A STUDY OF MIXED MILK SAMPLE METHODS OF
SEDIMENT TESTING USING OFF-THE-BOTTOM STANDARDS
AND EQUIPMENT, FOR POSSIBLE USE WITH
FARM BULK MILK HOLDING TANKS.* **

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Tests indicate that the milk in farm bulk tanks can be tested for sediment by using a 1 quart mixed milk sample and concentrating the sediment on ½ the area of a standard sediment disc or by using a 1 pint sample with the sediment concentrated on ½ the area of a standard disc. Off-the-bottom sediment standards can be used for evaluating the grades of these modified discs. Results of these modified tests are comparable to those obtained by the present standard off-the-bottom method on ten gallon cans.

It is mandatory in several states that milk, as it is received from producers, be tested for sediment at regular intervals. The standard off-the-bottom method of testing for sediment in milk has been devised for use when milk is handled in ten gallon cans. This method is not applicable to farm bulk milk holding tanks for numerous reasons. Some of these are:

1. The ratio of bottom surface area to total volume varies with the type and size of farm bulk milk tank.
2. The design of the tanks to allow for complete drainage of milk causes sediment to settle out in an uneven pattern.
3. On many farm holding tanks the mechanical agitator is set in operation whenever the refrigeration mechanism is in operation. This does not allow a definite period of quiescence needed for settling out of sediment.
4. There is difficulty in using the standard off-the-bottom sediment pumps because the depth of farm bulk milk tanks in some cases exceeds the over-all length of the sediment pump. This adds to the problem of getting representative results.

It is apparent that a mixed milk sample for the sediment test would be most practical for use with farm bulk milk holding tanks. It also would be desirable if the same standards and equipment used for the off-the-bottom sediment tests could be used for sediment testing of mixed milk samples.

This study had two main objectives. The first was to determine the volume of a mixed milk sample that was needed to give a sediment test comparable to the off-the-bottom method. The second objective was to compare mixed milk sediment testing with off-the-bottom sediment tests using currently accepted standards for off-the-bottom sediment tests.

VOLUME OF MIXED MILK SAMPLE TO DUPLICATE OFF-THE-BOTTOM TEST

For each series of the observations in this study, 40 gallons of milk were placed in a 50-gallon round vat, and a known amount of standard sediment was added. The contents of the tank were mechanically agitated by an agitator operating at 48 RPM. The agitator was kept in operation throughout the period of sampling. After a 5-minute period of agitation, 10 gallons of milk were withdrawn into an ordinary milk can and held for two hours. A standard off-the-bottom sediment test was made on the can following this period of quiescence.

Simultaneously with removal of the 10-gallon sample of milk from the tank, pads were prepared containing the sediment from various volumes of mixed milk from the tank. A Perfection Vacuumatic Filter was used to draw the milk through the cotton discs and deposit the sediment on the area of the disc with a 1.25-inch diameter. Five pads, each containing the sediment from one quart of mixed milk, were made. Next a like number of pads were prepared each containing the sediment from two quarts of the mixed milk in the tank. This was repeated for the same number of pads using 3, 4, 5, and 6 quarts of the mixed milk sample per pad. This group of pads, 5 pads each containing the sediment from one quart of mixed milk, 5 pads each containing the sediment from two quarts of mixed milk, etc., at 1 quart intervals up to the last 5 pads which each contain sediment from six quarts of mixed milk sample per pad. This was repeated for the standard off-the-bottom pad taken from the 10 gallon sample drawn off at the start. Judges were instructed to compare the pads as follows:

1. If the mixed milk sample pad appeared to contain less sediment than the corresponding off-the-bottom pad it was scored as minus (−).
2. If the mixed sample pad appeared to contain approximately the same amount of sediment as the corresponding off-the-bottom pad it was scored equal (=).
3. If the mixed sample pad appeared to contain more sediment than the off-the-bottom pad corresponding to it, a score of plus (+) was given the pad.

