A STUDY ON CLEANING AND SANITIZING A PORTABLE MILK TRANSFER SYSTEM[1]

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About five years ago research on cleaning and sanitizing a portable milk transfer unit was initiated at the University of Massachusetts. A portable milk transfer unit generally consists of a stainless steel dumping tank and a long length (100 feet more or less) of flexible plastic pipe line, which transfers the milk from the barn into the bulk milk storage tank. The milk is either pushed through the pipe by a pressure pump or sucked through by the use of vacuum.

There are now at least five companies manufacturing this type of equipment. The scarcity and high cost of labor are stimulating dairy farmers to buy these transfer units. However, before the dairy farmer can legally use such equipment, an approval by the State and/or municipal sanitary authorities is necessary. While many states and municipalities have approved these transfer units, others have accepted them on a temporary basis pending additional data on whether these units can be maintained in a sanitary condition.

The purpose of this report is to furnish information which may help Milk Sanitary Authorities to determine whether or not the use of portable milk transfer units will result in impaired quality of milk supplies. This study consists of tests made at the University dairy barn, at a dairy farm near Amherst and in the dairy laboratory.

After the data had been collected in this study, a report *(2)* from the University of Illinois showed bacterial counts of milk to be as low with plastic tubing as with stainless steel or glass pipe lines, when the equipment was properly sanitized.

EXPERIMENTAL METHODS AND MATERIALS

Portable milk transfer unit.

The milk transfer unit used for this study was manufactured by the Plymouth Engineering Corporation of Boston, Massachusetts. Basically, the unit consists of dumping tank (capacity 38 quarts), strainer, centrifugal pump, all made of stainless steel, and a 100-ft length of 7/8-in inside diameter flexible plastic, raw milk pipe line (Transflow), weigh scale holder, and aluminum truck.

Determination of sanitary condition of the milk transfer unit.

The Millipore filter membrane (Millipore Filter Corporation, Watertown, Massachusetts) was used for this determination. Microorganisms were rinsed from the transfer unit by recirculating, for five min, 16 liters of sterile distilled water containing 20 ml of stock phosphate buffer solution and, when needed, an appropriate neutralizing agent for the germicide. The stock phosphate buffer was prepared according to Standard Methods *(1)*. Within two hours after recirculating the rinse water, portions varying from 50 ml to 2 liters, were passed through the Millipore filter membrane (approximately 2 in in diameter). Immediately after filtration each membrane was placed on top of a pad in a small petri dish. The pad was previously moistened with 1.5 ml of triple-strength nutrient broth containing 0.01% of 2, 3, 5 triphenyltetrazolium chloride. The plates were incubated at 35°C for 48 hr and colonies appearing as red spots were counted with the aid of a broad-field microscope.

Sanitary standard for plastic pipe line.

Since sanitary standards for flexible, plastic, raw milk pipe lines had not been formulated at the time this study was made, standards as set forth for other dairy equipment *(1)* were used. Accordingly, by the water rinse method large well-cleaned dairy equipment is considered satisfactory when estimates from rinse water indicate less than one colony per milliliter of capacity.

Water source.

The Amherst Municipal Water Supply was the source of water for the entire study, and its hardness was 18 p.p.m. $CaCO_3$.

Cleaning and sanitizing procedures used.

For the test at the University dairy barn, the barn personnel were instructed as follows:

1. Rinse milk from system with cool tap water.
2. Recirculate general dairy cleaner solution (recommended concentration on label) for 15 min, having a starting temperature of at least 145°F.
3. Rinse detergent solution from system with hot water. (125°F to 145°F)
4. Before next milking recirculate sanitizing solu-

[1]The mention of trade names in this paper is for identification and implies no endorsement of the products. Contribution No. 46 of the Massachusetts Agricultural Experiment Station.

tion (either hypochlorite, quaternary or dodecyl benzene sulfonic acid) in concentrations recommended by manufacturer and at room temperature, for three to five min.

5. Use acid cleaner in place of the alkaline cleaner once a week.

6. Dismantle pump once a week for inspection and cleaning with a brush.

For the tests at a dairy farm near Amherst the instructions in numbers two and four were changed from those used at the University barn as follows:

Item 2: Recirculate chlorinated alkaline pipe line cleaner solution (1/2-oz per gal) for 15 min at a starting temperature of 160°F.

Item 4: Immediately before the next milking, sanitize with hypochlorite (200 ppm chlorine) by recirculating at approximately room temperature for five min.

