



Advanced Disinfection and Oxidation Systems

Pharmaceutical Residual Removal In Wastewater Streams

Application Notes

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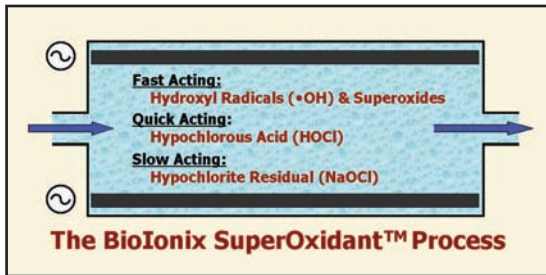
Application Challenges

Concern is growing over the contamination of the environment with pharmaceutical residuals, among which endocrine-disrupting compounds (EDCs), estrogens, antibiotics and antimicrobials are some of the most abundant groups. EDCs in particular have been linked to a variety of adverse effects in both humans and wildlife. Their widespread appearance in the aquatic environment is caused by their high usage by consumers in medications (17-alpha-

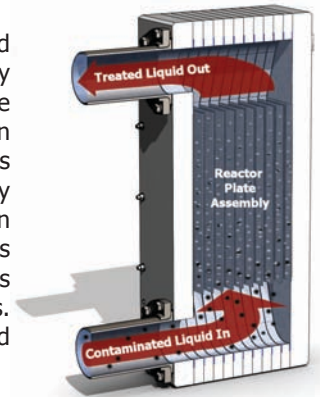
ethinylestradiol) and their presence in plastics (Bisphenol-A) and other products. In addition, antimicrobials are being added to soaps and hand sanitizers in large quantities. These contaminants can be found in rivers and lakes because they typically are not removed by municipal wastewater processing systems. Adverse effects of these contaminants have been documented and there is an increasing awareness of a need to treat this problem.

Solution: BioIonix Advanced Disinfection Systems

BioIonix offers a breakthrough electrochemical process that disinfects liquid streams as they pass through the BioIonix reactor module.



The BioIonix process generates safe and powerful SuperOxidants™ that destroy bacteria and other pathogens while providing additional residual disinfection performance. It effectively disinfects liquids with opaqueness, color, high turbidity and heavy solids content. No disinfection chemicals are used. The BioIonix process eliminates the hazards and toxic byproducts of chemical and radiation technologies. The BioIonix process is safe, reliable and environmentally friendly.



Performance Tests and Results

In cooperation with the Environmental Chemistry Lab of the University of Wisconsin – Madison, BioIonix has completed an initial testing program to evaluate the performance of the BioIonix process for removing trace pharmaceutical residuals in wastewater.

The UW-Madison lab prepared test mixtures containing trace residuals at levels found in wastewater. The wastewater used was secondary effluent from a local wastewater treatment plant containing relatively high levels of total coliforms.

In the tests below, energy doses, treatment times and other proprietary parameters were controlled to provide a range of

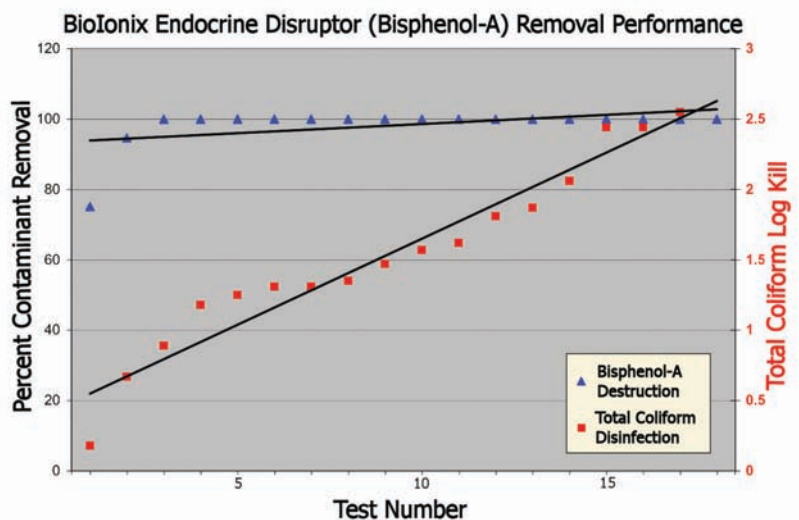
disinfection performance. Total coliforms were measured by the company using the IDDEX test. The UW-Madison lab performed the residual measurements using HPLC-MS/MS.

