SEDIMENT TESTING OF BULK TANK MILK ON THE FARM [1] [2]

B. J. LISKA

Dairy Department, Purdue University, Lafayette, Indiana

The introduction of the bulk tank system of handling milk on the farm has brought about several major changes in milk quality control work. Many receiving room operations have been transferred from the dairy plant to the milk house on the farm. This change has caused some problems since milk now is accepted and samples for quality tests are taken before the milk is pumped into the bulk tank truck.

Considerable attention has been given to modification of methods and equipment for standard off-the-bottom sediment tests in order to accurately determine the sediment in bulk tank milk *(4, 6, 7, 8)*. The method using a pint of mixed milk in which the sediment is collected on an area 0.4 inches in diameter has been developed *(4, 6)*. This method is now included in *Standard Methods for the Examination of Dairy Products (5)*.

The mixed milk method has not been accepted for use in many areas. However, the survey by Kihlstrum and Delhey *(3)* indicates that routine sediment testing of bulk milk is needed. They found that milk in 10.8% of 1193 tanks yielded a sediment test of No.4 and 17.1% of the tanks contained milk with sufficient sediment to rate No. 3. Kihlstrum and Delhey used sediment testing equipment of various types and performed the testing on the farm. They suggested that sediment tests be performed on one pint mixed milk samples delivered to the laboratory.

The mixed sample method of testing milk for sediment can be performed at the time the milk is picked up or on a sample which is returned to the dairy plant laboratory. The test looses its value as a means of excluding unfit milk when it is performed in the laboratory after the producers milk is mixed with milk from other producers. A sediment test performed at the time of the milk pick up at the farm, with the producer present, is a good tool in quality control programs. The test is simple to explain and demonstrate to the producers. When the sediment test is performed in the dairy plant laboratory it looses some of its effectiveness in quality control work.

The mixed sample sediment test was accepted although simple, practical equipment with which it could be performed on the farm was not available. At the time bulk tank milk is received the temperature is 36-40°F. Kihlstrum and Delhey *(3)* found no difference in the amount of sediment in milk tested at 65°F. and 80-90°F. Prewarming the milk to 80-90°F. melts the butterfat so the filter pad is not clogged with solidified butterfat *(2, 8)*. With present methods for performing the sediment test on bulk tank milk, the milk is warmed in a separate container with hot water or electric heat and poured into the sediment tester, or milk is drawn into the sediment tester and the tester is held under hot running water until the milk is warmed sufficiently. The first method requires extra equipment while the other involves use of extra time to properly warm the sample.

This study was undertaken to develop a more practical method of performing the mixed milk sediment test on the farm.

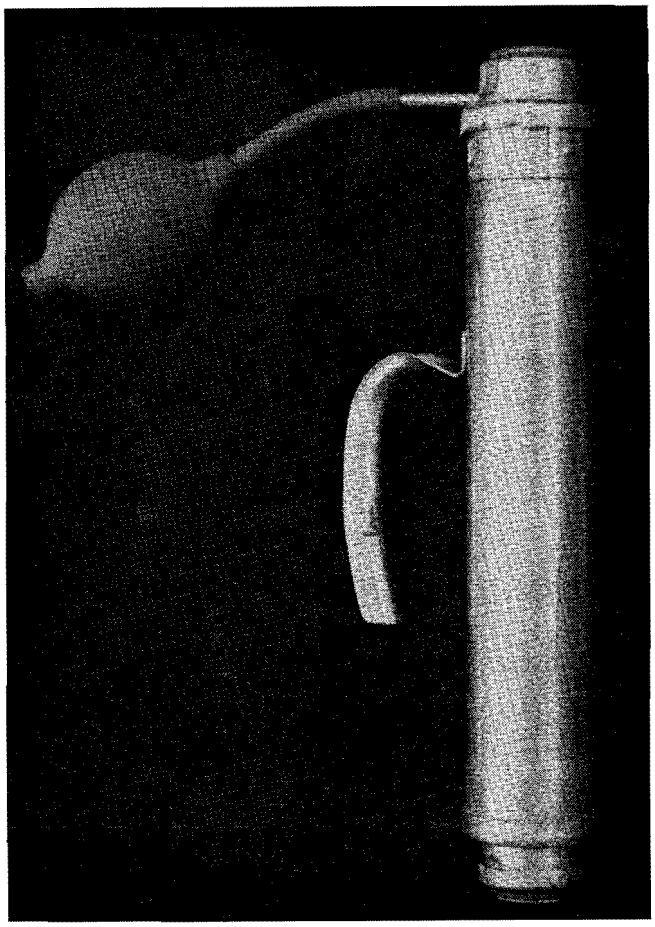

Figure 1. Superior type pressure tester.

[1]Journal Paper Number 1786 of the Purdue Agricultural Experiment Station.

[2]Presented at the 48th Annual Meeting of the INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS, Inc., at Des Moines, Iowa, August 14-17, 1961.

