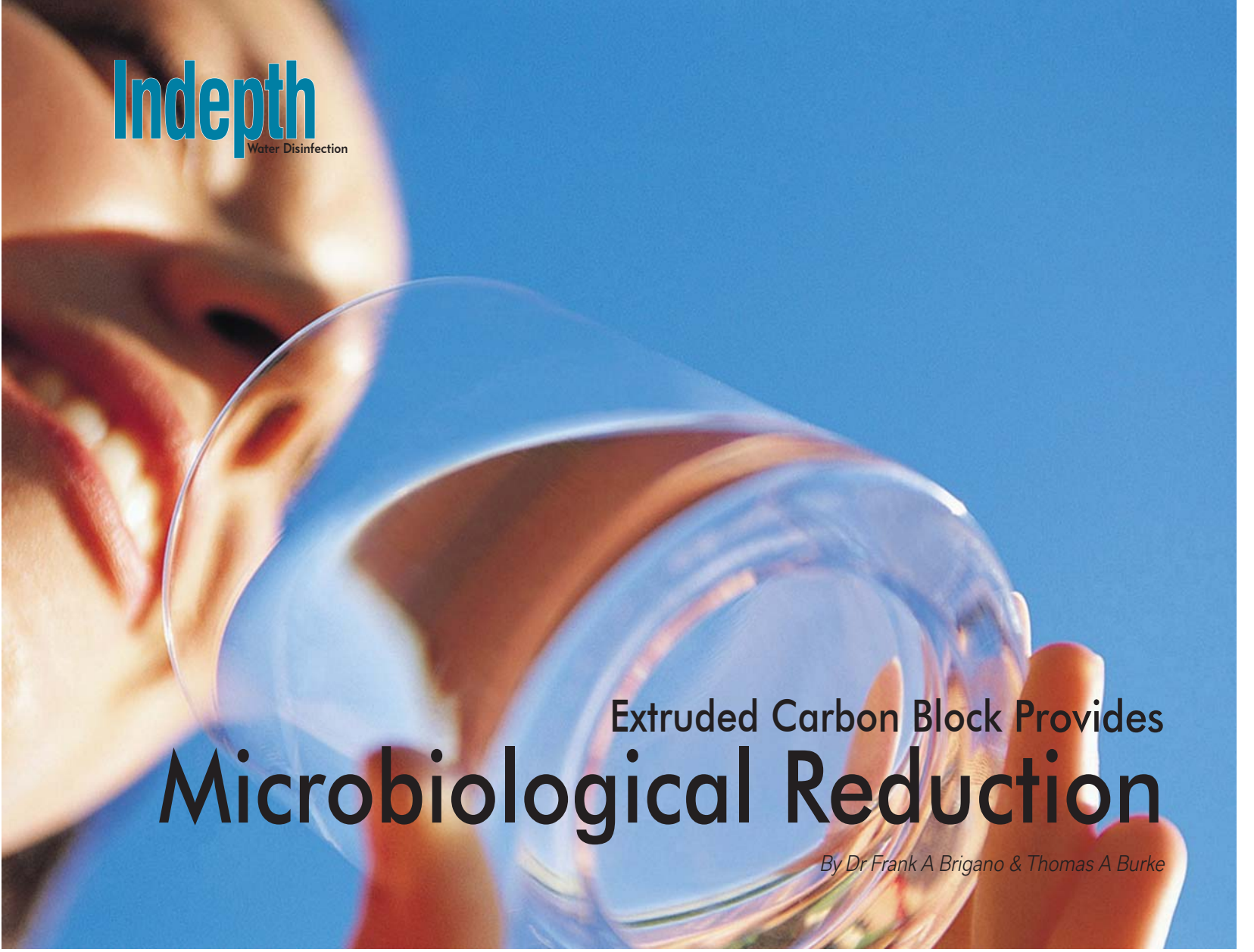

Extruded Carbon Block Provides

Microbiological Reduction

By Dr Frank A Brigano & Thomas A Burke

Reverse osmosis and ultra-violet light are two examples of technologies that have been used to disinfect drinking water and help reduce the incidence of waterborne disease. Often these technologies are costly and out of reach for most consumers. Other technologies such as chlorination, while extremely effective in helping to provide clean drinking water supplies, may not prevent microbes such as Cryptosporidium from passing through to the consumer, and may leave disinfection by-products in the water.

KX Technologies LLC has developed an extruded carbon block filter that provides microbiological reduction. Consumers looking to provide a cost effective filtration solution for their family's drinking water now have the option of using a carbon filter manufactured and certified to stringent standards.

While developing the technology, the focus was on the 1988 US Environmental Protection Agency (EPA) microbial purifier guide protocol, which has been incorporated into NSF Protocol P231, to certify microbial reduction drinking water products. This protocol calls for the reduction of 6 logs (i.e., 99.9999%) of bacteria, 4 logs (i.e., 99.99%) of viruses and 3 logs (i.e., 99.9%) of cysts. Microbial cyst reduction certification is incorporated within NSF/ANSI Standard 53, "Drinking water treatment units - Health effects." However, this microbiological reduction technology exceeds the US EPA Guide protocol for bacteria reduction at greater than 6 logs and virus reduction at greater than 4 logs, and it meets or exceeds the cyst reduction requirement of NSF/ANSI Standard 53. Internal testing results for this technology verify the results across several types of bacterium. ☞ **www.kxtech.com**

Extruded carbon block filters with microbiological reduction are ideally suited for point-of-use applications.