Results. The BioIonix process was able to eliminate these residuals in a manner consistent with disinfection performance. Near total pharmaceutical residual destruction occurred even in tests designed to yield low coliform disinfection levels. Results were so consistent that as a practical matter total coliform disinfection levels may be used as a reasonable proxy to indicate residual removal in a wastewater plant using the BioIonix process, a practical advantage.

Endocrine Disruptor Removal

Bisphenol-A is primarily used to make polycarbonate plastic (recycling #7) food and beverage containers, plastic food wrap, and epoxy resins that are used to line metal cans for foods, such as cans of soup. Bisphenol-A can leach from these products as they age, to be subsequently ingested by people. Recent research has shown that this chemical, commonly found in drinking water and wastewater and not removed by current water treatment, is an estrogenic hormone disruptor that can cause reproductive damage and birth defects that may lead to certain cancers in adulthood.

The BioIonix process effectively removed 100% of the endocrine disruptor Bisphenol-A in wastewater samples, while simultaneously achieving up to 2.5 log kill of total coliform.





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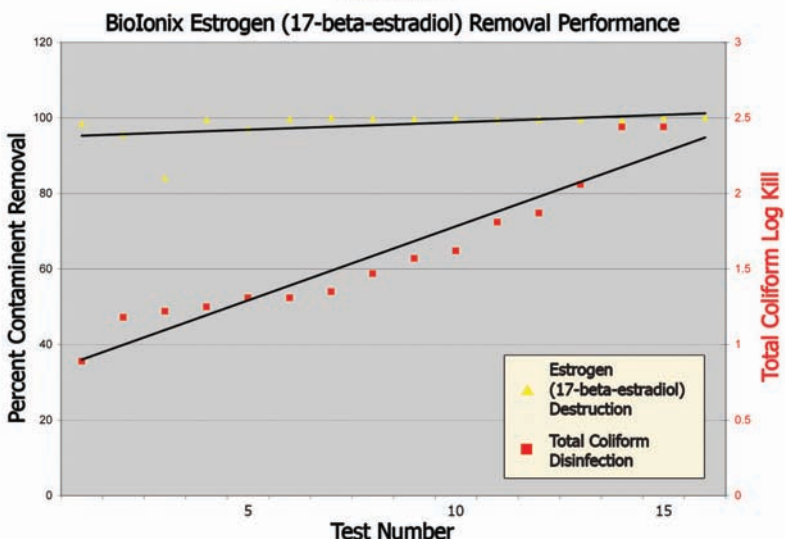
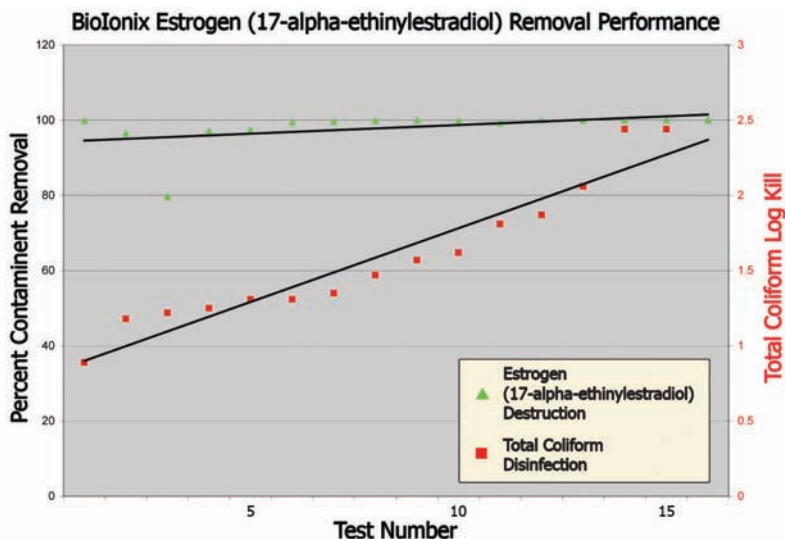
Estrogen Removal

