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Final Report

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To: David Webb
Doulton Water Filters

From: Charles R. Sterling
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RE: Testing for Removal of Doulton Single Filter Housing with Ultracarb Candle for Removal of Cryptosporidium Oocysts

Procedure:

The 8 1/2" Ultracarb ceramic candle was inserted into the single filter unit housing as instructed. The unit was then connected to a 5 gallon pressure vessel. An initial pressure test was conducted by closing the terminal outlet, filling the pressure tank with 10 liters of dH_2O and pressurizing the system with 30 PSI of nitrogen gas. After checking for leaks, the 10 liters were allowed to flow through the filter.

After depressurizing the system, the pressure vessel was filled with 10 liters of dH_2O and seeded with 10^5 formalized oocysts (10^7/L). The water was stirred to ensure a homogenous distribution of oocysts. The system was again pressurized to 30 PSI and the water allowed to flow through the filter. Two liters were allowed to pass through the filter. Liter #2 was saved for processing. The outlet at the terminal end was shut off leaving the system under pressure. After 16 hours, liters 3-5 were passed through the filter saving liter #5 for processing. After leaving the system under pressure for 8 more hours, liters 6-10 were passed through with liter #9 collected.

Each one liter sample was filtered through a 1um pore size Nucleopore polycarbonate membrane filter. The sample flask was washed with dH_2O + 0.1% Tween 80 (washing solution) to remove any residual material. The rinse was also filtered. Each filter was carefully removed and placed in a 50 ml conical tube (tube A). The filter was washed and vortexed 3 times. After each wash the contents were placed into another 50 ml conical tube (tube B). The volume in tube B (45-50 ml) was concentrated by centrifugation (3000 rpm in a Sorvall T-6000B centrifuge for 10 minutes). The liquid portion was aspirated down to 1 ml, then mixed to resuspend the pellet. This pellet is a 1:1000 concentration of the original liter and represents a theoretical oocyst count (assuming no oocysts were trapped by the filter) of 10^{10} oocysts/ml. Samples of the suspension were then placed in a

hemacytometer and counts were made in triplicate at 400X mag. giving a particle concentration in oocysts per ml. This figure was then multiplied by the final volume of the suspension to give the total number of oocysts recovered. This number was divided by the seeded concentration value times 100 to calculate the percentage of oocyst removal.

Water quality challenge conditions:

Tap water

NTU = 0.2
pH = 7.8
TDS = 630mg/L
TOC = 3.4mg/L

Results:

Table 1: Removal of Cryptosporidium oocysts using the Doulton Single Housing Unit with Ultracarb Candle

Sample	# Oocysts Recovered	% Removal
1) Liter #2	none	100
2) Liter #5	none	100
3) Liter #9	none	100

No oocysts were found in any of the samples tested (100% removal). This represents a greater than 6 log reduction of oocysts.

Liter #2 did contained a fairly large amount of black and white particulate matter, enough to produce a solid black pellet (pellet mass was approximately 5mm x 1.5mm) when the liter was concentrated. The amount of particulate matter decreased only slightly in liter #5 and was a little less evident in liter #9.

Discussion:

This filter unit performed very well and far exceeded the EPA recommended 3 log reduction (99.9% removal) of parasitic cysts.

The black and white particulate matter found in each sample was probably carbon and ceramic which had been washed from the filter. This occurred even after the candle had been flushed with 10 liters of water prior to the start of the testing phase. It would be recommended, therefore, that more water flushing (more than 19 liters) be done on new units to remove this loose particulate matter prior to use.

There were no detectible external leaks.