

THE STERILIZATION OF MILK BOTTLES WITH CALCIUM HYPOCHLORITE

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Since public opinion has been sufficiently aroused to demand the distributors in many cities to furnish milk under a certain bacterial count, it is becoming more and more necessary for even the small dairyman to supply himself with the apparatus necessary to assist him in securing these prescribed standards.

One of the problems which confronts both the producer and likewise the distributor of milk is the sterilization of utensils used in collecting and distributing the product. Undoubtedly the ideal method of rendering these utensils free from bacteria is by steam sterilization. This method, however, necessitates the installation of expensive apparatus and the cost of operating a steam sterilizing plant even for the requirements of a small dairy farm is correspondingly great. In other words, the small producer can scarcely afford such apparatus, and as a result the utensils add to the bacterial count of the milk from day to day.

In the investigation of small dairy plants the application of hypochlorite to the sterilization of milk apparatus suggested itself to the writers as a method of sterilization simple in its application with a possible field of merit. The investigations of this paper have been confined to a determination of the relative efficiency of various solutions of calcium hypochlorite in the sterilization of milk bottles. A number of dairies were visited and the work was done on the spot with the apparatus actually in use by the dairymen at that time. In this way it was possible to determine the relative efficiency of this chemical under a variety of conditions. The exact procedure of the work was carried out as follows: The dairy selected for investigation was visited with sufficient apparatus to do immediate plating for the bacterial count before and after treatment. The milk bottles used in the experiments were selected from those already cleaned and ready for refilling with milk for distribution. A solution of calcium hypochlorite of known strength was carried so that a definite amount could be added to the local water used in the process of treatment. The treatment was done in a tub or tank of sufficient size to permit the submerging of the bottles used. The technique of obtaining the count on bottles before and after treatment consisted in rinsing the inside of the bottle as thoroughly as possible with a definite amount of sterile, distilled

water and immediately plating an aliquot part of the liquid. The counts were made on standard agar medium and incubated for 24 hours at 37.5° C. During this investigation eight dairies were visited and the treatment was conducted as indicated in Table I.

It should be mentioned here that the method of washing the bottles used at the dairies visited, was practically identical. The bottles were first washed by means of a brush in a sodium carbonate solution followed by a rinsing in clean water.

The source of the water used in the process of treatment at the different dairies varied considerably. Dairies No. 1, 5, 7 and 8 derived their supply from the Mississippi river, No. 2, 4 and 6 from deep, drilled wells, and No. 3 from a shallow, driven well.

The bacterial count on the bottles before treatment show a wide range in the number of organisms present. The counts on the total number of bottles examined from the eight sources (Table I) show a minimum count of 30., a maximum count of 1,600,000 and an average count of 120,000 per bottle. The counts on these same bottles after treatment (Table I) show a minimum count of 0., a maximum of 540. and an average of 45. per bottle.

During the investigation the amount of chemical rendering efficient results was reduced from 20 to 10 parts per million of available chlorine and the time of exposure from one hour to twenty minutes.

The summary of results (Table II) computed from the average results under the conditions indicated, show a removal of over 99.9 per cent. of the bacteria by this treatment. From the results it appears that by submerging milk bottles in a water to which calcium hypochlorite in the amount of 10 parts per million of available chlorine has been added, a very marked reduction in the bacterial count is effected. An examination was made of the organisms remaining after treatment on the plates from dairies No. 2 and 3 and over 95 per cent. of these organisms were found to be spore bearers.

Summary and Conclusions.

1. The sterilizing of milk bottles by submerging in a solution of calcium hypochlorite appears to be a quick and inexpensive method of materially reducing the organisms present.

2. It is not the intention of the writers to recommend this as a substitute for thorough steam sterilization but simply to be used as an expedient when the other method is impracticable.

3. The total, average, bacterial efficiency of over 99.9 per cent. on the 20 minute treatments with calcium hypochlorite in amounts not exceeding 10 parts per million of available chlorine shows merit in the application of hypochlorite for this purpose.

4. A series of investigations are now under way in this laboratory to further substantiate these results and to apply the method to actual practice.

The writers wish to acknowledge the valuable advice and criticisms of Dr. R. H. Mullin, Director of Laboratory Division of the Minnesota State Board of Health, under whose supervision the investigation was conducted.

TABLE I.
DETAILS OF ANALYTICAL RESULTS.

