LYE SOLUTION FOR MILKING MACHINE RUBBER PARTS

C. K. JOHNS
Division of Bacteriology and Dairy Research
Science Service
Canada Department of Agriculture, Ottawa, Ontario

To determine how wide a margin of safety existed with the lye soak solution, the residual milk was allowed to dry on to the teat-cup assemblies, then without any attempt at cleaning they were filled with the lye solution. This, supplemented by a weekly brush-washing, maintained these parts in good sanitary condition. The several advantages of the lye solution employed are indicated.

A simple, inexpensive method of caring for milking machine rubber parts has long been the object of an intensive search. Parfitt's introduction of the lye soak solution method gave rise in 1930 to a suitable method which has, since that time, continued to give complete satisfaction in the Central Experimental Farm dairy. Substitutes, including detergent-sanitizers, have been tried from time to time but none has been found to equal the lye soak method in reliability, simplicity, and economy. Satisfaction with this procedure has likewise been experienced elsewhere.2-4,6,7,10,16 Recently, however, Enright8 has blamed the lack of cleanliness of teat cup assemblies upon the inadequacies of the lye storage method.

Our method consists simply of rinsing the units in 3½ Imp. gals. (3 U.S. gals.) of cold water, brush-washing the outsides of the assemblies, and filling with 0.5 percent lye solution. The units are then merely drained before use.9 Once a week the units are completely dismantled for inspection and all inner surfaces brushed with a hot cleanser solution. The inflations are alternated in use; one week idle, one week in service.

Following this practice the rubber parts have remained clean and the bacteria counts of the raw bulk milk have rarely exceeded 10,000 per ml. Recently the inflations have been boiled once a month in 2 percent lye solution to prolong their life. That the lye soak solution method embodies a surprisingly large factor of safety was clearly shown in 1933-34.14 Due to a misunderstanding, the suction rinse of two milker units, together with the weekly dismantling and brushing, was omitted for over five months. Nevertheless, bacteria counts remained low, and except for a moderate deposit of calcium phosphate from the residual milk the inflations remained clean. It is, therefore, difficult to understand why this recommended procedure should fail to maintain the teat cup assembly in a sanitary condition.

Apart from failure to fill the teat cup assembly completely, or the use of too weak a lye solution, allowing milk to dry on the milker parts appeared to be the only other form of neglect likely to result in high counts. The effect of such mistreatment was therefore investigated on four DeLaval units fitted with new inflations. For this purpose the usual procedure was abandoned, and instead the teat cup assemblies were hung up in a warm room (around 80°F) for 6½ hours after the morning milking and for 30 minutes after the evening milking. At no time was the milk residue rinsed off. Following the drying interval the assemblies were filled with lye solution. Just prior to the next milking they were drained and used without any

\* Contribution No. 322 (Journal Series) from the Division of Bacteriology and Dairy Research, Science Service, Canada Department of Agriculture.

| TABLE 1 |
| SUMMARY OF COUNTS ON MACHINE-DRAWN MILK SAMPLS |
| CENTRAL EXPERIMENTAL FARM, OCT. 17, 1949-JAN. 14, 1950 |

<table>
<thead>
<tr>
<th>Period</th>
<th>No. of Samples</th>
<th>Log. Average Count</th>
<th>Distribution of standard plate counts</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Oct. 17-Nov. 2</td>
<td>7</td>
<td>13,200</td>
<td>500-750</td>
</tr>
<tr>
<td>B. Nov. 3-Dec. 16</td>
<td>37</td>
<td>7,798</td>
<td>1</td>
</tr>
<tr>
<td>C. Dec. 19-Jan. 14</td>
<td>8</td>
<td>6,480</td>
<td>1</td>
</tr>
</tbody>
</table>

Dr. C. K. Johns is Senior Bacteriologist with the Division of Bacteriology and Dairy Research, Canada Department of Agriculture, Ottawa, Ontario, where he has been since 1927. A graduate of the University of Alberta, he obtained his M.Sc. from McGill University and his Ph.D. from Wisconsin. He was President of the I.A.M.F.S. in 1934-35, and is a Fellow of the American Public Health Association, where he serves as a Referee for the Subcommittee on Standard Methods for the Examination of Dairy Products.
further treatment. Once a week the units were dismantled, inspected, brushed in hot cleanser solution, and reassembled. Samples of milk were obtained daily from the pasteurizer vat before and after pasteurization and examined for total count and coliform organisms.

The plate count results are summarized in Table 1. Periods A and C represent the preceding and following periods when the customary pre-rinsing with cold water was practiced, while Period B is the experimental period. The arithmetic mean for the 37 samples examined during Period B was 8,025, the logarithmic mean 7,798, per ml. Counts on the pasteurized milk ranged between 21 and 100 per ml with an arithmetic mean of 43. Coliform organisms were present in 0.01 ml portions of 51.35 percent of the raw milk samples during the experimental period, compared with 53.0 percent during the control periods. No coliforms were found in 1 ml portions of the pasteurized milk at any time.