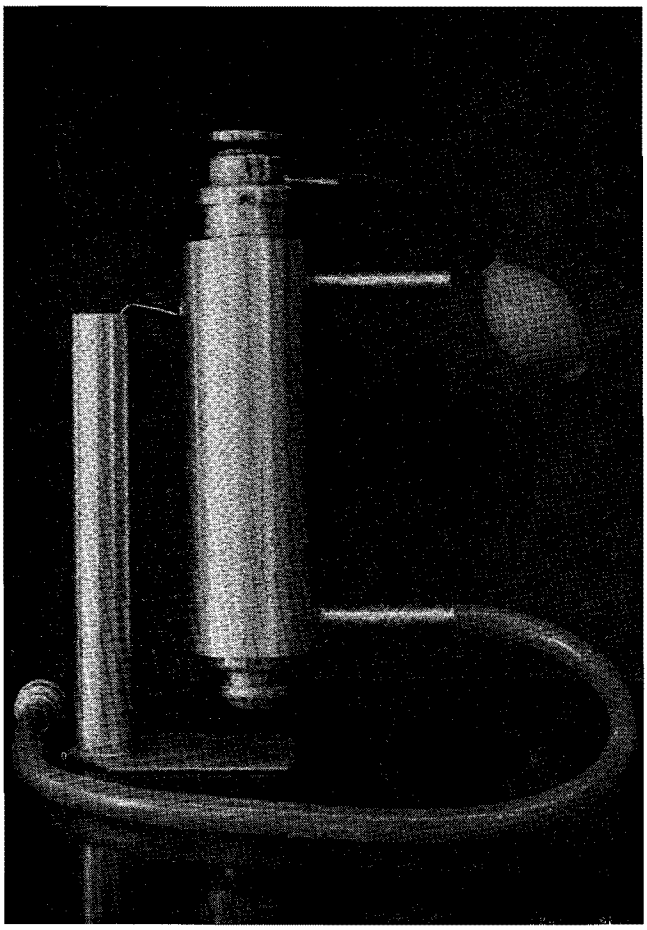

Figure 2. Modified tester showing water jacket, inlet for water, thermometer and stand.

METHODS AND RESULTS

There are a number of sediment testers now commercially available. It was decided early in the study to try modifying a tester now available so that milk could be preheated in it and tested on the farm. The tester selected is shown in Figure 1. The simplest means of preheating the milk appeared to be by circulation of hot water through a water jacket around the tester. It was assumed that hot water would be available where bulk milk tanks are in use. Several models were made which were rather crude but functional before the model shown in Figure 2 was developed. The new sediment tester is essentially a standard Superior type cream sediment tester with a water jacket made from three inch diameter stainless steel pipe. The jacket is held in place with neoprene gaskets which are removable. There is an inlet and overflow for hot water. Preliminary work on the temperature and rate of water circulation was undertaken. The results are presented in Tables 1 and 2. Water at a temperature of 130°F circulating through the water jacket at the rate of one gallon per minute will warm one pint of milk in the tester from 38°F to 90°F in 1.5 min.

TABLE 1—EFFECT OF WATER TEMPERATURE ON LENGTH OF TIME REQUIRED TO WARM MILK IN THE TESTER[a]

	(Time (sec)		
Temp. of water[b]	To 70°F	To 80°F	To 90°F
100	62	90	148
115	40	51	77
130	34	57	63
145	31	44	60

[a]Milk Started at 38-40°F.
[b]Flow rate: 1 gal per min.

Preliminary trials indicated the tester was practical for use in determining sediment in bulk tank milk. After a number of tanks were checked the following procedure for securing samples and performing the test was adopted:

1. Start the agitator on the bulk milk tank.
2. Attach the tester to the source of hot water and regulate the rate of water flow through the jacket.
3. Place a lintine cotton disk in the tester head and tighten it in place.
4. After 3-5 min of agitation, use a dipper and measure one pint of milk and pour it into the tester.
5. Replace the top of the tester and allow the milk to be warmed to 80-90°F by the circulating water.
6. When the milk reaches 80-90°F as indicated on the thermometer, shut off the water and force the milk through the filter pad.

TABLE 2— EFFECT OF THE AMOUNT OF WATER CIRCULATED ON TIME REQUIRED TO WARM MILK IN THE TESTER[a]

	(Time (sec)		
Gal/min[b]	To 70°F	To 80°F	To 90°F
0[c]	30	75	180
½	21	62	91
1	18	55	83
1½	15	50	68
2	10	40	48

[a]Milk Started at 38-40°F.
[b]Temp. of water 130°F.
[c]Jacket filled not circulated.

7. Remove the filter pad, label and grade it.

During use the sediment tester may be kept in the stand as shown in Figure 2 or hung on the wash sink as shown in Figure 3. Figure 3 also shows the position of the dial thermometer. The dial thermometer can be easily added to the tester and it saves time in determining whether or not the milk is sufficiently warmed to pass through the filter pad satisfactorily. In this way a temperature of 80-90°F can be repeated to make conditions of the test more uniform.

Sediment disks representing sediment tests made during this study are shown in Figure 4. The wet disks were graded using a photograph of reference standards for bulk tank milk. This set of standards has been prepared and recommended for use by the American Dry Milk Institute, the Cheese Institute, the Evaporated Milk Association and the American Butter Institute *(1)*.

