THE USE OF HYPOCHLORITES AS A STERILISING AGENT FOR DAIRY UTENSILS.

By W. A. HOY and JANET R. L. RENNIE.

(*The National Institute for Research in Dairying, Shinfield, nr. Reading.*)

Since disinfectants containing hypochlorites have been used for the sterilisation of dairy utensils, and it has been claimed that such disinfectants are more efficient than steam sterilisation, it seemed advisable to study the question in the interests of the Milk Industry. The efficiency of three proprietary disinfectants (*A*, *B* and *C*) has, therefore, been investigated.

In the first instance the strengths of these solutions (estimated as available chlorine) were tested and the results obtained are given in Table I which shows that the quantities of "available chlorine" varied very much in the different disinfectants.

Table I.

	Percentage of "available chlorine"	
Disinfectant	By titration of liberated iodine	By titration with alkaline arsenite
A	1·23	1·22
B	1·07	1·05
C	0·49	0·49

Four series of experiments were conducted upon milk churns of 10 and 17 gallons capacity, and the influence of different methods of treatment of the churns upon the keeping qualities of milk and upon the bacteriological condition of the churns was studied. In the first three series the work was carried out according to the directions supplied with the disinfectants, and with solutions of equal or greater strength than those recommended by the manufacturers.

First Series.

Technique: The churns, after contamination with sour milk, were rinsed with cold water, then scrubbed with hot soda water, and again rinsed with clean cold water. The churns which are described in the tables as "washed" received no further treatment, but were allowed to drain for two hours. The disinfectants were applied to similarly treated churns in the following manner: about three gallons of the diluted disinfectant were poured into the churn and applied to the whole of the interior with a clean swab; the solutions were then poured out and the churns allowed to drain for two hours. The "steamed" churns, after similar preliminary washing, were inverted on a steam jet for $2\frac{1}{2}$ to 3 minutes. The lids of the churns in each case received the same treatment as the churns.

https://doi.org/10.1017/S0022172400008998 Published online by Cambridge University Press

After the above treatment, one pint of clean milk which was taken from the same volume was poured into each churn which was then rolled so that the milk might come in contact with its internal surface. The milk was then transferred to sterile bottles and kept at 60° F. that its keeping quality might be tested.

Under these conditions five tests were carried out. In the first three a 2 per cent. solution of disinfectant *A* (0·0246 per cent. available chlorine) was employed, and in the last two a 5 per cent. solution of the same disinfectant (0·061 per cent. available chlorine).

Table II. *Keeping qualities of milk from treated churns.*

Test	Size of churn	Washed churns Days sweet	Churns treated with disinfectant Days sweet	Steamed Churns Days sweet
1	10	1	1	3
	17	1	1	2
2	10	1	1½	2½
	17	1	1½	2½
3	10	1	1	2
	17	1	1	2
4	10	1	1	2
	17	½	1	2
5	10	½	½	2
	17	½	½	2
Mean		0·85	1	2·2

The foregoing results show that the average keeping quality of milk which had been put into disinfected churns was slightly longer than that of milk from washed churns, but that the milk from steamed churns had a very much longer keeping quality than either of the other two.

Second Series.

In this series a study was made of the bacteriological condition of churns which had been treated with disinfectants *A* and *B*. The churns were treated as before, but instead of introducing milk into them they were rinsed with 500 c.c. of sterile water which was then used for the bacteriological test, the results of which are shown in Table III.

Table III likewise shows that disinfectants *A* and *B*, even in 5 per cent. solutions, failed to produce the degree of sterility that was obtained when the churns were steamed.

Third Series.

The third series of tests was carried out with disinfectant *C*. The churns were not subjected to the usual scrub in hot soda water, as according to the instructions supplied with the disinfectant this was not necessary, but the disinfectant was added to the water in which the churns were washed.

