

PULSAR INTERCEPTOR™ AND DISRUPTOR®

using Ahlstrom Disruptor® Nonwoven Filter Media

PATHOGEN REDUCTION



USWater
systems.com



What is Ahlstrom Disruptor[®] Technology?

**Welcome to this introduction
to Ahlstrom Disruptor[®]-**
a unique and broad spectrum
water filtration technology!

Ahlstrom Disruptor[®] - Pathogen reduction

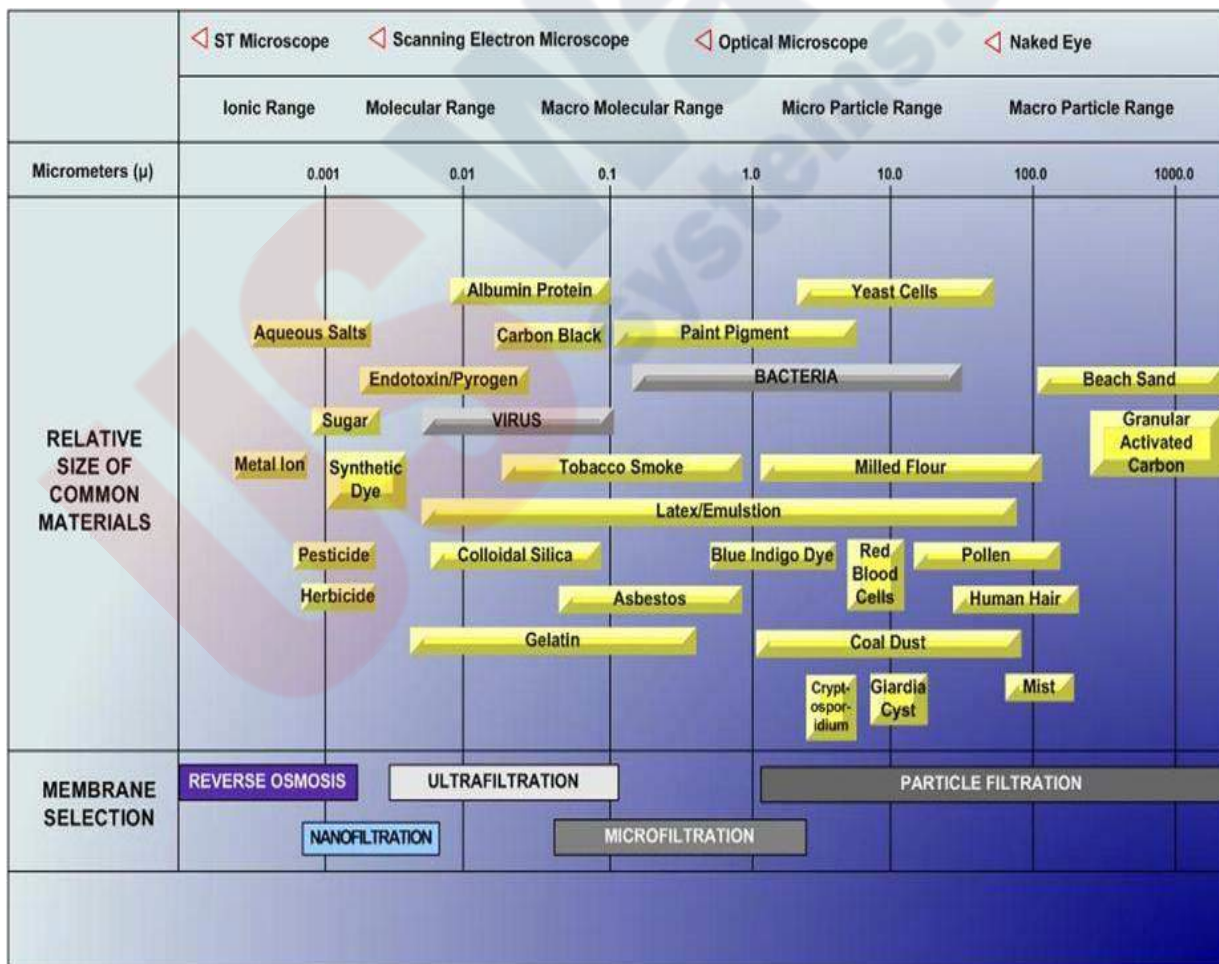


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Filtration of biological contaminants

Reduction of virus typically requires the use of ultra-filtration or reverse osmosis membranes.

