covers too, must be clean and free of sediment and rust.

Procedure “A.” Prepare a sediment free solution of soda:

a. Baking soda, 8 teaspoons to 1 gallon water
b. Soda ash, 5 teaspoons to 1 gallon water

1. Use 2 oz. of cream.
2. Transfer to sediment tester.
3. Add about 1 cupful of 180°F. soda solution to the tester, withholding a small portion to rinse the 2-oz. cream sample jar and the pad.
4. Filter and mount pad on suitable cardboard with patron’s number.

Note: Sweet cream requires no soda—use 180°F water only.

Note: Use of 1 teacup of soda solution for sour cream is appropriate. Three or four drops of phenolphthalein solution (acid test indicator) added to the cream, followed by addition of portions of the cup of soda solution will allow the use of the right amount of soda solution to produce a faint pink color and at this point no more soda need be added.

Procedure “B.” (Recommended by the American Butter Institute and Hunziker’s “Butter Industry.”)

Prepare a hydrochloric acid solution containing 3.2 cc of concentrated acid to 1000 cc of distilled water. Use 8 oz. of this instead of soda as in Procedure “A.” Complete the test in the regular manner.

Note: Above directions are for a tester using a 1½ lintine pad with a one inch filtering surface (as the common milk sediment tester). If your tester is provided with a 1½ inch filtering surface you should use 4 oz. of cream.

Mold Mycelia Test
(Known as the Parson’s Test)

Prepare a testing solution by using 1 package of commercially prepared powders to 3.5 quarts of distilled water. Heat the solution until all salts are dissolved. Filter through clean cheese cloth to remove any sediment. Place in well stoppered bottle.

Procedure. Secure suitable equipment for making the test.

1. Raise water in bath to 180 to 200°F. and maintain this temperature while testing. Place 2 oz. jars in bath before reaching final temperature.
2. Use 9 cc of well mixed cream sample in each 2-oz. jar in water bath.
3. Without delay, transfer 17.6 cc of the blue test solution to each jar. When using pipette, invert for rapid delivery of blue solution.
4. Use a watch, time the slow stirring of these samples with the multiple stirring device, and stop after 3 minutes. Remove source of heat and proceed to filter at once. Be sure the temperature remains above 150°F for all samples. If cooler, some curd may appear on pad with mold.

5. Give jar rotary motion to bring mold together. Filter and mount each pad with its proper number.

In learning to evaluate pads, compare with standard picture cards furnished by the American Butter Institute, 110 N. Franklin St., Chicago, Ill.

**Butter Analysis**

**Kohman Method.** Be sure to obtain a representative sample. A churn sample should consist of small portions from 5 or 6 separate places. Scrape a fresh surface and sample at once with spatula or spoon. A tub sample is taken from at least 3 places in the tub or box, using no butter within an inch of the top of the container. Warm the sample and mix to a creamy consistency avoiding melting. Keep sample tightly covered except when using.

**Procedure.**

1. Balance a clean dry moisture cup on the right pan of the scale after placing the upper-beam weight at 10 percent mark.

2. Weigh exactly 10 gm. into cup.

3. Evaporate over flame or hot plate; heat slowly to avoid spattering; rotate cup but avoid contact of butter and tongs.

4. Cool and weigh using lower-beam weight. Natural cooling is preferable; rapid cooling may be practiced by short immersion in clean cold water followed by wiping with very clean cloth used for this purpose only. Cool only to safe touch temperature leaving enough residual heat to evaporate any unwiped moisture film.

5. Record percentage moisture—scale reads direct.

6. Add 40 to 50 cc of high test gasoline to the moisture test residue, rotate cup to facilitate solution of the fat. Allow salt and curd to settle for 5 minutes (cup in tilted position).

7. Carefully pour fat-gas solution in waste jar or drain. Use decanting rod to prevent solution from following down outside of cup. Be sure no sediment is lost in pouring.

8. Make one or two successive washings using less gas and less time for settling. Usually two washings are enough but if the sediment in the cup fails to turn a light tan color in drying, a third washing is probably needed.

