Treating Bacteria *in Drinking Water*

There are hundreds and thousands of bacteria forms that we encounter in our daily lives. Most are harmless, some are beneficial and yet others can be fatal. Beginning in the 1920s, the major bacteria concern was bacillus, *which causes typhoid fever, and more recently,* E.coli *and* cryptosporidium *have gained notoriety.*

By Kimberly Walsh

Activated carbon proves effective against microorganisms

Both of these bacteria come from human and animal waste and can be fatal to people with compromised immune systems, as well as children and seniors. Both of these bacteria have been detected in our drinking water supplies, such as the 1993 Milwaukee, Wis., case where *cryptosporidium* was found in the drinking water supply and caused illness to roughly 400,000 people, and was estimated to be responsible for roughly 100 deaths.

Although municipal water supplies take great care in treating water, extra precautions are an important way to guard against harmful bacteria and other potentially harmful chemicals in the water. This is why the point-of-use (POU) and point-of-entry (POE) water filter market has grown to a multimillion-dollar industry.

Activated carbon, due to its tremendous surface area, is one of the most popular media used in these filters and treats a wide range of organics found in the water by a surface adsorption phenomenon called Van Der Waal forces. It is a double-edged sword, however, because this large surface area also can become a breeding ground for bacteria growth.

The Silver Lining

One traditional method used to prohibit bacteria growth in POU and POE filters is by impregnating activated carbon surface area with silver ions. Silver has been used since early civilization as a way to stop bacterial growth. Silver can be impregnated into the pores of activated carbon in varying doses such as 0.01% to 1% by weight. Although this is a relatively small amount of silver, there are some health concerns about its ability to leach into the treated water and questions remain: How much silver is too much where leaching is a concern? How much is not enough where long-term effectiveness is compromised?

There is heightened concern more recently with the introduction of nanosilver products that are making their way into the impregnation of activated carbon for bacteriostatic properties. Recent scientific studies have shown that nanosilver is toxic and can cause damage in new ways.

In May 2008, the International Center for Technology Assessment, along with a coalition of consumer, health and environmental groups, filed a petition with the U.S. Environmental Protection Agency (EPA) to stop the sale of many consumer products using nanosilver by utilizing its pesticide regulation authority.

There is a lot of talk on the effectiveness of traditional silver impregnated carbon in treating bacteria growth. In a study performed by North Dakota State University in February 1992, it was discovered that after one month of use, the silver impregnated activated carbon filter had practically diminished its effects on prohibiting bacterial growth. All silver ion impregnated filter media used in POU/POE filters must be tested and registered with the EPA, not for performance but for potential health hazards due to leaching. This is true for any agent that claims to be bacteriostatic.

Figure 1. One-Hour Dynamic Shake Flask Test (*E.Coli*)

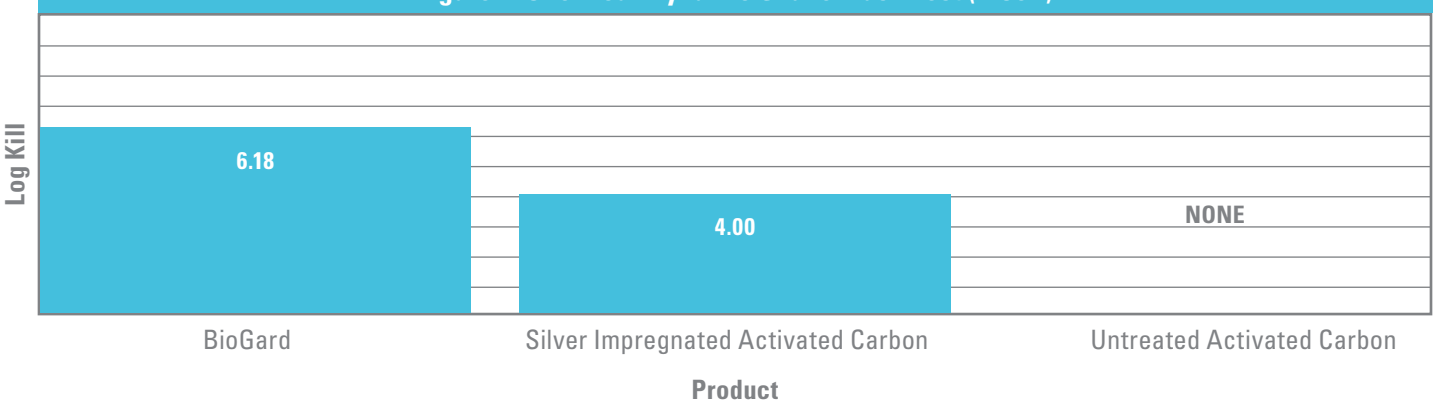

Figure 2. Total Plate Count (CFU/mL)

Sample Point	Influent	Effluent	Efficiency
Startup	250,000	320	99.99%
Day 1	360,000	530	99.99%
Day 8	300,000	8,100	99.97%
Day 15	340,000	4,500	99.97%
Day 22	230,000	2,800	99.98%

With the concerns of how well silver impregnated carbons work, coupled with the rise in the cost of silver and potential health concerns, new antimicrobial compounds are emerging as a safer, more effective and less expensive alternative to silver. The Spartan BioGard Series bacteriostatic activated carbons use a patented antimicrobial agent impregnated onto the activated carbon that protects against a wide range of microorganisms, fungi, yeasts and mold by forming a spike surface that works by rupturing the outer microbe cell membrane, whereas silver ions react with the microbe cells and are depleted with continuous use. By damaging the membrane of the microbe, it prevents the adaptation, mutation and resistance of the bacteria permanently and continuously.

Destroying Microorganisms

One of the standard methods used to determine the capacity of an antimicrobial agent to destroy microorganisms is by log kill. A log kill of 5 means that 100,000 microorganisms were destroyed on contact with the treated surface. A log kill greater than 5 is usually interpreted as an exceptionally active antimicrobial. In a recent independent laboratory analysis using *E.coli* as a test sample, the Spartan BioGard Series had a log kill of 6.18, more than 100 times more effective than silver impregnated carbon, which had a log kill of 4 (see Figure 1).

In addition, a bacteriostatic test using a carbon block manufactured with the BioGard activated carbon was performed by NSF Standard 42 for a total of 22 days (see Figure 2). This test is conducted using neutral pH water at 20°C utilizing native microorganisms that are measured by heterotrophic plate count of an average of 240,000 CFU/ml (geometric mean). The influent water containing the native bacteria is introduced at a rate of 0.50 gpm with a 1-minute-on/59-minute-off cycle for 16 hours, followed by an eight-hour stagnation period. Every five days, a 56-hour stagnation period is introduced to foster bacterial growth. In this particular test, effluent samples are taken every three to four days. This test had shown a reduction in bacteria count sometimes as high as 99.99% removal efficiency of the BioGard activated carbon product.

Another advantage of this activated carbon is that its pore structure remains intact. In other words, the microbial agent used to impregnate the carbon does not diminish the activated carbon's effectiveness to remove other organics. With silver ions, there is a tendency to block some of the activated carbon's surface area, reducing activated carbon's efficiency to adsorb other constituents that may be present in the water. *wqp*

Kimberly Walsh is vice president of marketing for Carbon Resources, LLC. Walsh can be reached at 760.630.5724 or by e-mail at kim@carbonresources.com.

For more information on this subject write in 1016 on the reader service card.

WEBresources >>>

Related search terms from www.waterinfolink.com: carbon, bacteria removal, contaminants

For more information related to this article, visit www.wqpmag.com/lm.cfm/wq030906