

Interplay Between Disinfectants and Microbial Population in Two Simulated Reclaimed Water Distribution Systems

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Background

- With increased potable water demands, freshwater is becoming scarce.
- Reclaimed water could serve as a viable source of sustainable freshwater water.
- Factors influencing biochemical reactions in distribution systems are surface area to volume, flow velocity, and water age.
- Reclaimed water has much higher levels of organic carbon serving as nutrients for bacterial regrowth.

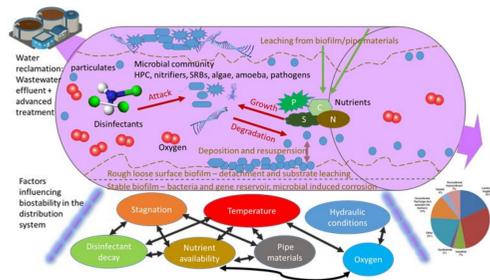


Figure 1. Factors impacting distribution systems

Objective

- Determine the impacts of disinfectant types on water chemistry and microbial population of recycled water in small and large-scale simulated water distribution systems.

Experimental Parameters

Water Quality Analysis

- Disinfectant Decay (HACH)
- Total Cell Count (Sievers 5310C)



Figure 2. Left - HACH machine. Right - Flow Cytometer

Experimental Design

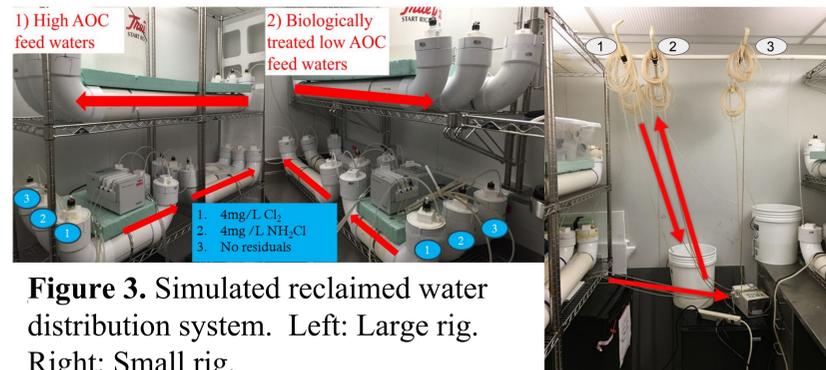


Figure 3. Simulated reclaimed water distribution system. Left: Large rig. Right: Small rig.

Simulated Distribution Systems Setup and Operation

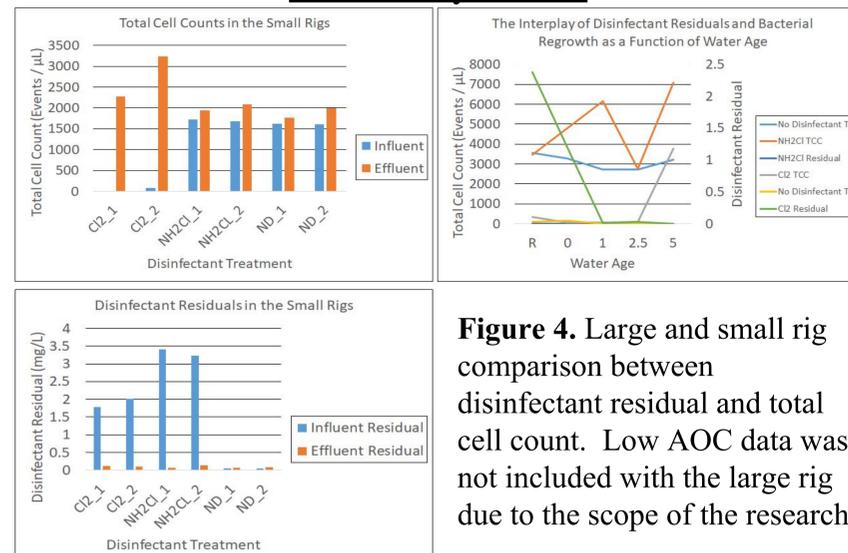
Large-Scale DS

- 6 “Reservoirs” - 8L feed water treated and replenished every 30h based on:
 - Nutrient Level: High assimilable Organic Carbon (AOC)
 - Disinfectant:
 1. Chlorine: 4mg/L free chlorine
 2. Chloramine: 4mg/L total chlorine
 3. No disinfectant: breakpoint chlorinated

Small-Scale DS

- Duplicate setup with 3 “Reservoirs” - 6L feed water treated and replenished every 24h based on:
 - Nutrient Level: High AOC only
 - Disinfectant:
 1. Chlorine: 4mg/L free chlorine
 2. Chloramine: 4mg/L total chlorine
 3. No disinfectant: breakpoint chlorinated

Preliminary Results



Module Implementation

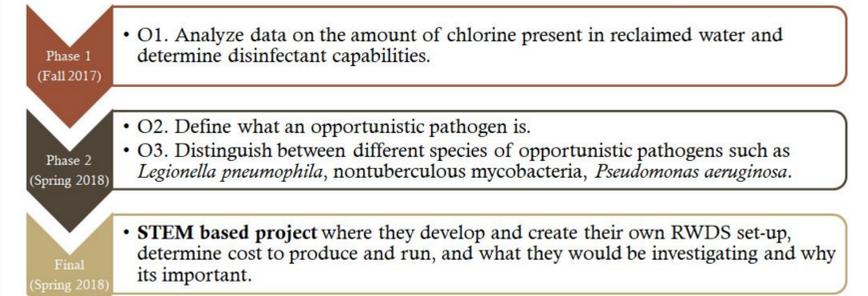


Figure 5. RET phase implementation.

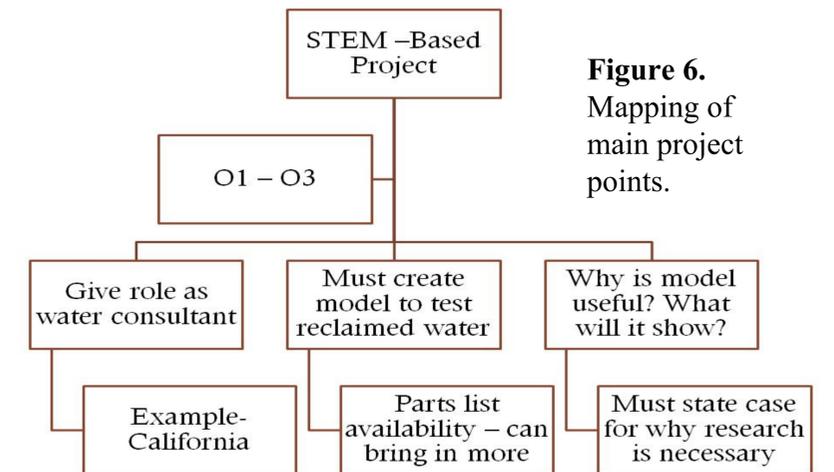


Figure 6. Mapping of main project points.

Future Research

- Use of ozone (O₃) and ultraviolet light (UV), along with the treatments of chloramine and chlorine, to assess levels of bacterial regrowth in simulated distribution systems.
- Increase temperature (30°C) of small-scale simulated distribution system to help determine proper disinfectant levels to limit the amount of bacterial regrowth.

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