master
chemical
corporation
501 West Boundary
PO Box 10001
Perrysburg. OH 43551-0761
Phone: 419-874-7902
Fax: 419-874-0684

August 29, 1990

Dr. Richard Niemeier
Director
DIVISION OF STANDARDS
DEVELOPMENT & TECH. TRANSFER
NIOSH
4676 Columbia Parkway, C-14
Cincinnati, OH 45226

Dear Dr. Niemeier:

On August 17, Master Chemical submitted comments and supplemental information in response to NIOSH's May 18 Federal Register notice (55 Fed. Reg. 20, 637) requesting comments and secondary data relevant to occupational exposure to cutting fluids. The enclosed article, "Coolant Pasteurization - A Promising Answer?", was inadvertently left out of the enclosures provided at that time. We apologize for this oversight and ask that you add this article to our original submissions.

Dr. Niemeier, thank you for your time and consideration. As before, should you have any questions or require clarification on any of the materials provided, please contact me at your earliest convenience.

Sincerely,

Michael J. Gehring
Manager-Health, Safety
and Environmental Affairs

/jmh

Good housekeeping and effective plant management—not magic buttons—are the apparent paths to practical coolant maintenance

Coolant Pasteurization— A Promising Answer?

BY JOE H. WRIGHT

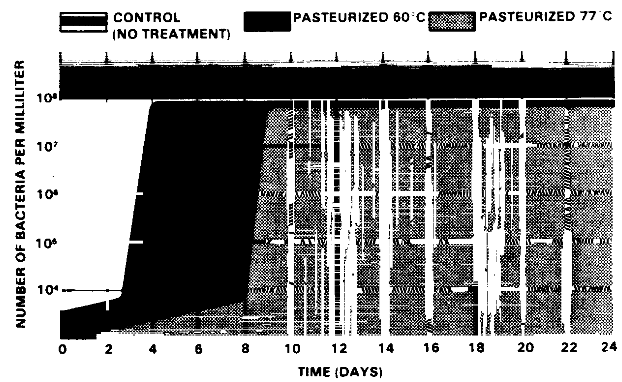
Increasingly tough environmental regulations and the subsequent sky-rocketing costs for disposal of waste metalworking fluids have spawned the introduction of a wide variety of coolant maintenance/recycling systems. Available systems may include equipment for purifying water, coolant mixing and concentration control, tramp oil removal, and filtration. Although a number of factors can contribute to coolant failure, perhaps the most frequent cause of coolant disposal is rancidity resulting from bacterial degradation. As a result, pasteurization techniques have received considerable attention as a means of prolonging coolant life.

Two basic approaches

Pasteurization utilizes heat to reduce the number of bacteria in a coolant solution. Two methods for pasteurizing coolants in either batch or continuous modes have been advocated. One method, holding or slow pasteurization, involves heating the coolant to 61-62°C for 30 minutes. The second method, flash pasteurization, is accomplished by heating the coolant to approximately 71°C for 15 seconds. Both techniques have been used for many years to delay the bacterial decomposition of milk.

Coolant users must carefully consider the major effects and limitations of pasteurization. It is important to remember that pasteurization does not kill all of the bacteria in the coolant solution and, therefore, should not be confused with sterilization. Pasteurization typically reduces the number of bacteria by 97-99%, although wide deviations from these estimates are known to occur. Some types of microorganisms actually multiply at the temperatures used for holding or slow pasteurization and are not appreciably affected by the flash method[1,2]. Many people are surprised to learn that pasteurized milk can contain 30,000 or more bacteria per milliliter.

Coolant Pasteurization



Laboratory test data show the regrowth of bacterial populations in coolant.

The bacteria dilemma

The residual population of bacteria that survives the pasteurization process can cause serious problems. Aerobic bacteria commonly found in coolants can grow with astonishing speed, dividing approximately every 45 minutes[3]. Because pasteurization has no residual inhibitory effect, regrowth of bacteria to very high levels can result in a very short period of time unless additional steps are taken. With milk, this problem is handled by rapid chilling from the pasteurization temperature to approximately 4°C in just a few seconds. This is critical because the optimum temperature for bacterial growth (30-45°C) is only slightly lower than pasteurization temperatures.

Unfortunately, it will never be practical to chill and maintain coolants at temperatures low enough to significantly inhibit regrowth of bacteria. Most pasteurization systems allow the coolant to cool slowly to room temperature, allowing considerable time for rapid bacterial growth. This is one reason that pasteurized coolant often is returned to the coolant sump with *more* bacteria than it contained before pasteurization. Some systems have incorporated heat exchangers to cool the fluid to near ambient temperatures, but this is much too warm to have any significant inhibitory effect on bacterial regrowth.

Other limitations

Pasteurization suffers from several additional limitations which deserve comment. Repeated pasteurization will tend to encourage heat-resistant strains of bacteria. Rapid regrowth of organisms that survive heating occurs because there is less competition from the heat sensitive strains that are killed off. Further, by-products formed by the breakdown of coolant components and dead bacterial cells provide valuable nutrient materials for surviving organisms.

Significant costs may be associated

1. Reddish, G.F., ed. *Antiseptics, Disinfectants, Fungicides, and Chemical and Physical Sterilization.* Philadelphia: Lea and Febiger. 1957.
2. Pelczar, M.J. and Reid, R.D. *Microbiology.* New York: McGraw-Hill. 1958.
3. Rossmoore, H.W. "Microbiological Causes of Cutting Fluid Deterioration." SME Technical Paper MR 74-169, 1975.

Reprinted from MANUFACTURING ENGINEERING November 1984 Issue

with the energy requirements for pasteurization and should be considered. Water, which comprises 90-99% of most coolant solutions, has a very high specific heat. This means that a considerable amount of energy is required to raise the temperature of a coolant to the pasteurization range. Hill and Elsmore[4] found that it would be necessary to pasteurize a coolant solution every 5.75 hours at 70°C for 20 seconds to maintain a significant reduction in the microbial population. Obviously, energy costs and material handling problems would prohibit this practice for either central coolant systems or batch systems supplying coolant to machines with individual sumps.

Good housekeeping, not magic

Perhaps the biggest misconception about pasteurization is that it is a "magic button" that will permit rancid coolant to be recycled. Unfortunately, physical and chemical degradation of coolant by bacteria seriously depletes coolant components and produces troublesome waste by-products such as acids and salts. The result is that a fluid that exhibits noticeable odors or other signs of serious deterioration should be disposed of with other waste materials—*never* recycled. This is true even if mechanical and/or chemical treatment can cosmetically improve the appearance of the fluid to resemble fresh coolant.

The battle for control of coolants is won or lost in the coolant sump. Maintaining clean sumps and minimizing contamination are essential for long-term maintenance and control of coolants. This boils down to good housekeeping: effective machine cleaning practices, proper mixing with pure water, efficient removal of tramp oils, and adequate filtration.

Milk, yes. Coolants, no.

Pasteurization is a fairly effective technique for one-time processing and controlled storage of consumable materials such as milk, but is ineffective and impractical for reprocessing materials like coolants over and over. Acceptable coolant performance is obtained by using high-quality fluids, properly designed equipment for controlling contaminants, and a conscientiously applied program for in-plant management of the overall system.

There are, in the final analysis, no magic buttons. **ME**

Joe H. Wright is affiliated with Master Chemical Corp. (Perrysburg, OH).

4. Hill, E.C. and Elsmore, R. "Pasteurization of Oils and Emulsions," Oxley, T.A. and Barry, S., eds. Proceedings of 5th International Biodeterioration Symposium, Aberdeen, UK. 1983, pp. 462-471.