9. Upon completion of washing with gas, evaporate last traces of gas on an electric hot plate (low heat) or source of heat other than a flame. Great care is needed to heat slowly. Rapid heating is likely to cause spattering of salt and curd.
10. After drying, cool; place on right scale of pan; remove 10 gm. weight; slide lower beam weight to left to 0; move upper beam weight to the left from position 10 percent.

11. When balance is obtained, read percentage of salt and curd and record. For example if balance occurs at 8, the percentage is 2 \((10 - 8 = 2)\); if at 7, the percentage is 3 \((10 - 7 = 3)\), etc.

12. Use residue for salt test.

13. Add warm water, preferably distilled, in measured amounts depending on capacity of pipette available for use, e.g. 250 cc for a 25 cc pipette, 176 cc for 17.6 cc pipette or 100 cc if for 10 cc pipette. In any case use 1/10 of total solution for the salt test. After adding the accurately measured warm water, stir well with clean stirring rod.

14. The standard silver nitrate solution contains 29.06 gm. per liter and results are recorded directly as each cc of silver solution represents 1 percent of salt in the butter.

15. A 10 percent potassium chromate solution is used as an indicator, 3 to 5 drops per test. You have now determined the moisture and salt directly. Fat and curd are calculated by differences. For example 16.5 percent moisture, 3 percent salt and curd and 2.2 percent salt.

\[
\begin{align*}
3.0 - 2.2 &= 0.8 \text{ percent curd.} \\
16.5 + 2.2 + 0.8 &= 19.5 \text{ percent moisture, salt and curd.} \\
100 - 19.5 &= 80.5 \text{ percent fat.}
\end{align*}
\]

**Kohman Short Method.** Conducted in the regular manner as given above except solution of the fat in gasoline is omitted.

1. After completion of moisture test add a measured amount of water at about 120°F. (see Item 13 above).

2. Pour this mixture into another clean dish and follow by pouring back and forth about 20 times. This is very necessary in order to get complete solution of the salt.

3. Allow 1 or 2 minutes for fat to rise, then pipette 1/10 of solution to clean dish for titration with silver nitrate solution (see Items 13, 14, 15 above). You have now determined moisture and salt. The curd is estimated, usually as 1 percent.

\[
\begin{align*}
\text{Thus:} & \\
16.5\% \text{ moisture} & \\
2.2\% \text{ salt} & \\
1.0\% \text{ curd (estimated)} & \\
19.7\% & \\
\text{Then:} & \\
100 - 16.7 &= 80.3\% \\
\text{Normal curd content averages 0.6 to 0.9\%. Therefore estimation at }1.0\% & \text{ allows a safety margin.}
\end{align*}
\]

Obviously this method is less accurate. If an attempt is made to keep the fat content of butter close to 80 percent, the complete Kohman analysis is recommended. Also, if starter is worked into butter, if overchurning occurs,
if improper neutralization and pasteurization of high acid cream are prac­ticed, then curd content of butter may be above average and a complete Kohman analysis is safest.

**Milk Tests**

**Fat Test.** Thoroughly stir the batch of milk to be tested, sample at once and stopper sample jar tightly until used.

1. Mix sample well by pouring 4 or 5 times.
2. Both acid and milk should be about 60°F.
3. Pipette 17.6 cc immediately to test bottle and clearly mark the bottle with sample number.
4. Add 17.5 cc of sulphuric acid and mix gently until curd is dissolved, then agitate vigorously for about 1 minute.
5. Balance tester and run at prescribed speed.
6. Centrifuge 5 minutes; add hot water (160-180°F.) to base of neck.
7. Centrifuge 2 minutes and add hot water to bring fat column within gradu­ations of neck.
8. Centrifuge 1 minute and then transfer test bottles to deep water bath (135 to 140°F.) for 5 minutes.
9. Read and record tests as each bottle is removed from bath.
10. Tests are read from the upper limit of the meniscus to the lowest point of the fat column.

**Sediment Test.**

1. Secure a well-mixed one pint sample.
2. Pass through sediment disc with one inch filter surface.
3. Mount on card with proper sample number.
4. Judge sediment pad according to amount and kind. (See U.S.D.A. Dept. Circ. 384.) Insects and other objectionable material are cause for con­demning milk.

**Acidity Test of Milk, Skimmed Milk, and Whey.** See acidity test of cream. In testing milk, skimmed milk or whey for acidity, 9 cc of sample may be pipetted instead of weighing 9 grams.

