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Tests for Cream Sediment

BY E. W. BIRD, D. F. BREAZEALE AND H. P. GUEST

COMMERCIAL milk plants have employed the sediment test for milk for many years. In fact, the milk sediment test has its place on the milk score card. The amount of sediment is always determined in scoring milk. The test is extremely simple; it consists of passing 1 pint of milk through a sediment tester and catching the sediment present in the milk on a circular pad 1 inch in diameter.

The application of a sediment test to cream, on the other hand, has been attempted only very recently. A test as simple as that for milk is impossible. The cream’s high fat content necessitates warming it to melt the fat so that the sample will filter easily; the variable acidity of cream for butter-making necessitates the use of a neutralizing agent, in many instances in order that the filter pad will not clog. Because of the high fat content of the cream it is imperative to use less than a pint in order to reduce the cost and eliminate the handling of a bulky sample after dilution.

Interest in cream sediment tests has spread rapidly. Many inquiries have been received concerning them, and in the spring of 1934 several groups of Iowa creameries requested that the Iowa Agricultural Experiment Station develop a rapid, satisfactory test for plant use. The request was complied with, and within a month a tentative method was released to the creamery operators. With the help of the Dairy Industry Extension Service this test has been modified for certain types of cream. Several tests have been studied, in addition, and it is considered that sufficient experience has been obtained to permit making rather definite suggestions regarding cream sediment tests.

It is considered that a universal sediment test, i.e., a simple set of directions applicable to all kinds of cream, is impossible to attain. This is because, apparently, the different treatments which cream has received up to delivery time, leave the casein or curd portion of the cream in different forms. When these different samples of cream are treated—for instance, with lye or baking soda—the form in which the curd portion is left will vary considerably; some samples will run through the sediment

1 Dr. H. P. Guest is associated with the Department of Chemistry at Iowa State College.
tester without difficulty, while others will not pass through the tester with any amount of effort.

In sweet milk or cream the curd portion is suspended in very fine particles—so fine in fact, that they cannot be seen under the ordinary microscope—and yet the curd is not in solution as sugar would be in coffee or salt in butter serum. Experimental work indicates that when the cream sample is treated so that the curd portion is in a similar suspension form, the samples pass through the tester easily but when enough chemical is added to cause the curd to form a sort of gelatinous, semi-solution, the filter clogs.

DESCRIPTION OF TESTING METHODS

From the foregoing discussion it would appear that the less acid there is in the cream, the less treatment it requires and vice versa; testing of cream for sediment verifies this. Although there are no set rules, the following general statements seem to be in order:

1. If the cream is sweet and free from ropiness or other defects, which cause the curd to form masses that do not dissolve readily, a 2-ounce sample of cream may be diluted with a cupful (1/2 pint) of hot water (180° F.) and passed through the sediment tester. In most instances this procedure will be found satisfactory.

2. For medium sour cream—for instance, from 0.3 to 0.8 percent—this test is recommended:2

Place a 2-ounce sample of cream in a pint granite-ware cup, add 1 cupful (1/2 pint) of hot (180° F. or higher) baking soda solution (8 teaspoonfuls per gallon of water). Stir thoroughly and run through the sediment tester. Use portions of the 1/2-pint of baking soda solution to rinse the sample bottle so that all sediment is transferred to the tester. Rinse the cup with water and pass this water through the tester.

3. For very sour cream—above 0.8 percent acidity—use this method:

Place a 2-ounce sample of cream in a pint granite-ware cup, add a 9.0 g. acid dipper of 1 percent lye solution (10 g. lye in 1 quart distilled or soft water), stir, allow to stand 2 minutes (cold), add a cupful (1/2-pint) of hot distilled or soft water (180° F. or over), mix thoroughly and pass through the tester. Rinse the sample bottle with a little cold soft water to insure its complete transfer to the cup and rinse the cup with a little hot water to transfer it completely to the tester.

2 This method is a modification of that described by the Illinois Butter Manufacturers Improvement Association.
METHOD OF SAMPLING

It has been found convenient, in taking sediment test samples, to fill completely a 2-ounce sample bottle at the time the cream is received, weigh the sample for the Babcock test from this amount and run the sediment test on the remainder. In this way it is not necessary to take two samples, and the method insures as much care in taking the sediment sample as is employed in taking the fat test sample.

DESCRIPTION OF TYPES OF SEDIMENT TESTERS

Figure 1 shows the construction of the suction (A) and the pressure (B) types of milk sediment testers. Since the advent of the cream sediment test a number of testers have come on the market. To the best knowledge of the writers these have all been of the pressure type. Most of them are more cheaply constructed (and sell for a much lower price) than those shown.

The suction tester is used in this manner:
1. Filter pad (3) is placed on screen (4), which is then clamped into position.
2. The plunger (2) carrying the screen and pad is then pushed into the tester (1) until it strikes the bottom.
3. The treated sample is poured into the tester.
4. The plunger is pulled out slowly and steadily. (This creates sufficient suction to force the milk through the filter pad and deposit the sediment on the pad.)

The pressure tester is used somewhat differently.
1. The pad (3) and screen (4) are clamped into position on the small end of the tester.
2. The treated sample is poured into the tester.
3. The lid is clamped down.
4. The sample is forced through the pad by pumping air into the tester with the atomizer bulb.