This procedure was carried out with varying amounts of standard sediment in the milk ranging in concentrations from 20 mg per 10 gallons of milk to 75 mg per 16 gallons. The results of these observa-
TABLE 1. VOLUME OF MIXED MILK FOR SEDIMENT TEST TO DUPLICATE
OFF-THE-BOTTOM TEST

<table>
<thead>
<tr>
<th>Volume of mixed milk sample</th>
<th>1 Qt.</th>
<th>2 Qt.</th>
<th>3 Qt.</th>
<th>4 Qt.</th>
<th>5 Qt.</th>
<th>6 Qt.</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of observations</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. with less sediment</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>than O.B.* pad (−)</td>
<td>100</td>
<td>98</td>
<td>62</td>
<td>7</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>No. with more sediment</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>16</td>
<td>68</td>
<td>95</td>
</tr>
<tr>
<td>than O.B.* pad (+)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. with same sediment</td>
<td>0</td>
<td>2</td>
<td>38</td>
<td>77</td>
<td>29</td>
<td>5</td>
</tr>
<tr>
<td>as O.B.* pad</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% of agreement with</td>
<td>0%</td>
<td>2%</td>
<td>38%</td>
<td>77%</td>
<td>29%</td>
<td>5%</td>
</tr>
<tr>
<td>O.B.* pad</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*O.B. signifies off-the-bottom

The use of a one gallon sample of mixed milk for a sediment test would not be very practical. It would involve special equipment and require extra time when testing the milk in the farm bulk holding tanks. By using a smaller sample and concentrating the sediment from this sample on one-eighth the area of a standard 1.25 in. sediment pad, the sediment from a one gallon sample of mixed milk is equivalent to the sediment from a one pint sample taken off-the-bottom of a ten gallon can of the milk.

GRADING SEDIMENT PADS WITH VARIOUS AREAS EXPOSED TO VIEW

The use of a one gallon sample of mixed milk for a sediment test would not be very practical. It would involve special equipment and require extra time when testing the milk in the farm bulk holding tanks. By using a smaller sample and concentrating the sediment on a proportionately smaller area, it would be possible to use standard sediment testing equipment. One method would be to use a standard 32 oz. (1 quart) sediment tester with a sediment pad having a diameter of 0.64 in. This would give a filtering surface of approximately one-fourth the area of the standard pad. Another possibility would be to use the 16 oz. (1 pint) sediment tester and a filtering surface of 0.44 in. diameter (approximately one-eighth area of standard pad).

A limitation of the use of this type of equipment for sediment testing mixed milk samples from farm bulk milk tanks would be the ability of the observer to evaluate these reduced area sediment pads in terms of currently recognized grades for standard off-the-bottom pads.

The following experiment was devised to determine the ability of judges to grade sediment pads with reduced areas, using the same standards as for the off-the-bottom sediment test.

Standards used for comparison in this study were those established by the Wisconsin State Department of Agriculture for grading standard off-the-bottom sediment pads. In these standards, a No. 1 standard disc shall contain no sediment, a No. 2 standard disc shall contain 0.5 mg of sediment, the No. 3 disc shall contain 2.5 mg of sediment and the No. 4 disc shall contain in excess of 2.5 mg of sediment. The standard sediment used in making the sediment pads was prepared according to Standard Methods.

Sediment pads were prepared using rapid flow cotton discs, according to Standard Methods. These were purposely made to resemble the four standard grades, namely, No. 1, No. 2, No. 3 and No. 4 or reject grade.

Judges were instructed to rate the pads as follows: All pads containing less sediment than a standard grade 3 pad were to be rated to the nearest grade. Those with more sediment than a grade 3 were to be placed in grade 4.

A total of 480 observations were made of the prepared sediment pads with the entire area of the pad exposed to view. As shown in table 2, 427 observations as to the grade of the pads were correct.

The same pads were rearranged, then covered with a piece of white paper having a round opening 0.64-inch diameter. This left an area exposed to view equivalent to approximately one-fourth the total area of the pad. Standards used for comparison were recovered in the same manner. Judges were instructed to rate these pads as they normally would full size pads.

As shown in table 2, of the 480 observations, the correct grade was given in 429 instances.

Again this same lot of pads was rearranged and covered with pieces of white paper. This time the papers had openings of 0.44-inch diameter, thus exposing approximately one-eighth the area of the standard pad. Standards were covered similarly and pads were graded. The results of these observations are shown in the last column of table 2. It will be noted that 430 correct grades were given out of the total of 480 observations.

The per cent of correct observations was 88.96% when the entire area of the sediment pad was graded, 89.38% when one-fourth the area was graded, and 89.58% when only one-eighth the area of the pad was exposed. The conclusion may be drawn from the above data that there is no significant difference in the number of correct observations when either the entire, one-fourth or one-

TABLE 2. GRADING PREPARED OFF-THE-BOTTOM SEDIMENT PADS WITH VARIOUS AREAS EXPOSED TO VIEW.