**Fat Test of Skimmed Milk.** See fat test for milk. Alter the directions thus: Use special test bottle, use 1 to 2 cc more of acid, whirl 10-2-1 minutes instead of 5-2-1.

**Fat Test of Buttermilk.** See testing milk. Alter procedure thus: Use skimmed milk test bottle. Use 9 cc of sample, add 2 cc normal butyl alcohol and mix. Use about 9 cc sulphuric acid. Centrifuge 6-2-2 minutes. Double the reading.
Standardizing Milk and Cream

Two types of problems are found. Type 1. Where an unspecified amount of product is desired, unlimited amount of one raw material and a limited amount of the other.

**Problem 1.** Make an unspecified amount of 22 percent cream using 40 lbs. of 35 percent cream and the necessary 3.5 percent milk to reduce the test.

\[
\begin{align*}
35 & \quad 18.5 \times (22 - 3.5) \times 2.16 = 40 \text{ lbs. of cream} \\
3.5 & \quad 13 \times (35 - 22) \times 2.16 = 28 \text{ lbs of milk} \\
40 & \quad \frac{18.5}{35} = 2.16 \\
\end{align*}
\]

Total 22% cream = 68 lbs.

**Problem 2.** Where a definite amount with a definite test is required. Make 80 lbs. of 22% cream using same materials as in Problem 1.

\[
\begin{align*}
35 & \quad 18.5 \times 2.54 = 47 \text{ lbs. of cream} \\
3.5 & \quad 13 \times 2.54 = 33 \text{ lbs of milk} \\
80 & \quad \frac{31.5}{80} = 2.54 \\
\end{align*}
\]

**Problem 3** (Type 1) in standardizing market milk:

Conditions: 250 gal. of 3.3 percent milk. Test desired 3.8 percent. Use 40 percent cream to standardize milk.

1 gal. milk weighs 8.5 lb.—250 \times 8.5 = 2125 lbs. milk

\[
\begin{align*}
40 & \quad 0.5 \times 58.7 = 29.35 \text{ lbs. of cream} \\
3.3 & \quad 36.2 \times 58.7 = 2125.0 \text{ lbs milk} \\
36.2 & \quad \frac{2125}{36.2} = 58.7 \\
\end{align*}
\]

(unnecessary calculation since 2125 lb. milk was amount to standardize).

\[
\begin{align*}
2125 & \quad 2125 + 29.35 = 2154.35 \text{ lb. 3.8% milk} \\
\text{Proof:} & \quad 2154.35 \times 0.038 = 81.85 \text{ lb. fat.} \\
2125 & \quad 2125 \times 0.033 = 70.12 \text{ lb. fat in milk} \\
29.35 & \quad 29.35 \times 0.400 = 11.74 \text{ lb. fat in cream} \\
70.12 & \quad 70.12 + 11.64 = 81.86 \text{ lb. fat in the source} \\
\end{align*}
\]

materials and in the finished batch.
Ice Cream

**Fat Test.** Either ice cream mix or melted ice cream may be used. If butter is used in making mix all portions of mix from the viscolizer may not test alike. Therefore, finish the run and stir well the vat of mix, then sample.

**Minnesota reagent test:**

1. Weigh 9 grams of sample into a milk test bottle.
2. Add 15 cc of Minnesota solution.
3. Mix and heat in water bath at 200°F or more for 10 to 15 minutes—shake occasionally.
4. When fat and solution are clear and layered, centrifuge ½ minute.
5. Add hot water to fill well into neck graduations and centrifuge again ½ minute.
6. Transfer bottle to deep water bath at 120°F for five minutes and read.
7. Multiply reading by 2 because only 9 grams of mix was used in an 18 gram bottle.

**Acetic Sulphuric Acid test:**

1. Weigh 9 grams of mix into milk test bottle.
2. Add 8 to 12 cc of concentrated acetic acid (80%),
3. Mix, then add about 8 cc of sulphuric acid.
4. Shake well, centrifuge 5-2-1 minutes.
5. Set in deep water bath at 130-140°F for 5 minutes.
6. Add glymol and read as bottles are removed from bath.
7. Multiply reading by 2.