With either tester it is best to rotate the sample so that the swirl of the liquid washes sediment particles from the plunger shelf in the suction tester or from the narrow shoulder near the opening of the pressure tester.

EXPERIMENTAL WORK IN DEVELOPING THE SEDIMENT TESTS

The experimental work may be divided into two sections—(1) the selection of the chemicals used to dissolve the curd, and (2) the routine use of methods in the College creamery to check their applicability to plant conditions.
Fig. 1. Types of sediment testers.

**SELECTION OF CHEMICALS**

The chemicals studied were:

1. **Alkalies**: ammonium hydroxide, trisodium phosphate, borax (sodium tetraborate), baking soda (sodium bicarbonate) and lye (sodium hydroxide).

2. **Acid**: hydrochloric.

Amounts of the reagents were varied to cover wide concentration ranges. With the exception of the borax and baking soda solutions, the reagent was added to the cream, the mixture was stirred, was allowed to sit (cold) for 2 minutes, was diluted with hot water and then filtered. Samples treated with borax were heated to the boiling point before filtering while those...
treated with baking soda solution were heated to 150° F. before they were filtered. The results are briefly summarized in table 1.

TABLE 1. DISPERSION OF CURD BY VARIOUS REAGENTS.

<table>
<thead>
<tr>
<th>Reagent employed</th>
<th>Smallest amount found satisfactory for 2 oz. sample of very sour cream</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amonium hydroxide</td>
<td>10.0 cc. (sp. gr. 0.90)</td>
<td>Objectionable because of odor.</td>
</tr>
<tr>
<td>Trisodium phosphate</td>
<td>5.0 cc. (10% solution)</td>
<td>Satisfactory dispersion with distilled or soft water.</td>
</tr>
<tr>
<td>Borax</td>
<td>100.0 cc. (4% solution)</td>
<td>Satisfactory dispersion; too slow.</td>
</tr>
<tr>
<td>Baking soda</td>
<td>150.0 cc. (2.25 oz. per gal.)</td>
<td>Slow; unsatisfactory with high acid samples because of foam.</td>
</tr>
<tr>
<td>Lye</td>
<td>9.0 cc. (1% lye solution)</td>
<td>Satisfactory with distilled or soft water; too alkaline for sweet cream.</td>
</tr>
<tr>
<td>Hydrochloric acid</td>
<td>0.25cc. (sp.gr. 1.19,37%)</td>
<td>Satisfactory except that attacked metal of one type of tester used.</td>
</tr>
</tbody>
</table>

Three tests were checked in the College creamery with a large number of samples over a long period of time. These tests included the lye and baking soda methods already described and in addition a second baking soda method in which $\frac{1}{4}$-teaspoonful of baking soda was added to 2 ounces of cream, the mixture stirred, a cupful of hot water (180° F. or higher) added and the material run through the sediment tester.

During these trials the results indicated that the dry baking soda method too often left undissolved baking soda particles on the filter pad; that the lye method was too alkaline for sweet cream samples and caused them in certain cases to form the gelatinous (unfilterable) semi-solutions previously referred to; and that from the standpoint of having the testing reagent free of sediment the baking soda solution was preferable to the dry baking soda method. After the baking soda has been dissolved, the clear solution may be siphoned from any materials (sediment) that may settle out.

In addition it was found that certain samples would not filter when treated by one of the methods. As many as 5 percent of the samples tested in one day might not filter, although this figure is higher than average. Usually, however, a sample that would not filter with one method could be filtered by one of the others. An attempt was made to correlate this peculiar behavior with period of lactation, yeastiness of cream, ropiness,
fat percentage of cream, acidity of cream and source of cream. No correlation seemed possible, however.

A GUIDE TO AMOUNTS OF SOILING

Figure 2 indicates the amounts of materials (not including insects) artificially added to clean cream to approximate different amounts of soiling with materials that might contaminate cream from milking time until it is received at the creamery. The numerals below the filter pads express the fractions of an ounce of foreign material in 100 pounds of cream if the sediment from 50 cc. of cream (approximately 2 oz.) is distributed over a circular area 1 inch in diameter. It will be noted that

Fig. 2. Sediment on 1-inch diameter circular areas from 50 cc. of cream. The figures express the weight of foreign material in ounces per 100 pounds of cream.
such small amounts of foreign material as 0.02 to 0.03 ounce make an appreciable showing on these pads.

It should be noted that the sample used was approximately 1/10 pint and not 1 pint as in the case of milk. It is apparent, therefore, that the 0.02 pad would have looked like the 0.20 pad and the 0.04 pad would have looked like the 0.40 pad if a pint sample had been used.

**PRECAUTIONS IN PERFORMING SEDIMENT TESTS**

These precautions should be observed in performing cream sediment tests:

1. To be fair to all patrons all samples must be of the same size and must be taken with the same care.

2. The use of dry neutralizing materials is not recommended because they may add sediment to the sample tested.

3. The water employed should be tested; it may be a source of sediment.

4. The sample bottles should always be rinsed as is recommended in the directions to insure complete transfer of the sample and sediment.

5. If the sample will not filter with the amount of alkali recommended for the two sour cream ranges, more alkali will usually hinder rather than help. Dilution with hot water will cause the sample to filter if anything will.

6. A sweet sample that will not filter may do so if baking soda solution is added.

7. The sediment tester should be rinsed well after each test.