After the churns had been rinsed free from sour milk, they were scrubbed in a 1 per cent. solution of freshly prepared disinfectant containing 0·0049 per cent. available chlorine, and then were allowed to drain in an inverted

Table III. *Bacteriological examinations of "rinse water" from treated churns.*

Test	Size of churn in gallons	Washed: Bacterial count per 1 c.c. water	Washed: Lactose fermenting organisms (acid & gas) c.c.	Treated with disinfectant: Bacterial count per 1 c.c. water	Treated with disinfectant: Lactose fermenting organisms (acid & gas) c.c.	Steamed: Bacterial count per 1 c.c. water	Steamed: Lactose fermenting organisms (acid & gas) c.c.
Disinfectant *A*. 2 % solution containing 0·0246 % "available chlorine"							
1	10	Uncountable	+1/10	Uncountable	+1/10	4 in 1/10	−1
	17	„	+1/10	„	+1/10	4 in 1/10	−1
Disinfectant *A*. 5 % solution containing 0·061 % "available chlorine"							
2	10	500,000	+1/10	100,000	+1/10	2 in 1/10	−1
	17	500,000	+1/10	30,000	(acid) 1/10	2 in 1/10	−1
3	10	540,000	+1/10	225,000	+1/10	0 in 1/10	−1
	17	Uncountable	+1/10	5,000	(acid) 1/10	2 in 1/10	−1
Disinfectant *B*. 5 % solution containing 0·053 % "available chlorine"							
4	10	Uncountable	+1/10	9,000	(acid) 1	0 in 1 c.c.	−1
	17	„	+1/10	3,100	−1	0 in 1 c.c.	−1
5	10	500,000	+1/10	120,000	+1/10	8 in 1 c.c.	−1
	17	Uncountable	+1/10	700	+1/10	9 in 1 c.c.	−1

Table IV. *Examination of water from treated churns.*

Test	Treated with Disinfectant *C*: Churn No.	Bacterial count per 1 c.c. water	Lactose fermenting organisms (acid & gas) c.c.	Keeping quality. Days sweet	Steamed: Churn No.	Bacterial count per 1 c.c. water	Lactose fermenting organisms (acid & gas) c.c.	Keeping quality. Days sweet	Control Milk. Keeping quality. Days sweet
1	1	220,000	+1/1000	1½	7	1	−1	2¾	2¼
	2	160	−1	1½	8	2	−1	2¼	.
	3	230	−1	1½	.	.	.	.	.
	4	80	−1	1½	.	.	.	.	.
	5	3,800	+1	1½	.	.	.	.	.
	6	1,200	−1	1½	.	.	.	.	.
2	1	8,200	+1/100	1¾	7	1	−1	4	4
	2	30	−1	2¼	8	4	−1	3¼	.
	3	100	+1	1¾	.	.	.	.	.
	4	20	−1	2	.	.	.	.	.
	5	7,200	+1/100	1¾	.	.	.	.	.
	6	190	+1	1¾	.	.	.	.	.
3	1	3,800	+1/10	1¾	7	10	−1	3	3
	2	1,870	+1	1¾	8	15	−1	2¾	3
	3	1,340	+1	1¾	.	.	.	.	.
	4	38,000	+1/100	1¾	.	.	.	.	.
	5	34,500	+1/10	1¾	.	.	.	.	.
	6	6,200	+1/100	1¾	.	.	.	.	.
4	1	1,430	+1/100	2	6	16	−1	2¾	2¾
	2	1,900	+1/100	1¾	7	14	−1	2¾	.
	3	12,200	+1/100	1¾	.	.	.	.	.
	4	10,000	+1/100	2	.	.	.	.	.
	5	32,500	+1/100	1¾	.	.	.	.	.
5	1	2,600	+1/100	1½	7	1	−1	2¼	2¾
	2	5,700	+1/10	1¼	8	10	−1	2¼	.
	3	20,700	+1/10	1	.	.	.	.	.
	4	12,200	+1/10	1¼	.	.	.	.	.
	5	12,400	+1	1¼	.	.	.	.	.
6	1	3,400	+1/100	1½	7	5	−1	2¾	2¾
	2	320	+1/10	2	8	0	−1	2¾	.
	3	1,010	+1/10	1½	.	.	.	.	.
	4	1,240	+1/100	2	.	.	.	.	.
	5	2,180	+1/100	1¾	.	.	.	.	.
	6	2,010	+1/10	2	.	.	.	.	.
Mean	.	.	.	1·4	.	7	.	2·8	2·9

position for about four hours. During this period the churns were well protected from possible contamination. The control churns were washed with warm soda water, rinsed, and then steam sterilised. Four hours after treatment each churn was rinsed with 500 c.c. of sterile water which was used for carrying out the bacteriological examination and 5 c.c. quantities of it were added to clean milk in order to study the effect upon its keeping quality.

