Pasteurization

World of Microbiology and Immunology

Pasteurization is a process whereby fluids such as wine and milk are heated for a predetermined time at a temperature that is below the boiling point of the liquid. The treatment kills any **microorganisms** that are in the fluid but does not alter the taste, appearance, or nutritive value of the fluid.

The process of pasteurization is named after the French chemist **Louis Pasteur** (1822–1895), who is regarded as the founder of the study of modern microbiology. Among Pasteur's many accomplishments was the observation that the heating of fluids destroys harmful **bacteria** .

The basis of pasteurization is the application of heat. Many bacteria cannot survive exposure to the range of temperatures used in pasteurization. The energy of the heating process is disruptive to the membrane(s) that enclose the bacteria. As well, the bacterial **enzymes** that are vital for the maintenance of the growth and survival of the bacteria are denatured, or lose their functional shape, when exposed to heat. The disruption of bacteria is usually so complete that recovery of the cells following the end of the heat treatment is impossible.

The pasteurization process is a combination of temperature, time, and the consistency of the product. Thus, the actual conditions of pasteurization can vary depending on the product being treated. For example heating at 145˚F (63˚C) for not less than 30 minutes or at 162˚F (72˚C) for not less than 16 seconds pasteurizes milk. A product with greater consistency, such ice cream or egg nog, is pasteurized by heating at a temperature of at least 156˚F (69˚C) for not less than 30 minutes or at a temperature of at least 176˚F (80˚C) for not less than 25 seconds.

Particularly in commercial settings, such as a milk processing plant, there are two long-standing methods of pasteurization. These are known as the batch method and the continuous method. In the batch method the fluid is held in one container throughout the process. This method of pasteurization tends to be used for products such as ice cream. Milk tends to be pasteurized using the continuous method.

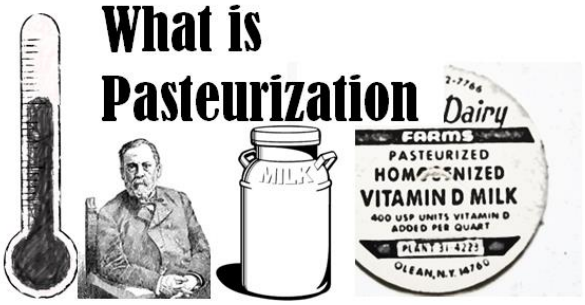
In the continuous method the milk passes by a stack of steel plates that are heated to the desired temperature. The flow rate is such that the milk is maintained at the desired temperature for the specified period of time. The pasteurized milk then flows to another tank.

Several other more recent variations on the process of pasteurization have been developed. The first of these variations is known as flash pasteurization. This process uses a higher temperature than conventional pasteurization, but the temperature is maintained for a shorter time. The product is then rapidly cooled to below 50˚F (10˚C), a temperature at which it can then be stored. The intent of flash pasteurization is to eliminate harmful microorganisms while maintaining the product as close as possible to its natural state. Juices are candidates for this process. In milk, **lactic acid bacteria** can survive. While these bacteria are not a health threat, their subsequent metabolic activity can cause the milk to sour.

Another variation on pasteurization is known as ultra-pasteurization. This is similar to flash pasteurization, except that a higher than normal pressure is applied. The higher pressure greatly increases the temperature that can be achieved, and so decreases the length of time that a product, typically milk, needs to be exposed to the heat. The advantage of ultra-pasteurization is the extended shelf live of the milk that results. The milk, which is essentially sterile, can be stored unopened at room temperature for several weeks without compromising the quality.

In recent years the term cold pasteurization has been used to describe the **sterilization** of solids, such as food, using radiation. The applicability of using the term pasteurization to describe a process that does not employ heat remains a subject of debate among microbiologists.

Pasteurization is effective only until the product is exposed to the air. Then, microorganisms from the air can be carried into the product and growth of microorganisms will occur. The chance of this **contamination** is lessened by storage of milk and milk products at the appropriate storage temperatures after they have been opened. For example, even ultra-pasteurized milk needs to stored in the refrigerator once it is in use.



Reference:

http://www.encyclopedia.com/science-and-technology/biochemistry/biochemistry/pasteurization

Name: _____ Date: _____

Pasteurization Reading Response Questions

Read the accompanying document and answer the following questions.

1. What is the process of pasteurization?

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2. Where did the name pasteurization come from? What area of science does it involve?

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3. What is the basis of pasteurization? What does the process combine and why?

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4. What are the two methods of pasteurization? Describe and give an example of each.

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5. Until when is pasteurization considered effective?

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