<table>
<thead>
<tr>
<th>Portion of area exposed</th>
<th>Entire Area</th>
<th>% Area</th>
<th>% Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of observations</td>
<td>486</td>
<td>480</td>
<td>480</td>
</tr>
<tr>
<td>No. of correct grades</td>
<td>427</td>
<td>429</td>
<td>430</td>
</tr>
<tr>
<td>% of grades correct</td>
<td>88.96%</td>
<td>89.38%</td>
<td>89.58%</td>
</tr>
</tbody>
</table>
eighth of the area of the sediment pad is exposed to view. It must be noted, however, that these pads were especially prepared to repre-
sent one of the standard grades. No doubt the percent of correct obser-
vations would be greatly re-
duced if pads containing, say more sediment than a number two but less than a number three, had been included in this group for grading.

USE OF STANDARD AND MODIFIED METHODS OF SEDIMENT TESTING

This last group of experiments was devised to test the applicabil-
ity of using the modified methods of testing mixed samples of milk for sediment and comparing them with the off-the-bottom method.

The sediment pads for this series were prepared as follows: known amounts of standard sediment, ranging from 10 mg per 10 gallons of milk to 150 mg per 10 gallons of milk, were added to 40 gallons of milk in a 50-gallon round vat.

The contents of the vat were agitated by a mechanical agitator operating at 48 RPM for 5 minutes. After this period of agitation 10 gallons of milk were withdrawn, with agitator in operation, into an ordinary milk can. This can of milk was allowed to stand for two hours and a standard off-the-bottom sedi-
ment test was made on it. Begin-
ing immediately after withdrawal of the ten gallon can of milk a series of mixed sample tests were made on the milk remaining in the tank, with agitator in opera-
tion. "Small disc" pads were pre-
pared by concentrating the sedi-
ment from one quart of the mixed milk on one-fourth of the normal area of the standard sediment pad. To accomplish this a stainless steel disc with an opening in the center of 0.64-inch diameter was soldered into a sediment pump head. The cotton pads were placed on top of the stainless steel disc and a quart mixed milk sample forced through them by use of a 32 oz. sediment tester. Other sets of "small disc" pads were made by concentrating the sediment from one pint of the mixed milk on one-eighth the usual area. Here a stainless steel disc with an opening in the center of 0.44-inch diameter was soldered into the sediment pump head used, and a one pint sediment tester used. In this manner by reducing the size of the mixed milk sample and the area of the sediment pads, these procedures theoretically are equivalent to using a one gallon mixed sample.

The samples of milk were dis-
charged through the cotton discs into a different container to keep the concentration of sediment in the milk uniform throughout sampling. The pads were mounted on separate cards and evaluated by a panel of judges. The results of this experiment are shown in table 3.

Of a total of 320 observations of sediment pads from off-the-bottom This represented 84.07 per cent of the observations in agreement. When grading the sediment pads from 1 quart mixed milk samples, the judges agreed in 1172 observations out of 1360. This represented an agreement of 83.24%. An agreement of 83.24% was reached when grading the sediment pads from 1 pint samples of mixed milk. In this case the judges agreed on the grade of 1132 pads out of 1360.

All grades ranging from 1 to 4 were represented in the above groups of sediment pads. It can be concluded from the above data that approximately the same de-
gree of accuracy can be obtained when using the modified mixed milk sample method of sediment testing as could be obtained with the standard off-the-bottom sedi-
ment test.

CONCLUSIONS

The merits of the sediment test for grading milk are influenced by many factors. Woeckel summarizes these as follows:

1. Geographical, climatic, and physical conditions prevailing at time of milking.

2. Characteristics of the milk at the time of performing the sedi-
ment test.

3. Procedure or performance of the test for extraneous material.

"4. Interpretation of the completed test."

Since the sediment test is sub-
ject to many factors that might influence its accuracy when used for grading milk, the variations in-
truded in order to adapt the sedi-
ment test to new types of dairy equipment should be kept to a minimum. Standards and methods for making the sediment test on 10-gallon cans of milk have been generally accepted. If these same standards and the same equipment with only slight modifications, can be used for sediment testing of milk in farm bulk milk holding tanks, the confusion created by the establishment of new sets of standards and new methods of testing will be avoided.

The use of a mixed milk sample for sediment testing farm bulk milk holding tanks is necessary if currently accepted standards for off-the-bottom sediment tests are to be continued in use. The findings above have shown that the greatest agreement between the mixed milk sample and the off-the-bottom sediment test can be obtained when a 4-quart sample of mixed milk is used. This same relationship has been observed by other workers in this field. By reducing the sample of mixed milk and also reducing correspondingly the size of the filter area, it is possible to obtain mixed milk samples from holding tanks using standard sediment testers. This may be accomplished by the use of the 32-
ounce testor with a modified filtering area of one-fourth the size of the standard sediment disc or with the 1-pint sediment testor and a filtering area of one-eighth that of the standard disc.