Ahlstrom Disruptor® technology reduces virus, bacteria, and endotoxin with high flow and low pressure drop as compared to polymeric membranes.



http://www.enprom.eu/index_files/image977.jpg

Polymetric membranes

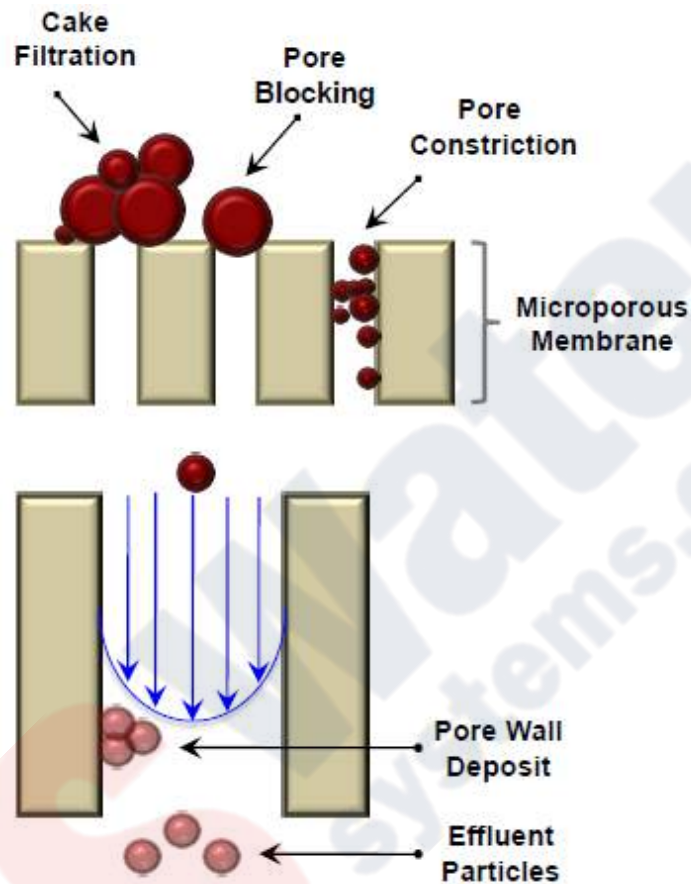


Image - Dr. J. Brant University of Wyoming

- Are mechanical filters
- Work exclusively through size exclusion
- Require high pressure
- Have low flow rates
- Have high energy costs
- Are subject to rapid fouling

Ahlstrom Disruptor[®] Technology



Improves upon restrictive properties of UF membranes

- **High efficiency** reduction
- Electro-absorptive reduction of virus
- **Electro-absorptive and mechanical** reduction of bacteria and endotoxin
- Mechanical **removal** of cysts
- **Higher** flow rates and **lower pressure** drop than polymeric membranes with similar removal efficiency

