

Pasteurization of Whey.

Editor "The Farmer's Advocate":

In "The Farmer's Advocate" of December 31st, on page 2030, a report is given of the discussion on "The Pasteurization of Whey," at a meeting held during the course of the Winter Fair.

Lest the following remarks should be misinterpreted, the writer wishes to place on record that he believes in the pasteurization of whey; in fact, has advocated this method of dealing with whey, both from the platform, and also in the publications of the Ontario Department of Agriculture.

In an investigation, which included the bacteriological analyses of can-washings of every can which carried milk to the Innerkip factory, it was found that yeasts which produced undesirable flavors in the factory were present in every can, the only exception being the cans belonging to a farmer who did not use his milk can for transporting the whey back to his farm. Although pasteurization was recommended to the patrons of this factory at the time, yet it has taken several years before the farmers could be induced to carry out this important and needed reform.

With these few remarks, let me call attention to one or two statements in Mr. Herns' address.

A pasteurizing temperature of 155 to 160 degrees F. is advocated, because higher temperatures cause the whey to become slimy and precipitate the albuminoids; but in Mr. Herns' opinion, this temperature is sufficient to kill all the bacteria and yeasts that are apt to bother the cheesemaker by causing abnormal flavors in his product. In fact, he considers that whey is rendered "germ free" by this process.

This statement, however, is apt to be misleading; it does not take into account the extraordinary resisting power of many organisms, and also fails to recognize the fact that a temperature of 155 degrees F. lies near the lower limit of the killing effect of heat.

When we wish to destroy micro-organisms by means of heat, we must take into consideration not only the degree of heat, but the length of time of the exposure, and the reaction of the liquid in which the bacteria are suspended. These are very important points, and, unfortunately, there is at present little information available. How long does the whey hold its temperature above 150 degrees F.? Probably not longer than 15 or 20 minutes, even when there is a considerable body of liquid in the tank. The acidity of the whey is also a valuable factor, because it increases the effectiveness of heating to a marked degree.

Every housewife knows that it is easier to can tomatoes than either peas or corn, the reason being that the acidity of the tomatoes helps to kill the bacteria that may be present. There is experimental evidence to show that peas which had soured after heating for 30 minutes at 236 degrees F., could be killed in the presence of the acid by heating for a few minutes at 212 degrees F. Therefore, the amount of acid present in the whey, which varies from .2 to .5, probably plays a not unimportant part in increasing the effectiveness of the pasteurizing temperature of 155 to 160 degrees F.

The writer, however, desires to utter a note of warning to cheesemakers, not to expect that the temperature recommended will kill invariably all harmful bacteria and yeasts; unfortunately, some are very resistant.

A glance at some of the results of various pasteurizing temperatures may be of interest in this connection.

The New York Experiment Station made a number of tests of a Danish pasteurizer, at a temperature of 158 degrees C. The efficiency of the continuous pasteurizer varied greatly from day to day. Tests upon 14 different days gave an average of 15,300 living germs per cubic centimetre (16 drops) left in the pasteurized milk, with a maximum of 62,800 and a minimum of 120 germs.

At the Wisconsin Station it was found that there was considerable variation in the effect of heating at temperatures ranging between 153 to 165 degrees F. In some cases, as many as 40 per cent. of the bacteria survived, and in the tests published, the average number remaining in the pasteurized milk amounted to 2,000,000 germs per cubic centimetre.

At the Pennsylvania Station, whilst no numerical results are given, it is stated that heated to this temperature (155 to 158 degrees F.) in a continuous pasteurizer, it was found by culture plates that few, if any, of the bacteria present in the milk were destroyed.

At Guelph, the writer made a number of tests of the efficiency of two makes of pasteurizers. The average of thirteen tests, at temperatures ranging from 140 to 146 degrees F., showed that 2,000 bacteria per cubic centimetre were found in milk pasteurized at this heat. The milk had acidity of .18. In the discussion of the results, emphasis is given to the fact that the effect of a temperature of 140 to 146 degrees F. is on the border between efficiency and non-

efficiency, and that the lactic-acid bacteria are the first to succumb, and that certain undesirable bacteria, hardier, and more resistant to adverse influences, are either not affected or only to a slight degree by this temperature, and if left even in moderate numbers, they rapidly increase, and may give rise to "off" flavors.

Mr. Herns mentions that pasteurizing whey gets rid of yeasty and bitter flavors, caused by various species of yeast. The thermal death-point of the yeast which produces bitterness and yeasty flavor in cheese is 145 degrees F. for 10 minutes, and if this temperature (145 degrees) is maintained in the whey tank for the length of time mentioned, this troublesome visitor would, if present, be killed.

