



## A SPECIAL SECTION ON WATER RE-USE AND RECIRCULATION

# NUTS & BOLTS

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## Safe And Simple Water Disinfection

**D**isinfection of water in the context of aquaculture is a broad subject for discussion. Some of the applications are: treatment of influent and effluent water, and water in recirculation. The range of equipment is also varied, and the choice depends on capital and operating budgets, ambient water quality, water quantity and the disinfection goals. Nonetheless, there is one method of treatment that is versatile and effective and will work in almost any situation — solids filtration followed by ultraviolet irradiation.

With governments changing effluent discharge requirements, viruses, bacteria, fungi and parasites that might threaten to destroy entire stocks of fish in hatcheries, and the need for bio-security creeping to the top of hatchery managers' priority, we need to find safe and simple water disinfection methods. The

most applications. The amount of solids removed can be set by the mesh size on the filter screen, which in turn is dictated by the size and type of particle generated in the system, and the total suspended solids (TSS). We like to see a maximum particle size of no more than 30µ going into the UV chamber. More importantly, maximum TSS loads are set at 5-10 mg/l for closed vessel UV systems; open channel systems can accept 30 mg/l due to the different configuration of the lamps in the irradiation chamber.

Pressurized sand filters also work well as a UV pre-filter. The main advantage of such systems is their ability to filter and remove very small particles such as algae and silt.

An extensive study was conducted last year by the State of Utah into how best to ensure that Whirling Disease did not enter their hatcheries via the influent water supply. Several State hatcheries are already shut down because of this, and prevention of infection is of extreme importance. The study examined two closely monitored influent treatment systems both incorporating solids filtration followed by UV. One chosen pilot system used pressurized media filtration in combination with UV disinfection using medium pressure UV lamps. The other was micro-screen filtration using a drum filter followed by UV generated by low pressure, high output lamps.

Once the pilot test had concluded and all the data were analyzed a review panel examined the results. The PRAqua Rotofilter™ followed by the Trojan Technologies closed vessel UV system was chosen for full-scale construction at the Mammoth Creek Hatchery, Utah. Mammoth Creek had previously been shut down due to the presence of Whirling Disease in the supply water from their spring, but will be recommissioned once the new influent water treatment system is in place.

This combination of equipment is effective with almost any of the known waterborne fish pathogens. In the State of Utah's investigation, both treatment systems succeeded in preventing the parasite from entering the hatchery, but there were advantages and disadvantages of each that had to be considered.

### Why choose micro-screen filtration?

There were certain criteria that were examined which lead to the decision:

The chosen pilot equipment has a reputation for ease of operation, and requires very little maintenance and attention during continual operation. The design is simple and doesn't involve any complicated valving or piping. The backwashing system requires minimal water for backwash flow, and the drum filter continues to filter even during backwash, preventing the flow from being interrupted. Unlike media filters that require backwashing, water supply flow to the culture tanks is continuous.

### No untreated water shall pass the disinfection system!

One of the special requirements of the pilot- and full-scale projects was that no untreated water was permitted to pass the disinfection system. This is essential if the supply water is known to contain pathogens. A simple solenoid valve can stop flow during power outages, but a more sophisticated way of preventing passage of contaminated water is by incorporating an uninterruptible power supply (UPS) in to the UV control system, and interlocking it with actuated valving. By bridging the transfer




Fiberglass enclosed PRAqua Rotofilter micro-screen drum filter (below) Trojan UVLogic ultraviolet irradiation system.

safest method of disinfection is UV: there are no dangerous byproducts, no toxic residues to accumulate in the fish, no residuals in the water that could kill fish, no chemicals, and no associated human health issues.

The cleaner the water the better the UV will work or, put another way, the fewer the number of UV lamps will be required to penetrate the water and inactivate the organisms. Micro-screen drum filters work extremely well for solids removal upstream of UV in



### Pilot System




**> Inactivation**

- Ultraviolet disinfection system irradiates the organism

#### Two-Stage Treatment

**> Pre-filtration**

- Rotary drum filter used to remove solids & improve water transmissivity.



There are disadvantages associated with any pressurized system. One of the biggest being the need for high-pressure pumps, which are expensive, have high operating and maintenance costs, and pose a risk of break-down. A major advantage of the micro-screen drum filter over the pressurized filter prior to UV irradiation is its low head requirement, which reduces costs significantly. Drum filters require about 10-12 inches (25-30cm) of head compared to 50-70 feet (15-21m) for the pressurized systems, so a pump station is not required.

Drum filters require only a small footprint, which reduces the building requirements and hence, the overall cost of the project.

**Capital and Operating Costs:** The rotary drum filter and UV disinfection using low pressure high output lamps were hands down the least expensive method of disinfecting, both in capital and operating costs.

time between grid power-outages and back-up electrical generation, the UPS eliminates delays between lamp shut-down and start-up, so flow interruption is rare. If the lamps are off, or if the intensity is insufficient to provide the designed dosage, the actuated valve will close and an alarm is sounded.

Although the State of Utah targeted whirling disease, micro-screen drum filtration followed by UV is a very effective method of inactivating almost all the fish related pathogens including fungi, bacteria, parasites and viruses. The UV dosage can be adjusted depending on which organism is being targeted. When designed properly this simple solids filtration and UV disinfection system will allow hatchery managers and staff to sleep a little better.

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