The Creamery Water Supply[1]

By C. Jensen[2]

The bacteriological quality of water coming in contact with dairy products is of importance for two main reasons:

1. The water may contain disease-producing germs, that are left in the dairy products.
2. The water may contain organisms that can cause spoilage of dairy products.
3. In addition, guarding the health of the employees makes the control of the water supply important.

Germs in water supplies get into dairy products most readily by direct contact with the products. Unless sterilization is improperly done, the organisms from water sources usually are killed. However, when sterilization is carelessly handled, the live germs that are left may contaminate the products. With metal equipment, unless it is defective, the danger is not so great as with wooden equipment like churns. The organisms may lodge in the corners and crevices as well as in the pores of the wood, rendering complete sterilization almost impossible. Water-borne organisms added to churns through wash water may grow there and may thus become the source of contamination of butter. Direct contamination of butter with waterborne bacteria is brought about when (a) the last remnants of cream are flushed out of the vat with contaminated water and when (b) butter is washed with contaminated water.

The following facts concerning the bacteriology of the creamery water supply should prove helpful in properly understanding and controlling the problem:

1. Water supplies that are safe to drink from the viewpoint of public health are not necessarily free from organisms that can cause butter spoilage.
2. The bacterial population of a water supply may vary from time to time. Therefore, it should be inspected at frequent intervals for presence of organisms capable of causing butter spoilage.
3. Water-borne organisms that cause flavor deterioration in butter usually grow at relatively low temperatures (33° to 50° Fahrenheit). Therefore, they would be expected to grow in butter under ordinary refrigerator conditions.
4. Common defects developed in butter by water-borne bacteria are rancidity and cheesy flavors. Other defects, such as fruity, potato and skunk flavor and odor defects have also been attributed to water-borne bacteria.
5. Water-borne bacteria which cause flavor deterioration of butter may be classified in accordance with their fermentative abilities. For example:

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[2]Dairy Technologist

a. Lipolytic organisms produce within the cells an enzyme system called lipase, which attacks and breaks the fat down chemically with the formation of fatty acids. Rancidity develops in butter.

b. Proteolytic organisms produce the enzyme system protease, which breaks down the proteins into simpler chemical compounds. In butter, cheesiness and putrefactive flavors develop.

c. Oxidase active organisms liberate the enzyme oxidase, which is also involved in the development of flavor deterioration in butter.

d. Some organisms are both lipolytic and proteolytic in character, while others liberate all three types of enzymes.

6. Not all organisms that are lipolytic, proteolytic or oxidase-active are important from the standpoint of causing butter spoilage, but many of them are important.

7. Most water-borne bacteria which can bring about flavor deterioration in butter are sensitive to acids and to salt. Therefore, flavor spoilage is slowed down and in some instances fails to develop when butter cultures and salt are added to the butter.

8. Water-borne bacteria of the types mentioned under 5, a, b, c, and d, above, may become lodged in the pores of the wood in the churns. When this occurs, there is little that can be done to eliminate the organisms from the churn. Wood is excellent insulating material and therefore the usual heat treatment given the churn in the sterilization process after washing is ineffective in destroying the organisms imbedded within the wood.

A study of water supplies in this and other areas has demonstrated that many creamery water supplies are contaminated with organisms that can cause spoilage of butter flavor.

9. Water storage tanks in creameries may be a source of butter spoilage organisms. The water tank should be of the closed type, of satisfactory sanitary construction, and should be drained and cleaned often enough to keep it in satisfactory bacteriological condition. It is presumed that wooden tanks are more often the source of butter spoilage than metal tanks. Organisms falling into a poorly covered tank may cause such contamination, but growth also is involved, particularly when there is an opportunity for organic matter to accumulate in the tank.

Standards suggested for butter-plant water supplies:

1. Water should meet all drinking water standards.

2. Total bacterial count on standard agar for milk analysis containing fat emulsion, with incubation four days at 21° C. (69.8°F.) should not exceed 100 per ml. and preferably should be under 50.

3. If proteolytic and/or lipolytic bacteria are present, the numbers should be relatively low, and actively lipolytic or proteolytic organisms as indicated by the colony types should not exceed five per milliliter.

4. When the water is used to wash butter in experimental churnings, the unsalted butter should keep satisfactorily for at least seven days at 70° Fahrenheit. Experimental churnings are not required in regular examination of water supplies, but are advisable when the quality of the water is still in doubt after the usual bacterial tests or when a supply definitely is suspected of causing deterioration in butter.

5. A water supply should be examined at regular intervals; if it commonly is satisfactory, examinations can be less frequent than if it is rather variable in quality.

Water treatment. Various bactericidal water treatment methods have been suggested. Some of these are:

1. Pasteurization and recooling of water. This treatment is satisfactory from the standpoint of bacterial destruction, but is too costly to be practicable.

2. Filtration and treatment with ozone, ultra-violet light and various chemicals have also been recommended. Of these methods, chlorine treatment has been the most widely used. Its effectiveness, low cost and convenience have been thoroughly established. Various types of chlorine in the treatment of city water supplies ample evidence of the value of the process.

Sediment in water. Some water supplies contain excessive sediment which can be added to butter directly, or which is left in the equipment after washing and then gets into the product when the equipment is used again. This type of water may or may not be satisfactory bacteriologically. Filters of various types are commonly employed to remove sediment in water. When used as the water is flowing from the water lines into the churns, filters are not always satisfactory, due to the speed at which a filter must operate. Filtration and sedimentation of water going into the storage tank has the advantage that it can operate effectively at the speed that the water comes from the well.

JAPANESE LAND AND PEOPLE

Total area—147,000 square miles (94,080,000 acres).
Total population—80,000,000 people.
Density of population—540 per square mile.
Density of population per square mile of cultivated land—5,330 or 8.3+ persons per acre of cultivated land.
Total cultivated land—only 15,000,000 acres.
Plans for land reclamation (1945-50) are to add 3,900,000 acres to cultivated acreage of which only 10% could grow rice.
Actual reclamation under plan up to April 1948: 692,000 acres.
Japanese foresters recommend reforestation of some 7,190,000 acres to help control erosion.
Because of multiple cropping the acres of crop are nearly 40% greater than acres of cultivated land (3 crops in a year are not uncommon in S. W. Japan).
Food production on reclaimed land will depend upon natural fertility of the reclaimed soil, the availability of commercial fertilizers, and farm manures; speed of settlement of reclaimed areas and managerial practices of settlers.

(Data from "Land Use and Conservation in Japan" in **World Crops**, May, 1950.)