The data obtained under the limitations of this research work in-
dicate that judges are able to evaluate the grade of these modified sediment discs with about the

<table>
<thead>
<tr>
<th>No. observations</th>
<th>Off-the-bottom</th>
<th>1 Qt. mixed</th>
<th>1 Pt. mixed</th>
</tr>
</thead>
<tbody>
<tr>
<td>320</td>
<td>1360</td>
<td>1360</td>
<td>1360</td>
</tr>
<tr>
<td>260</td>
<td>1172</td>
<td>1132</td>
<td>1132</td>
</tr>
<tr>
<td>84.07</td>
<td>86.18</td>
<td>83.24</td>
<td>83.24</td>
</tr>
</tbody>
</table>
same degree of accuracy as obtained with the standard off-the-bottom sediment pads. The same standards as are currently accepted for the off-the-bottom sediment test can be used for evaluating the sediment pads obtained by these modified methods.

SUMMARY
Taking into consideration all the normal variations in any test such as the sediment test, it appears that farm bulk tanks can be tested for sediment by using the "small disc" mixed milk sample method of concentrating the sediment from one quart of mixed milk on one-fourth the area of the normal sediment disc or that from one pint on one-eighth the area of a normal disc. Off-the-bottom sediment standards can be used for evaluating the grades of these modified discs. The results can be compared to those obtainable by the present standard off-the-bottom method on ten gallon cans. A careful procedure must be followed, using a sediment pump in good working condition checked for accuracy according to Standard Methods. By taking the sediment tests on farm bulk milk tanks with the "small disc" mixed sample method, accuracy expected can be as good as the ability of the person to evaluate the pads according to present standards.

ACKNOWLEDGMENT
To all the staff members who were so generous with their time in being members of the judging panel.

BIBLIOGRAPHY

SEDIMENT TESTING FARM BULK MILK.

34TH ANNUAL MEETING
NATIONAL HEALTH COUNCIL

The 1954 National Health Forum, to be held at the Hotel Statler, New York City, as part of the thirty-fourth annual meeting of the National Health Council March 24 to 26, will focus on "Changing Factors in Staffing America's Health Services."

Announcement that this year's Forum would concern itself with the knotty problem of how to assure adequate health personnel for the nation was made by Dr. William P. Shepard, vice president of the Metropolitan Life Insurance Company, appointed Forum chairman by Albert W. Dent, president of the National Health Council and president of Dillard University, New Orleans.

Dr. Franklin D. Murphy, Chancellor of the University of Kansas, will speak at the dinner which will close the Forum on Thursday evening, March 25. As dean of the University's School of Medicine before he took his present position in 1951, Dr. Murphy instituted the "Kansas Rural Health Plan" which has been hailed all over the country as a means to bringing better medical care to small town and country dwellers.

The Kansas program is three-fold, involving expansion of the Medical School's facilities to permit increased enrollment, help to doctorless communities in planning a "medical workshop" to attract a practitioner, and making post-graduate courses more readily available to all doctors in the state.

The National Health Council, a coordinating body among 45 national organizations and professional societies in the health field, sponsors the National Health Forum each year.

Dr. Shepard said that the Forum, through group discussions, would give special consideration to such "changing factors," affecting most or all of the health fields, as the growing emphasis on rehabilitation, changing military requirements, increase in the number and variety of occupational health programs, and greater importance of vocational counselling.

"We anticipate wide interest in the meeting because nearly everyone trying to get a health job done often finds himself handicapped or even hobbled by staffing problems," said Dr. Shepard, who has had wide and varied experience, including the direction of a local health department and a 10-year chairmanship of the American Public Health Association's Committee on Professional Education.

He is now a member of the Health Resources Advisory Committee. Office of Defense Mobilization, and is a former president of the American Public Health Association and of the National Tuberculosis Association. He was for twenty-five years clinical professor of public health and preventive medicine at Stanford University Medical School.

Philip E. Ryan, executive director of the Council, said that the accommodations available for the meeting are somewhat limited and the rule must therefore be "first come first served."

"Through the cooperation of the Council's member organizations reservation blanks will be mailed rather widely as soon as a preliminary program can be printed," said Mr. Ryan. "Obviously we cannot reach everyone in the health, education, and vocational guidance fields who may care to attend. Any one wishing to make sure there is room for him or her at the Forum should write the Council now, and a reservation blank will be mailed promptly."