Weekly inspections of the disassembled teat-cup assemblies showed them to be only slightly less clean than when the usual rinsing treatment was employed. The slight film that developed might be expected to result from the precipitation of calcium phosphate from the residual milk by the highly alkaline lye solution. Despite such gross neglect, these units appeared to be in a satisfactory state of cleanliness.

Titration of the lye solution on 20 occasions during the test period gave values ranging from 0.35 to 0.49 percent, with a mean of 0.41 percent.

DISCUSSION

There are at least two opinions on the subject of milking machine sanitation. The first is that it is imperative that after each milking the teat cup assembly be rinsed, dismantled, brushed in hot detergent solution, rinsed, and finally sanitized by heat or chemical solutions. The second is that few producers will faithfully carry out such a complicated, time-consuming procedure, that most of them will take "short-cuts," and in consequence get into trouble. It is felt that a simpler procedure is much more likely to be carried out faithfully. As Flake observes, "it is preferable to have a high degree of compliance with a procedure that will result in an acceptable machine than to have a low percentage of compliance with a more time-consuming procedure that would, if properly followed, yield a milking machine that is more nearly sterile."

Our aim has been to develop a method which is neither expensive nor time-consuming, and which can be used successfully where the hot water supply is limited. Provided the teat-cups and tubing are completely filled with 0.5 percent lye solution, a satisfactory sanitary condition can be maintained even with gross negligence, as indicated by the results reported in this paper.

While it may not be feasible under all conditions to maintain teat cup assemblies in good sanitary condition without the use of an additional suction rinse with hot cleanser solution, the need for dismantling and brushing twice daily does not appear to have been demonstrated. Our own results and those of others have shown that suction washing gave significantly lower counts than brush washing. Hay has also warned of the danger of destroying the smooth inner surface of high quality milking rubbers by the use of spiral brushes or metal scrapers, while all too frequently worn-out brushes are being relied upon.

It is unfortunate that the idea has gained acceptance that where the teat cup assembly is dismantled only once a week for inspection, this constitutes "once a week" cleaning. This is far from correct. The lye solution method is intended to keep a clean milking machine in that condition, not to clean up a dirty one. Lye solution has valuable detergent properties, in addition to its germicidal activity, and might be regarded as the original detergent-sanitizer. Advantage is taken of this in the machine-washing of milk bottles, where brushing is not usually employed. In common with other alkaline salts, however, it is less effective in the control of mineral deposits. In hard water areas an incrustation of calcium carbonate may slowly build up on the surfaces. Such deposits, while unsightly, apparently do not affect the bacterial content of the milk. They are easily removed by a weak acid solution, or avoided by using soft water, or by adding a small amount of polyphosphate as a sequestering agent. The substitution of sodium metaphosphate for lye has also been recommended, as has an occasional treatment with an organic acid detergent.

In the Cornell studies, Dahlberg et al. found that "a lye solution in the milker teat cup assemblies on a rack was a very effective cleaner and sterilizer." Jensen and Bortree reported that infusions treated with lye solution absorbed much less fat than did those stored in chlorine, quaternary ammonium, acid detergent, or polyphosphate solutions. Moreover, some of these solutions caused deterioration of the rubber or other undesirable changes. The Arizona studies also indicated that lye solution, following a cold water rinse, gave lower counts than conventional methods, with a daily saving in time of 30 minutes to an hour for a 2-unit machine. Moseley recently queried Guernsey milk producers whose raw milk plate counts during 1950 never exceeded 50,000 per ml. Of the 13 replying, 11 used wet storage and 9 of these used lye solution. The above findings, and our own, do not support Enright's contention that the use of lye solution can be blamed for most of the unclean teat-cup assemblies.

Regardless of the method employed to remove the milk residue, wet storage in lye solution between milkings possesses the following advantages:

1. Lye is more readily obtainable than other recommended detergents or sanitizers.
2. It is the cheapest effective compound.
3. It retains its strength, both in the solid form and in solution.
4. It maintains its efficiency in the presence of rubber and other organic matter.
5. It possesses valuable detergent properties, dissolving casein and saponifying fat, the presence of which causes deterioration of rubber liners.
6. It does not cause oxidation of the rubber.
7. It does not form the granular deposit reported by Parfitt with hard water solutions of hypochlorites.

(Continued on page 160)
The Efficacy of the Microscopic Examination of the Incubated Producer Milk Samples in Detecting Streptococcus Mastitidis in Dairy Herds. *J. Milk Technol.*, 9, 197-201 (1946).


**Antibiotics in Milk**

7. Even a 5-minute treatment with lye solution is sufficient to maintain surfaces in good sanitary condition.

**Conclusion**

Lye solution maintained milking machine rubber parts in a satisfactory sanitary condition even when the residual milk was permitted to dry on the surfaces.

**Acknowledgments**

Grateful acknowledgment is made of the generous cooperation of the Dairy Staff of the Animal Husbandry Division, Central Experimental Farm, in carrying out these studies, and of the technical assistance of Mr. J. G. Desmarais in carrying out the analyses.

**References**


