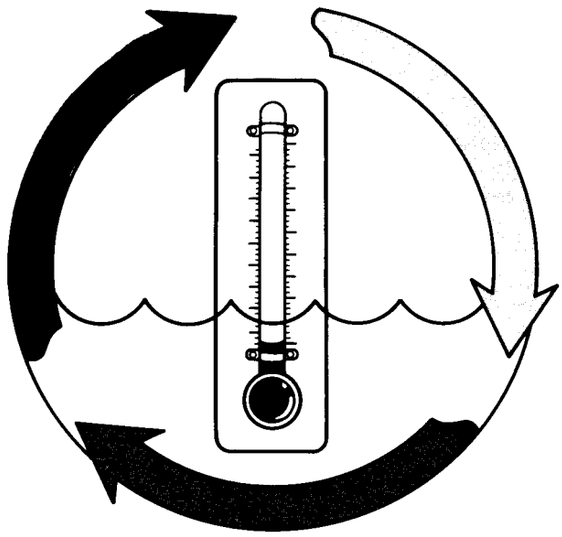
BANK OR DRAIN

Pollution Prevention Pays in Food Processing

Systems for Recycling Water in Poultry Processing

Cut water and sewer costs $85,000 per year by recycling chiller water.



Each operation on the process line in a poultry plant uses water and produces wastewater. The wastewaters typically contain high levels of organic and inorganic wastes that can impose a very large load on local wastewater treatment plants.

The chemical oxygen demand (COD) and total solids (TS) in wastewater streams from poultry plants usually average 2,000 milligrams per liter (mg/l) each. Waste concentrations vary with the source of the wastewater. They can range from a high of 4,000 mg/l for chemical oxygen demand and 3,000 mg/l for total solids in the giblet chiller effluent to a low of 250 mg/l for each of these parameters in the wastewater from the whole bird washer.

Treating and recycling some of the water used in poultry processing can save plant managers a great deal of money by cutting both water and sewer costs, as demonstrated by a recent study.

Study Tests Chiller Water Recycling

The study was conducted to identify effective and economical water treatments, including disinfection, to meet the U.S. Department of Agriculture's standards for the recycling of poultry chiller water. Reconditioned chiller water meeting these criteria was used to chill hot broiler carcasses, and the quality of the chilled carcasses was then evaluated.

USDA recycling regulations require that the treatment processes reduce microorganism concentrations by at least 60 percent, including coliforms, *Escherichia coli,* Salmonella, and the total microorganism count. The regulations also call for the treated water to have a light transmission (T) of at least 60 percent at 500 nanometers (nm). As the quality of reconditioned water improves, less of the reconditioned water is required to replace a gallon of fresh water in the chiller. At the maximum recycle ratio, 1.75 gallons of recycled chiller water is required to replace 1 gallon of fresh water. As the quality of the reconditioned water improves, this ratio decreases, making it possible to use as little as 1.1 gallons of reconditioned water to replace a gallon of fresh water.

Methods and Results

Three methods for treating poultry prechiller water were tested, as shown in Figure 1.

1. Ozonation in a countercurrent-flow contact column;
2. Screening, ozonation, sand filtration, and ozonation;
3. Screening, diatomaceous earth (DE) filtration, and ozonation.

The results of the three treatment methods are shown in Figures 2 through 5. Ozonation alone (treatment 1) significantly improved the quality of the water, which met all requirements for recycling within 10 to 20 minutes of treatment. Twenty minutes of ozonation reduced the chemical oxygen demand by 38 percent and the total solids load by 28 percent.

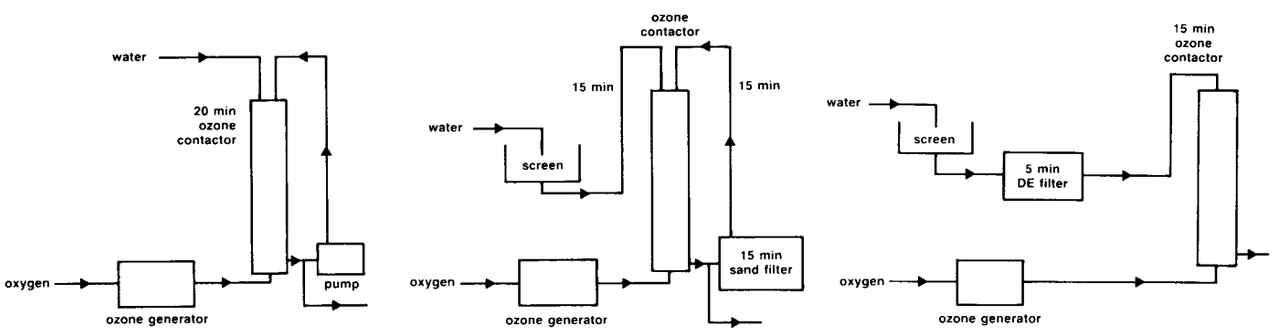
Both the sand and diatomaceous earth filtration treatments (treatments 2 and 3, respectively) yielded water quality that exceeded the federal recycling requirements. The DE treatment yielded the highest quality water in the shortest treatment time, although the sand and DE processes are not directly comparable because of variations in process time.

Five minutes of filtration through diatomaceous earth followed by 15 minutes of ozonation (treatment 3) resulted in an average light transmission of 97 percent. This method also reduced chemical oxygen demand by 87 percent and total solids by 65 percent.

