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REMOVAL OF GARLIC FLAVOR FROM MILK AND CREAM.

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It is a well-known fact that when cows eat wild onion or garlic within four hours before milking there is imparted to their milk a very disagreeable flavor and odor. This flavor is not only unpleasant but it lowers the commercial value of the milk. Any method, therefore, which will remove this flavor and odor should be of interest to dairymen.

THE EXPERIMENTAL MILK.

In all our experiments milk with a strong onion flavor was used. The milk was prepared by feeding a cow with three-fourths of a pound of wild onion or garlic 20 minutes before milking, and we believe that the milk so obtained has as strong a flavor, probably stronger, than any commercial milk so tainted.

DESCRIPTION OF PROCESS.

Briefly stated, the process which we have used for removing onion or garlic flavor from milk consists in blowing air through milk which is heated to at least 145° F. The apparatus used in our work is shown in figure 1. It consists of a round, open-top tin tank, *A*, of about 4 gallons capacity, surrounded by a water jacket. Supported above tank *A* is a second tank, *B*. Tank *B* has a perforated bottom, the holes being about one thirty-second of an inch in diameter, placed at a distance of about one-half inch apart. This tank stands about 3 inches above tank *A*, and is supported by four legs. There is left, therefore, an open space between the two tanks through which the air escapes after its passage through the milk. An air pipe extends to within one-half inch of the bottom of tank *A*. A pump is also provided with connections to both tanks.

The method for removing onion or garlic flavors is as follows: Milk is placed in tank *A* and heated to 145° F. by means of hot water in the water jacket. During the heating the milk is agitated by mechanical means. It is possible that a slight agitation by air would act as well as a mechanical stirrer, but if such agitation is too violent it may churn the fat in the cold milk. When the temperature has reached 145° F. air under pressure is blown into the milk through the air pipe, which extends nearly to the bottom of tank *A*. This air causes a violent agitation of the milk. When the air is turned on,

the milk pump is started and milk is pumped from tank *A* to tank *B*, from which it flows through the perforated bottom and returns to tank *A* in fine streams after the manner of rain. The pumping is continued throughout the blowing process. The principal object of tank *B* is to cause milk to drop into tank *A* in such manner as to destroy the layer of foam which forms on the milk which is being treated with air in the lower tank. This method of allowing the milk to fall in fine streams also aids in aeration and therefore helps in the removal of the onion or garlic flavor.

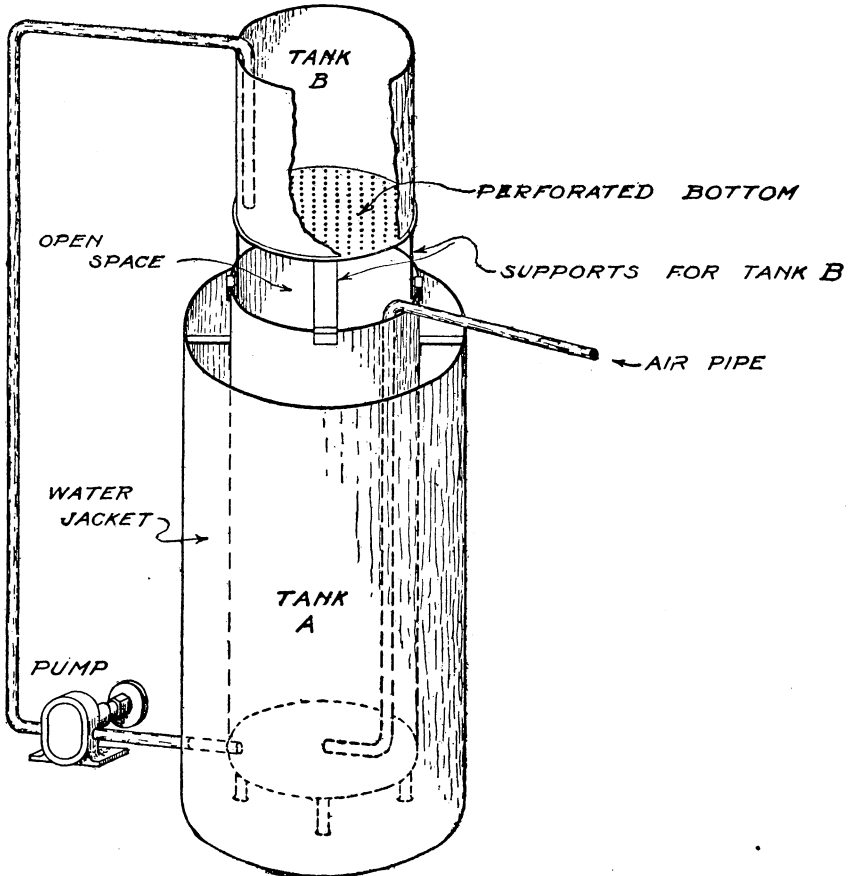


Fig. 1.—Apparatus for removing wild onion or garlic flavor from milk or cream.

Air was obtained from the laboratory pressure air line, and about one-fifth of a cubic foot of air per gallon of milk per minute was used.

PROCESS MOST SATISFACTORY AT 145° F.