The results are shown in Table IV, and they demonstrate that the disinfectant failed to sterilise the churns and that in consequence there was a loss in the keeping quality of the milk to which rinse water from these churns had been added. On the other hand, the keeping qualities of the milk to which the rinse water from the steamed churns had been added differed but little from those of the control milk.

Fourth Series.

The results given in Table V were obtained during a further investigation of disinfectant *A* in which a 6 per cent. solution containing 0·0738 per cent. available chlorine was used. This was done on the suggestion of the manufacturers.

Table V. *Comparison of bacteriological counts of "rinse water" obtained from churns treated with disinfectant A.*

First rinsings		Second rinsings	
Bact. count per c.c.*	Lact. fermenting organisms (acid and gas) c.c.	Bact. count per c.c.	Lact. fermenting organisms (acid and gas) c.c.
1	−1	1030	+1
0	−1	2160	−1
0	−1	1570	−1
418	+1	Uncountable	+1
538	+1	,,	+1
220	+1	,,	+1
0	−1	110	+1
0	−1	137	+1
0	−1	139	+1
76	+1	Uncountable	+1
78	+1	,,	+1
100	+1	,,	+1
0	−1	,,	+1
0	−1	,,	+1
0	−1	,,	+1
0	−1	72	+1
0	−1	75	+1
1	−1	63	+1
14	−1	Uncountable	+1
8	−1	,,	+1
5	−1	,,	−1
52	+1	350	+1
54	+1	358	+1
37	+1	380	+1

* N.B. All determinations carried out in triplicate.

The test churns were prepared and treated as before except that instead

https://doi.org/10.1017/S0022172400008998 Published online by Cambridge University Press

of allowing the churns to drain after treatment, the disinfectant was emptied out and the lids were immediately placed in position after they had been treated in a similar manner. By this alteration of technique a considerable amount of disinfectant collected in the bottom of the churn. It was quite obvious that this residue must necessarily be added to any milk which might be introduced into the churn. It was, therefore, decided to rinse out the solution which remained in the bottom of the churn with 500 c.c. of sterile water and then to add a further 500 c.c. The sides of the churn were well washed with the second quantity of water, and in order to aid the removal of bacteria a sterile mop was used. Bacteriological tests were made of both these quantities of water, and the results are shown in Table V. In this table the quantities of water which were used for washing the churns are described as "first rinse" and "second rinse."

Eight tests were carried out on eight different churns of 17 gallons capacity, and the bacteriological examinations from the rinsings of each churn were made in triplicate.

Table V shows that a 6 per cent. solution of disinfectant *A* did not sterilise the churn, and that the amount of disinfectant remaining in the first water used for rinsing sufficed to give a false impression regarding the sterility of the churn, this being of some importance, since under working conditions milk might easily have been introduced into these churns while disinfectant solution containing chlorine was still present.

Conclusions.

1. The amount of "available chlorine" contained in these disinfectants varied from 1·23 per cent. in disinfectant *A* to 0·49 per cent. in disinfectant *C*.

2. A 6 per cent. solution of disinfectant *A* failed to give the same degree of sterility in a churn as can be obtained by steam under working conditions.

3. The use of a chlorine preparation as a means of sterilising churns necessitates the subsequent washing out of the churns with water if the chlorine is to be removed before milk is added. This process introduces the danger of recontamination of the churn.

4. If the churn be not washed out after treatment with a chlorine preparation there is grave danger that chlorine will be added to the milk. That this danger is not altogether hypothetical would appear to be the case, since in the United States, where this method of sterilisation is more extensively used than in this country, the Department of Agriculture has issued a bulletin describing a method for the detection of hypochlorites and chloramines in milk and cream (*United States Dept. of Agr. Bull.* No. 1114, August 1922).

(*MS. received for publication* 24. I. 1927.—Ed.)