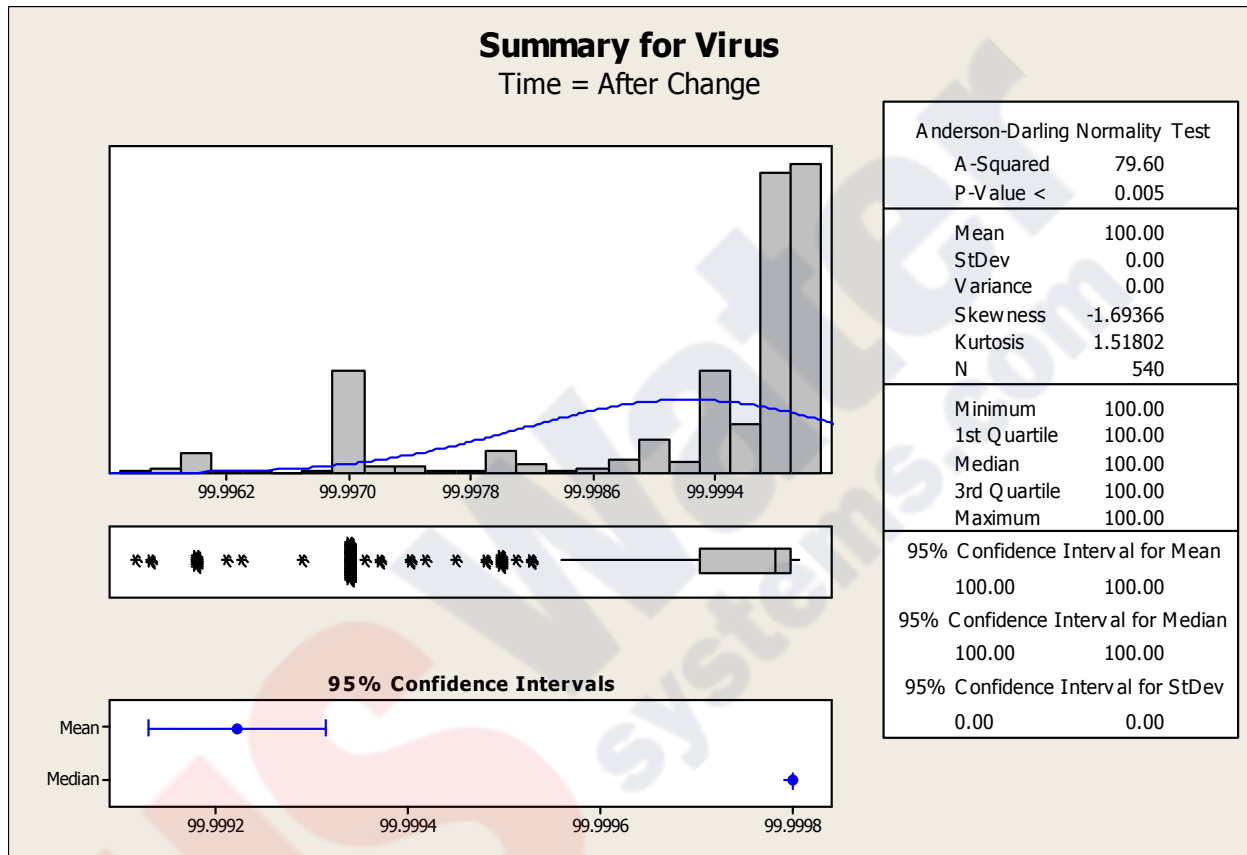
Ahlstrom Disruptor® pathogen reduction efficiency



We have made significant process improvements that have **increased the pathogen reduction efficiency** of all Ahlstrom Disruptor® products. We have also validated a biologic test method that more accurately measure the pathogen reduction efficiency.

- Manufacturing techniques have been refined to significantly increase the charge field generated by the technology
- Pathogen test methods have been developed in cooperation with a certified water testing lab to be applicable for electro-absorptive media
- Result is that Ahlstrom Disruptor® can effectively reduce viruses by 99.99%, bacteria by 99.9999% and cysts 99.95% or greater

Virus reduction curve of all Ahlstrom Disruptor[®] grades



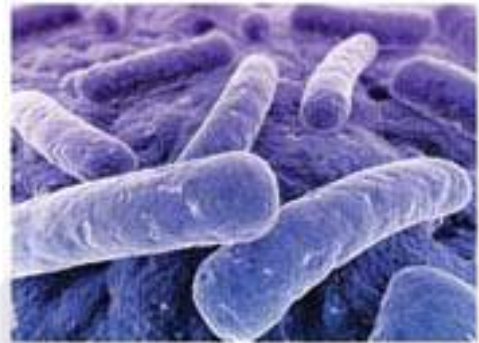
- Mean = 99.999%
- Median = 99.9998%
- Standard Deviation = 0.001

Unlike polymeric membranes, Ahlstrom Disruptor[®] is a nonwoven filter media having a pore size distribution.

Biological testing

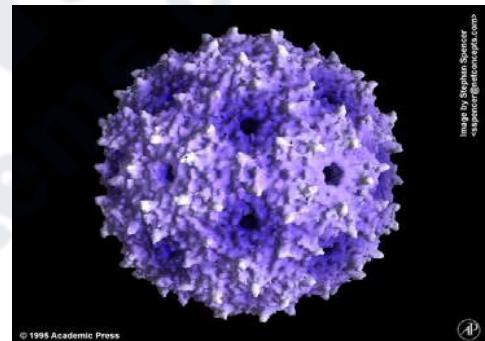
Bacteria

- Raoultella terrigena
- Influent concentration of 10^5 or 10^6 per ml
- Required reduction 99.9999% or 6 log