For the test in the Dairy Laboratory the milk transfer unit was soiled by recirculating warm (100°F -106°F) raw milk of varying bacterial count (50 thousand - 1 billion per ml). Extremely high counts in the raw milk were obtained by recirculating the same milk the following day. Recirculation of the raw milk was an automatic controlled cyclic operation, on for 12 min and off for 6 min, which lasted for a period of 1 1/2 hours. The temperature of the milk at the end of the cycle period varied between 88°F - 96°F. At the close of the milk recirculating period the system was drained and then rinsed with cool tap water. Next a 5-gal portion of a chlorinated, alkaline cleaner (1/2 oz to 1 gal) was adjusted to varying temperatures and recirculated for 15 min, after which the temperature was again checked. The system was rinsed free of cleaning solution with hot water 120° - 130°F., after which the sterile, buffered distilled water was recirculated for determining bacterial counts by the Millipore filter method. A special plastic-rubber plug was pushed through the 100-ft plastic pipe line by the use of compressed air, to remove excess water. The plastic pipe was then stored without further treatment until the next test. The portable unit did not receive any other sanitizing treatment other than washing with the chlorinated alkaline cleaner. An acid cleaner was used in place of the alkaline cleaner once a week, and the pump was dismantled and checked for visible soil once a week.

RESULTS AND DISCUSSION

Tests at the University dairy barn.

The rate of flow of a cleaning solution through the 100-ft length of plastic pipe line was checked and found to be slightly over five ft per second, which is the velocity often recommended for pressure circulation method for cleaning rigid pipe lines.

During the three months (May, June, and July) test period, a general dairy cleaner and three types of sanitizers, calcium hypochlorite, alkyldimethylbenzylammonium chloride and dodecyl benzent sulfonic acid were used. The sanitary condition of the milk transfer unit was checked approximately every five days by the Millipore Filter technique. Results from these checks showed that 50% did not meet the desired standard of less than one colony per ml of capacity. When not meeting the standard the counts per milliliter of volume ranged from 2 to 22 with an average of about 8. Visual inspection of the pump showed that the cleaning procedure used in these tests was inadequate. Failures in meeting the desired standard occurred more frequently as the test period progressed, suggesting a soil build-up. The three types of sanitizers used showed no significant differences in sanitizing effectiveness. When the quaternary ammonium sanitizer was used the plastic pipe looked dull, probably due to a film build-up. Also, when the quaternary sanitizer was recirculated, sometimes a floc was deposited on the surface inside of the tank and plastic pipe line.

The results of the tests at the University barn show clearly that for the specific procedure outlined, a portable milk transfer unit would not be maintained consistently in a sanitary condition over a period of time, when an ordinary general dairy cleaner was being used.

Tests at a Dairy farm near Amherst.

As the experimental cleaning procedure used at the University barn was found to be unsatisfactory, the procedure was changed for the new tests; namely, a chlorinated alkaline pipe line cleaner was substituted for the general dairy cleaner. One criterion for determining the sanitary condition of the milk transfer unit while being used at the dairy farm near Amherst, was the raw and pasteurized, bacterial counts of samples taken at the bulk tank as reported by the milk dealer purchasing the milk. The results are given in Table 1. A period of four months preceding the test period, during which time the milk was carried in pails from the barn to the milk room, where it was dumped into the bulk tank, served as a control. It will be noted that milk of satisfactory bacteriological quality was produced throughout the control period and also when the milk transfer unit was used. It will also be noted that the bacterial count of milk produced, when the portable transfer unit was in use, was considerably lower as compared to the control period. The writer is aware that the improved bacterial count probably was influenced by the tendency of barn personnel to do their job more conscientiously during test periods. Results of weekly checks on the sanitary condition of

TABLE 1. EFFECT OF PORTABLE MILK TRANSFER UNIT ON BACTERIA COUNTS OF MILK[a]

Before milk transfer unit was used			Milk transfer unit in use		
Date	Raw SPC/ml	Pasteurized SPC/ml	Date	Raw SPC/ml	Pasteurized SPC/ml
1957			1957		
April 16	4,600	90	August 5	10,000	700
April 23	12,000	50	August 16	20,000	160
May 13	3,400	60	August 19	4,100	120
May 20	10,000	50	August 27	8,200	50
June 5	23,000	130	September 2	10,000	40
June 10	15,000	120	September 8	9,300	90
June 11	20,000	120	September 16	8,200	100
June 16	28,000	3,100	October 1	18,000	110
July 1	20,000	100	October 20	13,000	109
July 2	62,000	3,200	October 28	2,300	160
July 14	120,000	1,000	November 5	5,300	190
July 16	24,000	160			
July 22	8,400	150			
Average	27,000	640		9,900	170

[a]Plates incubated for 48 hours at 35°C.

the milk transfer unit by the Millipore filter technique in all instances met the standard of less than one colony per ml of capacity. Thus, it appears that a portable transfer unit can be readily maintained in a sanitary condition for a considerable period of time by a cleaning and sanitizing procedure as was used at the dairy farm near Amherst.

Tests in dairy laboratory.

