

## AN ENQUIRY CONCERNING THE STATE OF CLEANLINESS OF EMPTY MILK CHURNS.

BY R. H. CUMMING, B.Sc., AND A. T. R. MATTICK, B.Sc.

*(From the Research Institute in Dairying, University College, Reading.)*

AN enquiry<sup>(1)</sup> instituted in 1916 showed that from 1 to 2% of rail-borne milk was sour on arrival at its destination, with the result that in London alone there was a loss of some 90,000 gallons of milk annually. That this loss was not confined to the London milk was brought out by the fact that a similar loss was found to obtain in the north of England.

Further investigations<sup>(2)</sup> showed that average milk, when carried in utensils and churns washed according to the methods generally obtaining, had a very high bacterial content especially during the summer months. The examinations for bacterial content were made when the milk was not more than about nine hours old. Proliferation of the organisms introduced into the milk at the time of milking was not therefore a sufficient explanation of this condition. It was thought that possibly an examination of the churns which were being returned empty to farmers might reveal one source of this excessive number of bacteria, since if the churns were inefficiently cleansed and particularly if they were also left damp, every opportunity would be afforded for the proliferation of bacteria during the warm summer weather, and the churns would reach the farmer in such a state that it would be very difficult for him to cleanse them adequately, even supposing he were in possession of the necessary apparatus.

For these reasons therefore the following series of experiments was undertaken.

Between October 9th and November 20th, 1919, 500 empty milk churns were examined for cleanliness on a station platform.

The state of cleanliness was measured by the following methods:

- (A) The general cleanliness as revealed by inspection.
- (B) The state according to the smell.
- (C) The number of colonies found by a bacteriological examination of the washings with sterile normal saline solution.

The results of (A) and (B) are set out in Table I in which the churns are classified according to their state as determined by inspection and the presence or absence of smell.

Table I shows that only 16% of the churns examined were apparently clean and dry and 28% though, apparently clean, were wet. On the other hand, 56% of the churns were undoubtedly in an unsatisfactory condition, since all of them revealed one or more of the following faults: the presence

either of milk or of milky water, or of an evil smell. In addition to the examination by inspection, bacteriological examinations of churns of each type were carried out by the following methods. One litre of sterile normal saline solution was poured into each churn which was examined and was thoroughly agitated,—a portion being first poured on to the inside of the lid

Table I.

Classification of churns by inspection.  
October 9th—November 20th, 1919.

Clean and sweet		Milk absent. Evil smell		Churn not washed. Milk present	Churn badly washed
Dry	Wet	Dry	Wet		
81	140	5	118	81	75
16%	28%	1%	24%	16%	15%

Total = 500

and then added to the bulk. A sample of the washings was then taken into a sterile bottle and examined bacteriologically within one hour of collection, by plating dilutions up to one in a hundred thousand on neutral lemco agar, incubating the plates for five days at 22° C. and then counting the number of colonies which grew. Litmus lactose peptone water tubes were also inoculated with 1 c.c. of the washings, and 1 c.c. each of the dilutions, and incubated for five days at 37° C. These were then examined for the presence or absence of lactose fermenting organisms as shown by the production or non-production of acid and gas.

The results of these examinations are shown in Table II, p. 86.

On analysis, this table shows that those churns which contained milk or milky water showed very high bacterial counts, and lactose fermenting organisms were found in high dilutions in all cases. Churns of the clean and dry type showed counts both high and low, but it is noticeable that the lactose fermenting organisms when present were not generally found in such high dilutions as in the case of samples from churns containing milk or milky water. Several of the churns of this type which were examined, showed counts which were well under 10,000 per cubic centimetre of washings and lactose fermenting organisms were not found. On the other hand very high counts were obtained in some cases in this series showing that, although these churns appeared to be clean and were dry, they had not really received an efficient cleansing.

Out of a total of 13 churns of the clean and dry type which were examined bacteriologically, only 5 showed really low counts and contained no lactose fermenting organisms, so that although these churns appeared to be clean and would readily have passed a cursory examination, there must have been some grave defect in the methods of cleansing, which either did not eradicate or introduced contaminating organisms in the majority of cases.

Some idea of the gross contamination of milk by dirty churns may be gathered from a consideration of the figures in Table II.

Table II.  
Bacteriological Examination.  
October 9th—November 20th, 1919.

Condition of churn	Counts	Acid and gas in litmus lactose peptone water
Unwashed (whole milk present)	Uncountable in	
	1/100,000	+ 1/100,000
" " "	4,000,000	+ 1/100,000
" " "	Uncountable in	
	1/10,000	+ 1/10,000
Badly washed (milky water present)	18,400,000	+ 1/1000
" " " "	5,300,000	+ 1/1000
Apparently clean but wet	4,100,000	+ 1/100
" " "	780,000	+ 1/10,000
" " "	510,000	+ 1 c.c.
Apparently clean and dry	6,200,000	+ 1/1000
" " "	1,720,000	+ 1/10,000
" " "	1,600,000	+ 1/100
" " "	800,000	+ 1 c.c.
" " "	400,000	+ 1/1000
" " "	35,000	+ 1/10
" " "	15,400	+ 1 c.c.
" " "	6,500	—
" " "	5,000	+ 1/10
" " "	3,000	—
" " "	2,400	—
" " "	2,000	—
" " "	170	—

The best of the churns contained 170 bacteria per cubic centimetre of washings. Therefore as one litre of saline solution was used for washing, there must have been at least 170,000 bacteria in the churn. Another churn was found to contain at least 18,400,000 bacteria per cubic centimetre of washings. If 17 gallons of milk were put into this churn, that milk would start on its journey to the factory or consumer with an initial contamination of approximately 240,000 bacteria per cubic centimetre. These are the results of an examination in winter, when temperature conditions were not favourable for the rapid proliferation of organisms. It is probable that in summer, milk such as this would arrive at the end of a long railway journey in such a condition as to be unfit for use.

The investigation proves that the present methods of washing and cleansing churns are inadequate and one cause of the loss of milk through souring in transit. Further experiments are being undertaken to establish the minimum time of steaming necessary to insure as complete a sterilization as is possible under practical conditions.

#### REFERENCES.

- (1) WILLIAMS, R. STENHOUSE (1917). *Wastage of Milk. Journ Roy. Agric. Soc.* LXXVIII.
- (2) FREEAR, K., BUCKLEY, W. and WILLIAMS, R. STENHOUSE (1919). *Memorandum concerning Two Types of Commercial Milk.* Research Institute in Dairying, University College, Reading.