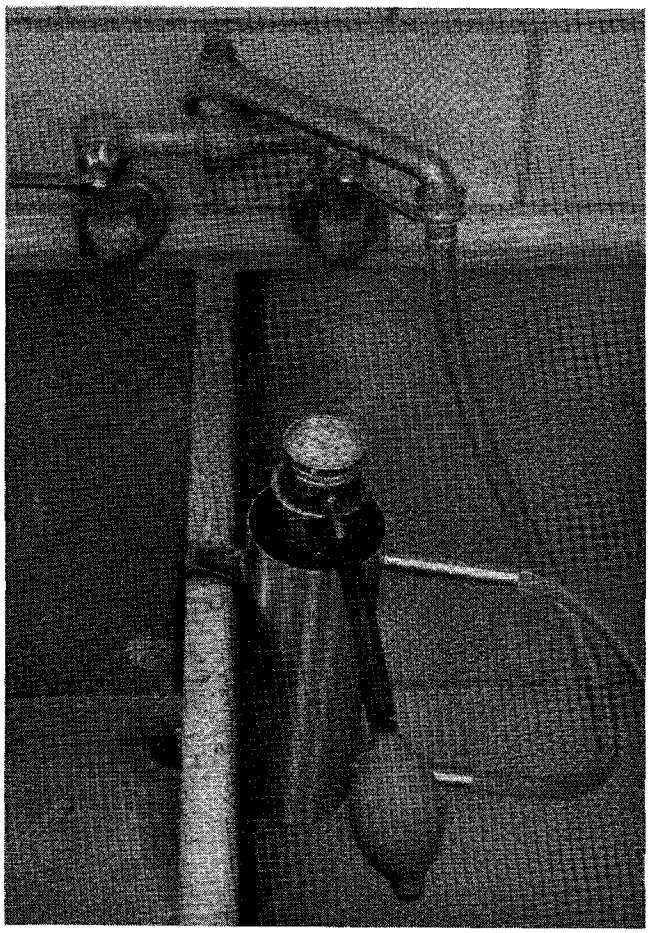

Figure 3. Modified sediment tester shown in operation.

DISCUSSION AND CONCLUSIONS

The sediment tester developed and used in this study is practical for sediment testing of bulk tank milk on the farm. Unfit milk can be detected before it is mixed with other milk. After the tank truck driver becomes accustomed to using the tester, he can perform the sediment tests as a normal part of his routine without the use of much additional time.

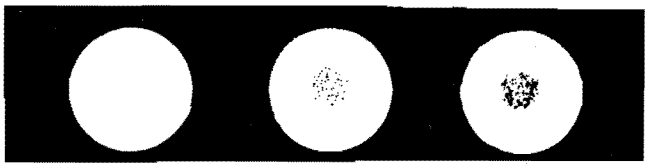

Figure 4. Sediment pads corresponding from left to right to grades 1, 2, 3 prepared using the modified tester and graded by comparison with recommended standards for bulk tank milk.

The sediment tester can be made from tinned steel or stainless steel. Cost and durability will vary with the type of material used. Since the milk is not returned to the bulk milk tank, there should be no objection to the use of tinned steel.

Choice of the type of sediment disk is quite important. The disk must be the thin, wafer type lintine cotton disk. If thicker, soft cotton disks are used, there is considerable difficulty forcing high fat milk through the filter disks. Using the thin, wafer type disk, properly warmed cream with 36% fat can be tested for sediment with no problems.

The work of Kihlstrum and Delhey *(3)* indicates a need for more emphasis on sediment testing of bulk tank milk. This should be in the form of a good, practical, routine sediment testing program used on the farm before the milk is pumped into the tank truck in order to maintain a high quality milk supply.

ACKNOWLEDGEMENT

The author wishes to express his appreciation to Morris Clark, Clark Dairy Supply Company, Greenwood, Indiana, for cooperation in the engineering and final design of the sediment tester.

REFERENCES

1. Flake, J. C. Evaporated Milk Association. Personnal Communication. 1961.

2. Jensen, J. M. and Jokay, L. Pipeline Milker and Bulk Tank Milk Filtration. J. Milk and Food Technol., **20**:230. 1957.

3. Kihlstrum, E. E. and Delhey, R. W. Farm Bulk Tank Sediment Testing. J. Milk and Food Technol., **23**:108. 1960.

4. Liska, B. J. and Calbert, H. E. A Study of Mixed Milk Sample Methods of Sediment Testing Using Off-the-Bottom Standards and Equipment for Possible Use With Farm Bulk Holding Tanks. J. Milk and Food Technol., **17**:83. 1954.

5. *Standard Methods for the Examination of Dairy Products*. 11th Ed. American Public Health Association. Chapter 15, 1960.

6. Watson, N. E. A Sediment Pump for Farm Tanks. J. Milk and Food Technol., **15**:43. 1952.

7. Watson, N. E. Sediment Determination in Farm Tanks. Dairy Industry Conference, Davis, California. 1953.

8. Watson, N. E. Determination of Sediment in Milk in Farm Tanks and/or Plant Storage Tanks and Tank Trucks. J. Milk and Food Technol., **19**:228. 1956.