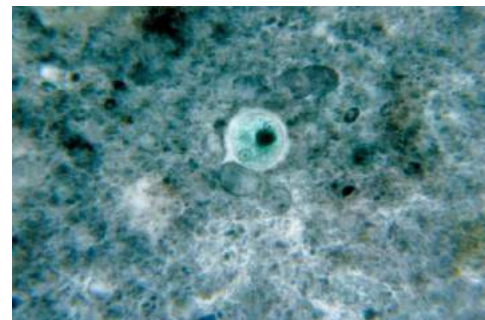
Virus

- MS2 Bacteriophage
- Influent concentration of 10^5 or 10^6 per ml
- Required reduction 99.99% or 4 log



Cyst

- 3 micron bead surrogate
- Influent concentration of 10^5 or 10^6 ml
- Required reduction 99.95% or 3.5 log

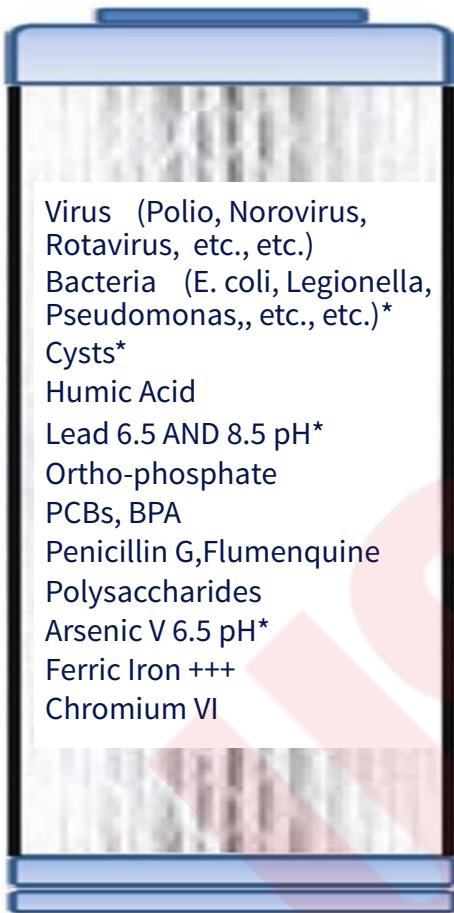


Estimated biological capacity per square foot of filter media

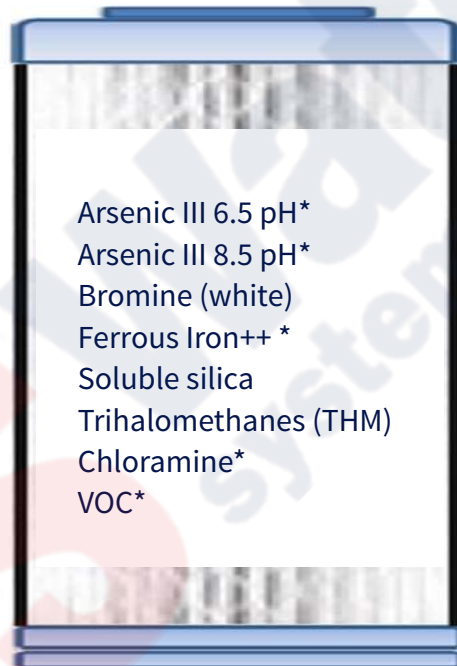
Biological Concentration		Biological Capacity
Per ml	Per liter	Volume per ft ² (Liters)
1000	1.0 x 10 ⁶	500000
10000	1.0 x 10 ⁷	50000
100000	1.0 x 10 ⁸	5000
1000000	1.0 x 10 ⁹	500

Biological concentration of 1000000/ml would be consistent with highly polluted river water or raw sewage.

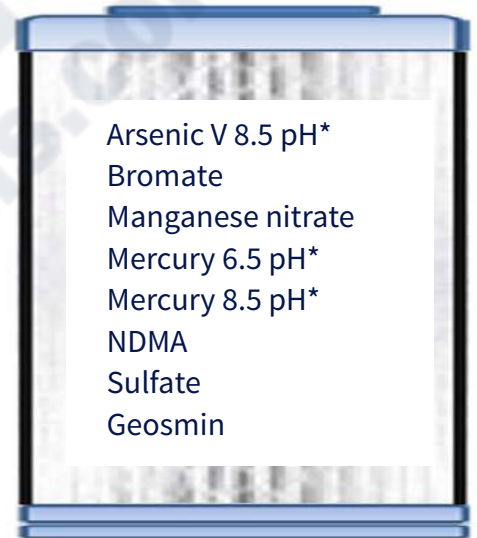
Summary of Ahlstrom Disruptor[®] removal capabilities