Date	Source of bottles	Size of bottles	Bacteria in bottle before treatment	Hypochlorite parts per million available chlorine	Time exposed to hypochlorite	Bacteria in bottle after treatment
7-3-11	Dairy No. 1	1 qt.	80.	20.	1 hour	0.
"	" " "	"	6,000.	"	" "	0.
"	" " "	"	30.	"	" "	0.
"	" " "	"	96,000.	"	" "	40.
7-10-11	" " 2	"	6,800.	"	" "	30.
"	" " "	"	32,500.	"	" "	0.
"	" " "	"	140,000.	"	" "	0.
"	" " "	"	16,500.	"	" "	100.
"	" " "	"	16,000.	"	" "	0.
"	" " "	"	1,000,000.	"	" "	155.
"	" " "	"	82,000.	"	" "	85.
"	" " "	"	9,600.	"	" "	0.
"	" " "	1 pt.	26,000.	"	" "	50.
"	" " "	"	50,500.	"	" "	150.
"	" " "	"	26,500.	"	" "	0.
"	" " "	"	29,600.	"	" "	10.
"	" " "	"	27,000.	"	" "	5.
"	" " "	"	38,000.	"	" "	20.
"	" " "	"	26,000.	"	" "	30.
7-12-11	" " 3	"	74,000.	"	" "	150.
"	" " "	"	750.	"	" "	10.
"	" " "	"	380.	"	" "	15.
"	" " "	"	325.	"	" "	0.
"	" " "	"	1,300.	"	" "	20.
"	" " "	"	7,500.	"	" "	25.
"	" " "	"	250.	"	" "	0.
"	" " "	"	300.	"	" "	5.
"	" " "	"	225.	"	" "	0.
"	" " "	"	150.	"	" "	5.
"	" " "	"	18,500.	"	" "	20.
"	" " "	"	3,700.	"	" "	5.
"	" " "	1 qt.	850.	"	" "	0.
"	" " "	"	350.	"	" "	0.
"	" " "	"	1,300.	"	" "	5.
"	" " "	"	2,200.	"	" "	5.
"	" " "	"	3,100.	"	" "	0.
"	" " "	"	1,200.	"	" "	10.
"	" " "	"	800,000.	"	" "	20.
"	" " "	"	3,000.	"	" "	5.
"	" " "	"	14,500.	"	" "	0.
"	" " "	"	2,500.	"	" "	0.

TABLE I.—DETAILS OF ANALYTICAL RESULTS.—Continued.

Date	Source of bottles	Size of bottles	Bacteria in bottle before treatment	Hypochlorite parts per million available chlorine	Time exposed to hypochlorite	Bacteria in bottle after treatment
7-12-11	Dairy No. 3	1 qt.	1,300.	20.	1 hour.	0.
6-30-11	" " 1	1 pt.	1,800.	10.	" "	10.
"	" " "	"	7,400.	"	" "	10.
"	" " "	"	11,500.	"	" "	30.
"	" " "	"	900.	"	" "	0.
"	" " "	"	1,900.	"	" "	0.
"	" " "	"	6,900.	"	" "	40.
"	" " "	"	450.	"	" "	0.
"	" " "	"	5,400.	"	" "	40.
7-18-11	" " 4	"	115,000.	"	" "	45.
"	" " "	"	100,000.	"	" "	15.
"	" " "	"	170,000.	"	" "	10.
"	" " "	"	28,500.	"	" "	10.
"	" " "	"	12,000.	"	" "	60.
"	" " "	"	17,500.	"	" "	45.
"	" " "	"	14,000.	"	" "	5.
"	" " "	"	18,500.	"	" "	15.
"	" " "	"	21,000.	"	" "	10.
"	" " "	"	1,200.	"	" "	20.
"	" " "	"	11,000.	"	" "	20.
"	" " "	"	9,100.	"	" "	5.
"	" " "	1 qt.	1,600,000.	"	" "	115.
"	" " "	"	8,600.	"	" "	70.
"	" " "	"	970,000.	"	" "	150.
"	" " "	"	160,000.	"	" "	30.
"	" " "	"	390,000.	"	" "	250.
"	" " "	"	970,000.	"	" "	20.
"	" " "	"	1,000,000.	"	" "	540.
"	" " "	"	170,000.	"	" "	50.
"	" " "	"	58,000.	"	" "	0.
"	" " "	"	46,000.	"	" "	60.
"	" " "	"	125,000.	"	" "	30.
8-23-11	" " 5	1 pt.	60,000.	"	30 min.	20.
"	" " "	"	100,000.	"	" "	10.
"	" " "	"	40,000.	"	" "	20.
"	" " "	"	800,000.	"	" "	60.
"	" " "	"	130,000.	"	" "	10.
"	" " "	"	100,000.	"	" "	30.
"	" " "	"	1,000,000.	"	" "	100.
"	" " "	"	130,000.	"	" "	10.
"	" " "	"	150,000.	"	" "	10.
"	" " "	"	90,000.	"	" "	0.
"	" " "	"	89,000.	"	" "	10.