To sum up:

1. The temperature recommended for the pasteurization of whey (150 to 160 degrees F.) lies near the lower limit of the killing effect of heat.

2. This temperature can only be efficient when the whey is held at the heat recommended (150 to 160 degrees F.) for a definite length of time—at least 15 to 20 minutes.

The other point mentioned by Mr. Herns, that the writer would like to discuss, is the suggestion that pasteurization of whey at 150 to 160 degrees F. would destroy the tuberculosis germ. This statement is, however, not definitely made by Mr. Herns, but this meaning might be taken from his account. The writer does not wish to accuse Mr. Herns of casuistry, or think his declaration an example of a guarded statement, like Gladstone's assertion, made to a supporter whose favorite measure he had promised to put in the forefront, and then dropped; that the forefront is not a point, but a line. A statement of this character, however, should be well supported by experimental evidence, otherwise we might acquire a false sense of security, at variance with the real facts.

The determination of the thermal death-point of the tubercle bacillus in milk has been the object of many researches. According to the researches of Theobald Smith and others, 20 minutes, at 140 degrees F., is sufficient to kill the tubercle bacillus, provided the milk is kept stirred, so as to prevent the formation of a skin on the surface. Bang has shown that a temperature of 185 degrees F. in a continuous pasteurizer kills this organism, and this temperature (185 degrees F.) has been taken as the Danish legal temperature for heating all the by-products of milk that are to be returned to the farm for feeding purposes.

Park gives the following figures for the killing of the tubercle bacillus:

Heated in milk at a temperature of 121° F., 4 hours.
Heated in milk at a temperature of 140° F., 30 min.
Heated in milk at a temperature of 149° F., 15 min.
Heated in milk at a temperature of 168° F., 10 min.

Thus, the question of the destruction of this disease-producing organism in milk hinges on the duration of time of the exposure, at the pasteurizing temperature of 150 to 160 degrees F.

In conclusion, the writer would suggest that the inspectors in the various districts take careful note of the temperature of the whey in the tanks, and note what length of time it remains at temperatures above 145 degrees F. The acidity of the whey should be ascertained.

With some data on these points, it would be easy to outline a series of experiments in order to

find out if any bacteria, associated with injurious fermentations in cheese, can survive the pasteurizing temperatures employed, and also to see if the tuberculosis germ survives this treatment. The writer considers the latter question very important, as there is considerable tuberculosis amongst swine, as evidenced by the testimony of the veterinary inspectors stationed at various Canadian abattoirs.

The Bacteriological Department of Macdonald College would be very pleased to conduct a series of experiments along any of the lines mentioned, in collaboration with the inspectors of factories.

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[*It is only fair to Mr. Herns to state that, in preparing the copy of his paper for the printers, a couple of verbal errors occurred, which had the effect of misrepresenting his utterance on this point. In the original paper, the characterization, "germ-free whey," was qualified by the phrase, "so far as possible." In the same paragraph, four sentences above, an indistinct type-written character was interpreted as an n, whereas it had been intended for a y. This caused the sentence to commence, "When flavors develop in cheese," instead of "Whey flavors develop in cheese."—Editor.]

Pasteurization of Whey and Feeding Value of Whey Fat.

Decided advantage from the pasteurization of whey, and a serious loss in the feeding value of whey when the fat is skimmed off to be made into whey butter, are the two outstanding points in an address prepared by Prof. H. H. Dean, of Guelph, for the Eastern Live-stock and Poultry Show, held at Ottawa last week. From a synopsis of this address, kindly furnished us by Prof. Dean himself, we quote the following important statements, setting forth, among other facts, the results of an O. A. C. experiment, last season, in comparing the feeding value of skimmed with unskimmed whey.

WHAT PASTEURIZATION IS.

Pasteurization means the heating of a liquid (in this case, whey) to a temperature of 140 degrees F., to 185 degrees F., and afterwards cooling the liquid. The term arises from the name of a noted French scientist, Louis Pasteur, who devised the process known by his name. The object of pasteurization is to free the liquid partially or entirely of germ life. This is accomplished by means of heat, preferably moist heat, such as steam. Time and temperature are important factors in destroying the minute plant-life known as bacteria. A temperature of 150 degrees F., to 160 degrees F., for several hours, such as is the practice when pasteurizing whey, is as effective as a higher temperature for a shorter time. If the whey tanks are kept reasonably clean, and are covered, so as to retain the heat overnight, the patrons ought to be able to obtain practically sterile whey the following morning. This means that the danger of spreading bad flavors to the milk or disease germs to stock on the farm through the medium of the milk cans, where whey is returned in them, is reduced to almost the vanishing point.

COMPOSITION OF WHEY.

By whey, we mean the by-product, or what is left from milk after the rennet has coagulated or



Turning Out the Cows.