Micro Organisms	ATCC#	Log Reduction Value
Escherichia Coli	11229	9.32
MS-2 Bacteriophage	15597-B1	5.88
PRD-1 Bacteriophage	1985-B1	6.76
Salmonella Species	19585	9.46
Brevundimonas Diminuta	13184	8.94
Raoultellaterrigena (formerly Klebsiella Terrigena)	33629	8.32
Pseudomonas Aeruginosa	15692	10.60
Pseudomonas Aeruginosa	14502	5.67

This technology features an automatic natural clogging shutdown feature that reduces flow through the medium due to the associated presence of organic materials in the water. This failsafe mechanism reduces the chance of product use beyond its intended life and thus safeguards the consumer.

Microbiological Interception Process

The filter is a microporous activated extruded carbon block with a mean flow path of one micron or less, sufficient to intercept Cryptosporidium oocysts, viruses, and bacteria. The filter medium contains a microbiological high molecular weight polycationic interception agent, a cationic silver halide complex and a pH-altering material. The block's capacity to intercept microbiological organisms is greatly enhanced by treating the microporous activated carbon with a long-chain cationic polymer. The cationic polymers will electrostatically attract negatively charged microbes, which approach the positive surface where the microbe will irreversibly stick. In our case, the cationic polymers are partially converted to the bromide form and firmly adsorbed onto the carbon (See Figure 1). The converted bromide cationic polymers have a molecular weight averaging 400,000 daltons that consist of approximately 2,500 monomer units. These individual monomer units of polymeric cationic molecules will be electrostatically repulsed from adjacent intermolecular polymeric units and forced into a greatly extended confirmation, especially when placed in contact with water.

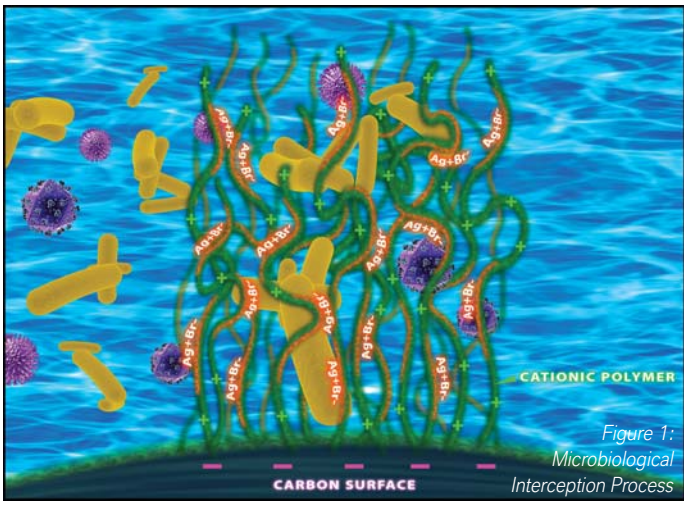

Figure 1: Microbiological Interception Process

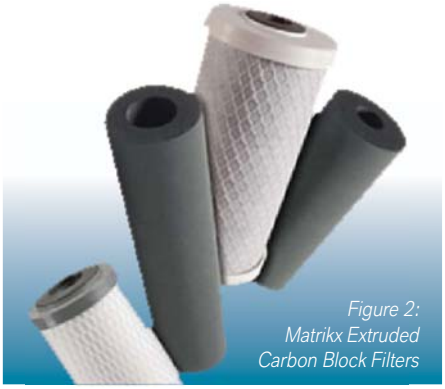
Figure 2: Matrikx Extruded Carbon Block Filters

Because each monomer has a length of approximately 20 angstroms, a molecular strain of converted bromide cationic polymer could theoretically extend to several microns beyond its fixed powder carbon base. All of the open pores of carbon block will therefore be effectively filled with an electrostatic net. With this, the microbiological interception is complete. The cationic silver halide complex is added to filter media to prevent the growth of intercepted bacteria on the filter medium. The silver ion acts as a biostat to prevent bacterial growth on the filter medium. A pH-altering material is added to the block matrix to ensure that microbiological materials present in an influent stream will always have negative surface charge. Pathogens have phosphoric or carboxylic functional groups on their surfaces. At high pH levels, these functional groups will be above their isoelectric point. The isoelectric point is the pH where a given pathogen will have a net neutral charge. In a basic environment, the pathogen will have a net negative charge. As long as the pathogen maintains a negative charge, it will be attracted to the cationic polymeric surface and will adhere irreversibly to that surface. Flow through this filter system will decrease and eventually clog when exposed to an excess of polyanionic acids. These natural and manmade polyanionic acids appear in environment as micro organisms and humic acids. Their presence will shut down the filter when the filter is exposed to contaminated water.

Rigorous Testing and Certification

Product qualification and certification is required for microbiological reduction products. The product must meet the performance and material safety requirements of NSF/ANSI standards 42 and 53. Microbial cyst reduction claims can be certified using NSF/ANSI Standard 53. Bacterial, cyst and virus reduction for the microbiological interception product is verified using proprietary protocols adapted from the EPA purifier guide protocol.

Point of Use Microbiological Reduction

These extruded carbon block filters with microbiological reduction are ideally suited for point-of-use applications. Given the inherent advantages of extruded carbon block including no channelling, no fluidising, less fines, and virtually unlimited product size and orientation options, manufacturers can easily develop several cost-effective consumer-oriented filtration products, ensuring clean, healthy drinking water.

About the Author

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We look forward to your feedback on this article. To know more about the author, you can write to us at content@eawater.com