In developing this process a large number of experiments were performed, using various temperatures. It was found that some of the onion or garlic flavor could be removed by blowing cold milk, but it was impossible to remove it entirely in any length of time which would be practical for commercial use. In one experiment milk with a strong onion flavor was blown for two hours at a temperature

ranging from 50° to 68° F. and the flavor was not removed. The temperature was then raised to 145° F. and after five minutes blowing the onion flavor was entirely removed. It was also found that when cold milk is violently agitated by air the fat churns, and when the milk is subsequently heated, followed by cooling and bottling, as in pasteurization, a thin layer of butterfat forms on the surface of the bottled milk. When milk was blown at temperatures from 70° to 100° F. a layer of melted fat formed in some cases during the blowing process. This was never observed when the temperature of the milk during blowing was 140° F. or above.

RESULTS OF EXPERIMENTS AT VARIOUS TEMPERATURES.

Since the best results were obtained when the milk was treated at temperatures above 140° F., the results of a few experiments on milk and cream which show the length of time required to remove the onion or garlic flavor have been tabulated in Table 1. In experiments Nos. 1 and 2 the milk was blown without the use of the upper tank *B*, while in experiments Nos. 3 and 5, at the same temperature, tank *B* was used. The same volume of air, about one-fifth of a cubic foot per gallon per minute, was used in these experiments. It will be seen, however, that the onion flavor was removed more quickly in experiments 3 and 5 when tank *B* was used. It is probable that the milk falling from tank *B* in fine streams breaks up the layer of foam on the milk in tank *A* and therefore aids in the escape of the onion flavor, which is volatile. The milk also is probably aerated when falling in this manner.

TABLE 1.—Time required to remove onion or garlic flavor from milk and 30 per cent cream at various temperatures.

Experiment.	Temperature.	Original onion flavor.	Onion flavor after blowing for period of—			
			10 minutes.	15 minutes.	20 minutes.	30 minutes.
	° F.					
1, milk ¹	145	Strong..	Strong.....			Medium.....
2, milk ¹	145	do				Faint.....
3, milk	145	do	Medium.....		Faint.....	Very faint...
4, milk	160	do	Very faint...	Very faint...	Absent.....	
5, milk	145	do		Faint.....		Absent.....
6, cream	140	do				Medium.....
7, cream	150	do		Medium.....		Very faint...
8, cream	145	do				do
9, cream	160	do	Faint.....		Faint.....	do

Experiment.	Temperature.	Original onion flavor.	Onion flavor after blowing for period of—				
			40 minutes.	45 minutes.	50 minutes.	60 minutes.	75 minutes.
	° F.						
1, milk ¹	145	Strong..	Very faint...				
2, milk ¹	145	do	Faint.....		Faint.....	Absent.....	
3, milk	145	do	Absent.....				
4, milk	160	do					
5, milk	145	do					
6, cream	140	do		Medium...		Very faint...	Absent.
7, cream	150	do		Absent...			
8, cream	145	do		do			
9, cream	160	do	Absent...				

¹ Upper tank with perforated bottom not used.

Experiment No. 4 shows that the onion flavor in milk is removed more quickly when the milk is heated to 160° F. There is produced, however, at this temperature a cooked taste and the cream line is reduced to a greater extent than when the milk is heated and blown at 145° F. When milk was blown at 145° F. the experiments showed that there was about a 50 per cent reduction in the cream line. The effect on the cream line will vary with the amount of agitation of the milk and the length of the blowing period.

It is seen from the table that the onion or garlic flavor was removed entirely from milk at the temperatures given in from 30 to 60 minutes. It is evident, of course, that the length of the blowing period will depend upon the strength of the flavor in the milk. In one experiment not shown in Table 1 the flavor was removed by five minutes blowing. In this case, however, the onion or garlic flavor was not strong in the milk before treatment.

REMOVING THE FLAVOR FROM CREAM.

In order to remove the flavor from cream it was found that in general a slightly longer blowing period was required than in the case of milk. The results of four experiments with 30 per cent cream are shown in Table 1. Here again the results show that the onion or garlic flavor may be removed more quickly at 160° F. than at 140° or 145° F. It would probably be possible to use 160° F. when the cream is to be used for butter making, but for direct consumption the cooked taste produced by long heating at 160° F. is undesirable.

EVAPORATION.

When milk or cream is treated by this process it was found that there is a loss by evaporation which amounts to 2 or 3 per cent. Therefore it is advisable to use the minimum amount of air which will remove the onion or garlic flavor.

COMMERCIAL USE OF THE PROCESS.

The application of this process on a commercial scale would be simple, as an ordinary tank could be used with another tank with a perforated bottom supported above it. The size of the air blower necessary to supply air will depend upon the amount of milk to be blown and the depth of the milk, since air has to be forced to the bottom of the tank. It is desirable that the air be filtered and washed before its passage into the milk, in order to remove dust.

Any of the manufacturers of air blowers will determine the size necessary when supplied with the proper data; that is to say, the amount of air pressure which the blower must provide.

The experiments indicate that onion or garlic flavor may be removed on a commercial scale from milk and cream by the simple process which has been described. It is believed that the milk or cream for direct consumption should be heated and blown at 145° F. in order to obtain the best results, but the temperature used and the method of application of the process will depend upon the particular needs of the creamery operator.