Additional tests on cleaning and sanitizing the portable milk transfer unit were made in the dairy laboratory rather than in a dairy barn, because the experiments could be better controlled. Table 2 shows the effect of varying chlorinated alkaline cleaner solution temperatures on the effectiveness of cleaning and sanitizing as measured by the Millipore filter technique. The data in the table are average values for three trials. The test period was spread over a period of three months and not more than a single test was run in one day. It will be noted that reducing the temperature of the cleaning solution too far greatly reduced cleaning and sanitizing efficiency. The sharp break in cleaning and sanitizing efficiency falls somewhere between 130°F and 120°F. When judged by the standard of less than one colony per ml of volume, cleaning solution temperatures of 130°F and above were satisfactory and temperatures of 120°F or below were unsatisfactory. There was no visible soil in the centrifugal pump when checked each week. It should be pointed out that the satisfactory sanitary condition of the transfer unit by the use of a chlorinated alkaline cleaner was obtained without additional sanitizing treatment. Chlorinated alkaline cleaners have considerable sanitizing properties, although they are not usually labeled as detergent-sanitizers. Additional sanitizing treatment seems advisable as a safety factor.

SUMMARY AND CONCLUSIONS

The portable milk transfer unit, including 100 feet of plastic pipe line, was readily maintained in a satisfactory sanitary condition when recirculating a chlorinated alkaline cleaner at a velocity of five ft per second for 15 min, at a minimum start and finish temperature of 130°F and 115°F respectively. The portable milk transfer unit was not maintained in a satisfactory sanitary condition when an ordinary dairy cleaner was used in place of the chlorinated alkaline

TABLE 2. — EFFECTIVENESS OF A CHLORINATED, ALKALINE CLEANER AT VARIOUS TEMPERATURES FOR CLEANING AND SANITIZING A PORTABLE MILK TRANSFER UNIT[a]

Solution temperature		Number of colonies per ml capacity of plastic tube and tank[b]
Start	After recirculating 15 min	
°F	°F	
160	129	0.02
150	121	0.02
140	115	0.06
130	111	0.15
120	107	15.9
110	103	18.8
100	98	27.0

[a]Data are the average of three trials.

[b]The standard is not more than one colony per milliliter capacity.

cleaner. This was true even when a good sanitizer was used after the cleaning operation.

When the chlorinated alkaline cleaner was used it was found unnecessary to use any additional sanitizing treatment. However, a sanitizing treatment immediately before use is recommended as a safety factor.

Because of the tendency for quaternaries to form flocs in certain waters and also to dull the appearance of the plastic pipe line, other commonly used sanitizing agents are preferred for sanitizing portable milk transfer units.

The use of an acid cleaner in place of the alkaline cleaner once each week was sufficient for local water conditions.

Dismantling the centrifugal pump for inspection once each week was sufficient for test conditions. More frequent inspection can be recommended as a safety factor.

REFERENCES

1. Standard Methods for the Examination of Dairy Products, 11th Edition, American Public Health Association, Inc., New York, New York. 1960.

2. Nelson, W. O., Alexander, M. H. and Ormiston, E. E.: Flexible Plastic Milk Pipelines are Here. Hoard's Dairyman, 104:68-69.1959.

News and Events

Dietary Food Changes Receive More Time For Public Airing

The Food and Drug Administration has announced a two-month extension of time for receiving public comments on proposed changes in the Nation's special dietary food regulations. The extension was ordered because of requests which had been received for additional time to study the proposals and prepare written comments for the record. The new deadline is October 18.

In announcing the 60-day extension, FDA said that some of the comments received to date indicate that a number of consumers have been misled about the purpose and contents of the proposals.

FDA said it is *not* true that a prescription would be needed to buy health foods or that "health food" stores would be put out of business; that consumers would be unable to buy natural foods or vitamins from natural sources, or that sellers would be unable to make truthful statements about inherent dietary properties, such as the Vitamin C content of orange juice.

It also is not true, FDA said, that the proposed change from the present term "minimum daily requirement" to "daily requirement" would put a ceiling on the nutritive value of special dietary foods. This change was proposed to discourage the addition of needlessly large amounts of vitamins and minerals to food supplements simply as a sales promotion device.

FDA said the proposed changes would prevent consumers from being misled by a listing of ingredients which have no value as food supplements. The changes are also directed at false or misleading labeling which may lead consumers to believe that the average American diet results in ill health and that nutritional supplements are required to prevent or cure this.

The Federal Agency said the proposals are designed to provide the consumer with complete and reliable labeling information which will enable intelligent selection and use of special dietary foods of all kinds.

FERRAZZANO TRANSFERRED TO PHS MOBILIZATION HEAD

Dr. Gabriel P. Ferrazzano assumed the post of Chief of the Division of Health Mobilization, U. S. Public Health Service, August 1, transferring from the position of Deputy Chief of the Division of Hospitals.

A general surgeon with a distinguished career in both clinical surgery and hospital administration, Ferrazzano has served as Medical Officer in charge of the U. S. PHS Hospital in Chicago; the U. S. PHS Outpatient Clinic in New York City; Assistant Chief of Surgery and later Clinical Director of the U. S. Public Health Hospital in New Orleans; and Chief of Surgery, U. S. Penitentiary Hospital, Atlanta.

He is a Fellow of the American College of Surgeons, a member of the American Medical Association, and the American College of Hospital Administrators.

Dr. Ferrazzano attended elementary and secondary schools in his home state, Rhode Island. Premedical study was taken at Holy Cross, Worcester, Mass.; he received his M.D. degree from Marquette Univer-