TABLE I.—DETAILS OF ANALYTICAL RESULTS.—Continued.

Date	Source of bottles	Size of bottles	Bacteria in bottles before treatment.	Hypochlorite parts per million available chlorine	Time exposed to hypochlorite	Bacteria in bottle after treatment
8-23-11	Dairy No. 5	1 pt.	200,000.	10.	30 min.	30.
10-9-11	" " 6	"	130,000.	"	20 "	25.
"	" " "	"	150,000.	"	" "	90.
"	" " "	"	160,000.	"	" "	35.
"	" " "	"	180,000.	"	" "	45.
"	" " "	"	310,000.	"	" "	50.
"	" " "	"	140,000.	"	" "	50.
"	" " "	"	120,000.	"	" "	50.
"	" " "	"	120,000.	"	" "	25.
"	" " "	"	110,000.	"	" "	40.
"	" " "	"	110,000.	"	" "	540.
"	" " "	1 qt.	23,000.	"	" "	75.
"	" " "	"	310,000.	"	" "	40.
"	" " "	"	480,000.	"	" "	120.
"	" " "	"	47,000.	"	" "	55.
"	" " "	"	42,000.	"	" "	40.
"	" " "	"	15,000.	"	" "	60.
"	" " "	"	20,000.	"	" "	75.
"	" " "	"	81,000.	"	" "	35.
"	" " "	"	51,000.	"	" "	45.
"	" " "	"	62,000.	"	" "	60.
11-15-11	" " 7	1 pt.	6,100.	"	" "	0.
"	" " "	"	240,000.	"	" "	50.
"	" " "	"	260,000.	"	" "	280.
"	" " "	"	135,000.	"	" "	50.
"	" " "	"	3,800.	"	" "	10.
"	" " "	"	38,000.	"	" "	30.
"	" " "	"	129,000.	"	" "	40.
"	" " "	"	36,500.	"	" "	40.
"	" " "	"	500.	"	" "	0.
"	" " "	"	1,000.	"	" "	10.
"	" " "	"	9,000.	"	" "	20.
"	" " "	"	120,000.	"	" "	30.
"	" " "	"	200.	"	" "	20.
"	" " "	"	200.	"	" "	10.
"	" " "	"	140,000.	"	" "	50.
11-20-11	" " 8	"	31,500.	"	" "	100.
"	" " "	"	900.	"	" "	10.
"	" " "	"	900.	"	" "	10.
"	" " "	"	1,200.	"	" "	10.
"	" " "	"	300,000.	"	" "	190.
"	" " "	"	3,200.	"	" "	60.
"	" " "	"	7,000.	"	" "	70.

TABLE I.—DETAILS OF ANALYTICAL RESULTS.—*Concluded.*

Date	Source of bottles	Size of bottles	Bacteria in bottle before treatment	Hypochlorite parts per million available chlorine	Time exposed to hypochlorite	Bacteria in bottle after treatment
11-20-11	Dairy No. 8	1 pt.	2,700.	10.	20 min.	60.
"	" " "	"	900.	"	" "	0.
"	" " "	"	6,100.	"	" "	50.
"	" " "	"	4,300.	"	" "	60.
"	" " "	"	15,500.	"	" "	70.
"	" " "	"	600.	"	" "	40.
"	" " "	"	310,000.	"	" "	270.
"	" " "	"	1,300.	"	" "	30.
"	" " "	"	600.	"	" "	20.
"	" " "	"	700.	"	" "	20.

TABLE II.

SUMMARY OF ANALYTICAL RESULTS.

Number of bottles treated	Hypochlorite parts per million available chlorine	Time exposed to treatment	Percentage removal of bacteria
42.	20.	1 hour	99.962
32.	10.	1 "	99.972
12.	10.	30 min.	99.983
52.	10.	20 "	99.927