Total microbial loads were reduced by more than 99.9 percent and no coliforms or salmonella were detectable after disinfection. No significant carcass quality differences (color, taste, or shelf life) could be observed between carcasses chilled in tap water and those chilled in recycled chiller water (at a 1.1 -to- 1.0 recycle ratio).

Results of this study show that water can be effectively treated to reduce effluent waste loads at their sources ... and to reduce fresh water demands for poultry chillers.

Figure 1. Three methods tested for treating prechiller water



Treatment Method 1
Ozonation for 20 minutes (20 ppm), flow rate 4.4 liters per minute.

Treatment Method 2.
Screening, preozonation for 15 minutes (33 ppm), rapid sand filtration for 15 minutes, and postozonation for 15 minutes (33 ppm).

Treatment Method 3.
Screening, diatomaceous earth filtration for 5 minutes, and postozonation for 15 minutes (33 ppm).

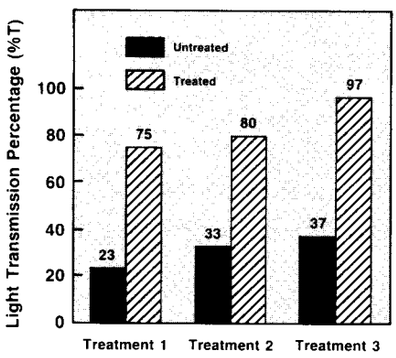


Figure 2. Effect of three treatment methods on light transmission of poultry chiller water.

Potential Economic Impact

Current USDA regulations require that 1/2 gallon of water be used to chill every broiler. If a plant processes 240,000 broilers per day, it uses at least 120,000 gallons of water daily to chill carcasses. If 80 percent of that water could be reconditioned, 96,000 gallons of water could be saved each day. At a cost of $1.90 per thousand gallons for water and sewer charges, this plant could save 24,000,000 gallons of water valued at more than $45,000 per year.

Chemical oxygen demand and total solids loads in the effluent could also be reduced by approximately 200,000 pounds per year (assuming an initial average of 1,000 milligrams per liter of COD and TS, respectively, in the untreated chiller water). If the surcharge on excess chemical oxygen demand is 20 cents per pound, the surcharge savings could be almost $40,000 per year. Thus the potential savings for water, sewer, and surcharges could total $85,000 per year. Other savings might be realized through by-product recovery and reductions in energy costs. The cost of purchasing and operating this type of system is currently being determined.

Other treatment processes that have been identified for further study include filtration, chlorination, ultraviolet disinfection, hydrogen peroxide disinfection, chemical treatments, screening, and clarification. The results of the study described here demonstrate, however, that the recycling of chiller water may offer a way to prevent environmental pollution while helping to conserve valuable water resources.

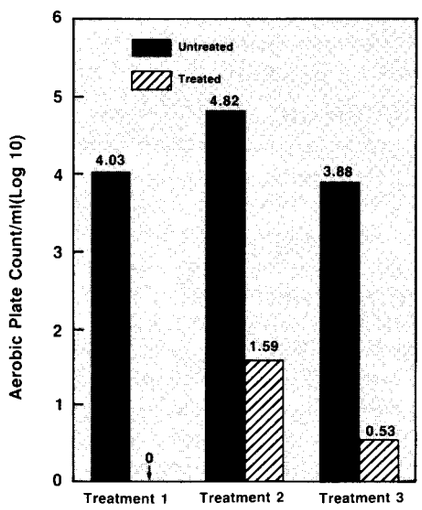


Figure 3. Effect of three treatment methods on aerobic plate count of poultry chiller water.

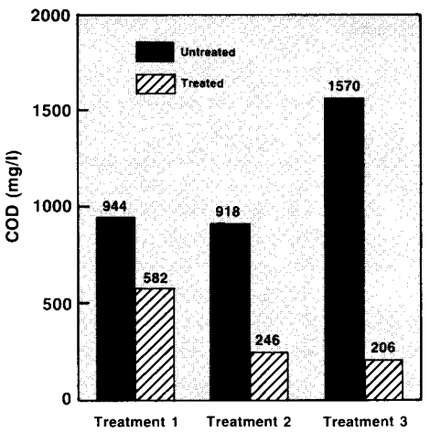


Figure 4. Effect of three treatment methods on chemical oxygen demand (COD) of poultry chiller water.

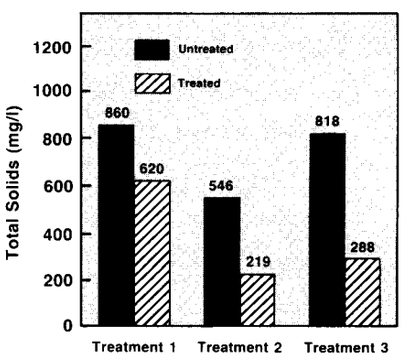


Figure 5. Effect of three treatment methods on total solids in poultry chiller water.

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For further information, see the following Extension publications.

CD-20, *Liquid Assets for Your Poultry Plant*
CD-22, *Poultry Processors: You Can Reduce Waste Load and Cut Sewer Surcharges*
CD-23, *Survey Shows That Poultry Processors Can Save Money by Conserving Water*
CD-24, *Poultry CEO's: You May Have a $60 Million Opportunity*

For copies of these and other publications in this series, see your county Extension agent or write to Food Science Extension, North Carolina State University, Campus Box 7624, Raleigh, North Carolina 27695-7624.

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