Project Number

WRF-04-013

USBR AGREEMENT: # 04-FC-81-1047

Improved Sample Collection and Concentration Method for Multiple Pathogen Detection

Principal Investigator:
Christine Moe, *Emory University*
Vincent Hill, *Centers for Disease Control and Prevention*

Cash Contributors (in addition to the Bureau of Reclamation):
State Water Resources Control Board (CA)

Document Title: Development and Evaluation of Ultrafiltration Methods to Concentrate Pathogens from Reclaimed Water

Objective:
The overall goal was to develop an ultrafiltration method that would reliably provide 50% or greater recovery of the test microorganisms (bacteriophages MS2 and Phi X174, *E. coli*, *C. perfringens* spores and *C. parvum* oocysts) from reclaimed water. This method could be used by utilities to simultaneously concentrate three groups of waterborne pathogens (viruses, bacteria and protozoa) for monitoring microbial quality of reclaimed water.

Highlights
Ultrafiltration, followed by a simple elution technique, provides a reliable method for simultaneous concentration and recovery of bacteria, viruses and parasites from reclaimed water.

- The three ultrafilters we tested provided similar recovery efficiencies.
- Reclaimed water from two very different treatment trains (advanced tertiary vs. constructed wetlands) were tested and the ultrafiltration method provided good microbial recovery from both types of effluent.

Project Findings
The goal of this project was to develop a simple, effective ultrafiltration (UF) procedure to concentrate multiple pathogens from reclaimed water. The experimental data indicated that calf serum blocking of ultrafilters did not result in substantially higher microbial recoveries from reclaimed water, so the project focused on elution to help achieve high recoveries. The results from 10-L and 100-L experiments with reclaimed water from two different facilities indicate that UF, followed by a simple elution technique using 0.01% Tween 80, can result in effective simultaneous recovery of diverse microbes, including vegetative bacteria, spore-forming bacteria, viruses, and parasites, from reclaimed water. The performance goal set for this project (at least 50% recovery for all study microbes at a 95% confidence limit) was largely met, with only a few exceptions. Because of the inherent variability associated with these types of water matrices, sample processing and microbial assays, it is not likely that additional sample processing or different reagents/techniques would result in significantly higher recoveries.

In addition to demonstrating good microbial recovery and associated sensitive detection limits, we also determined that none of the three ultrafilters studied provided significantly better performance. This useful finding suggests that the UF-elution method will work equally well with a variety of ultrafilters and that staff at water reclamation facilities can select the most appropriate ultrafilter based on cost or operational characteristics.