Significant Removal



Some Removal



Minimal to No Removal

*All marked with *: NSF concentration standard followed*

Meets NSF/ANSI Standards 42 and 61

Water Quality Association Gold Seal



Certificate of Compliance

to certify that
Ahlstrom Filtration, LLC
Ahlstrom Filtration, LLC

Has successfully met the applicable requirements of Standard(s):

Standard:	NSF/ANSI 42: Drinking Water Treatment Units, Aesthetic Effects*
Model(s):	5281, 5282, 5283, 5284, 5287, 5288, 5289, 5290
Standard:	NSF/ANSI-61: Drinking Water System Components - Health Effects
Model(s):	5281, 5282, 5283, 5284, 5287, 5288, 5289, 5290



Issue Date: 01/05/2012

Expiration Date: 12/31/2012

A handwritten signature in black ink, appearing to read "John L. ...".

Signature

This Certificate, or any part thereof, may not be used in a misleading manner and validation of its use is contingent upon the Official WQA web-listing.

Fact Sheet from USAPHC



Alumina Nanofiber Filters in Drinking Water Treatment

FACT SHEET 31-015-0211

What are Alumina Nanofibers?

Alumina nanofibers are very small fibers made from aluminum metal or aluminum containing materials. The fibers range in size from 1-100 (nm) in diameter and can be up to several micrometers in length (reference 1). To give perspective, a sheet of paper is about 100,000 nanometers thick. Alumina nanofibers consist of either aluminum oxide (Al_2O_3) or aluminum hydroxide, such as aluminum oxide hydroxide ($AlOOH$), commonly referred to as boehmite, or aluminum trihydroxide [$Al(OH)_3$], commonly referred to as gibbsite, bayerite or nordstrandite (reference 1).

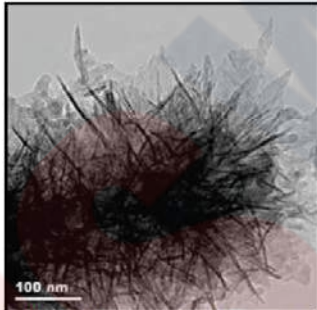


Figure 1. $AlOOH$ nanofibers (reference 2).

How can Alumina Nanofibers be used for Treating Drinking Water?

Alumina nanofibers have been incorporated into cartridge filters to increase their ability to remove contaminants. The nanofibers have two particular attributes that make them attractive for use in drinking water filters – the proven capability of alumina to adsorb various contaminants in conjunction with the extremely high surface areas of

the nanofibers allow for potential adsorption of significant amounts of contaminants (references 3, 4). This could extend the life of a filter. The electrostatic attraction allows for the potential adsorption (and thus removal) of viruses which are on the submicron and nanoscale. This would improve a filter's microbial pathogen removal capabilities. Research has shown the potential for Al_2O_3 alumina materials and Al_2O_3 alumina nanofibers to remove or reduce virus concentrations in water (references 5-8).

Currently, one company uses alumina nanofibers for drinking water treatment. The nanofibers are aluminum oxide hydroxide, or boehmite ($AlOOH$). The boehmite nanofibers are about 2 nm in diameter and 200-300 nm in length (Fig. 1). The nanofibers are incorporated onto submicron glass fibers which are then bonded onto a pleated filter medium (references 9, 10). The resulting filter has pore sizes of about 2-3 micrometers. However, due to the electrostatic attraction much smaller particles (e.g., viruses) could potentially be removed through adsorption, effectively making the filter function as though it had much smaller, submicron pore sizes similar to a membrane filtration technology such as ultrafiltration. With an actual pore size of about 2-3 micrometers, the filter could allow a high rate of flow with a low pressure drop compared to membrane technologies – an advantage over traditional membrane technologies. Some research shows Al_2O_3 alumina nanofiber filters of similar design to this company's filters performing effectively at high flow rates (references 8, 11).

Do Alumina Nanofibers used for Treating Drinking Water Pose any Human Health or Environmental Health Risks?

Alumina nanofibers used in drinking water treatment could be shed from a filter and be ingested or enter the environment.

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