17-alpha-ethinylestradiol is a synthetic pharmaceutical estrogen. Estrogens are used as part of some contraceptives, in estrogen replacement therapy of postmenopausal women, and in hormone replacement therapy. Sewage treatment plants can only breakdown a portion of this synthetic estrogen with current technologies. The remainder enters rivers and lakes and interferes with the hormone systems of fish and other aquatic life. There is growing concern among scientists that the presence of these synthetic estrogens in our lakes and streams water may be hazardous to human health as well.

The BioIonix process effectively removed 100% of the synthetic estrogen 17-alpha-ethinylestradiol in wastewater samples, while simultaneously achieving up to 2.5 log kill of total coliform.

Estradiol (17-beta-estradiol) is the most potent naturally-occurring estrogen. Sewage treatment plants can only breakdown a portion of this synthetic estrogen with current technologies. Concern has been raised in recent years that exposure to wastewater treatment effluents containing estrogenic chemicals can disrupt the endocrine functioning of fish and cause permanent alterations in the structure and function of the reproductive system. There is growing concern among scientists that the presence of these natural estrogens in our lakes and streams water may be hazardous to human health as well.

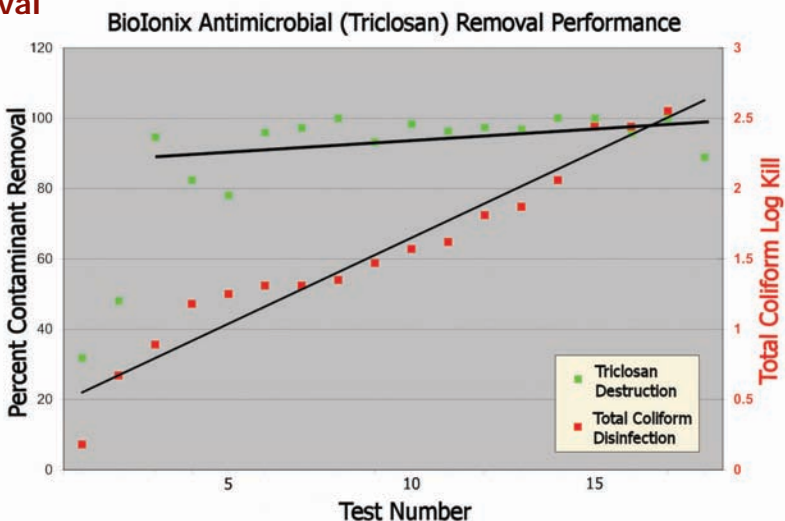
The BioIonix process effectively removed 100% of the natural estrogen 17-beta-estradiol in wastewater samples, while simultaneously achieving up to 2.5 log kill of total coliform.



Personal Care Products - Antimicrobial Removal

Triclosan is a synthetic antimicrobial/antibacterial agent whose use has become widespread in toothpastes, mouthwashes, deodorants, cosmetics, fabrics, plastics and other products. Research has shown that Triclosan, commonly found in drinking water and wastewater, may have several negative health effects; it can cause allergies and asthma by weakening the immune system; it disrupts the hormonal system; it can bioaccumulate; and, it belongs to a class of chemicals that are suspected of causing cancer in humans. Studies have also shown that when Triclosan is exposed to sunlight in water it may convert into the potent toxic chemical Dioxin.

The BioIonix process effectively removed up to 100% of the antimicrobial Triclosan in wastewater samples while simultaneously achieving up to a 2.5 log kill of total coliform.





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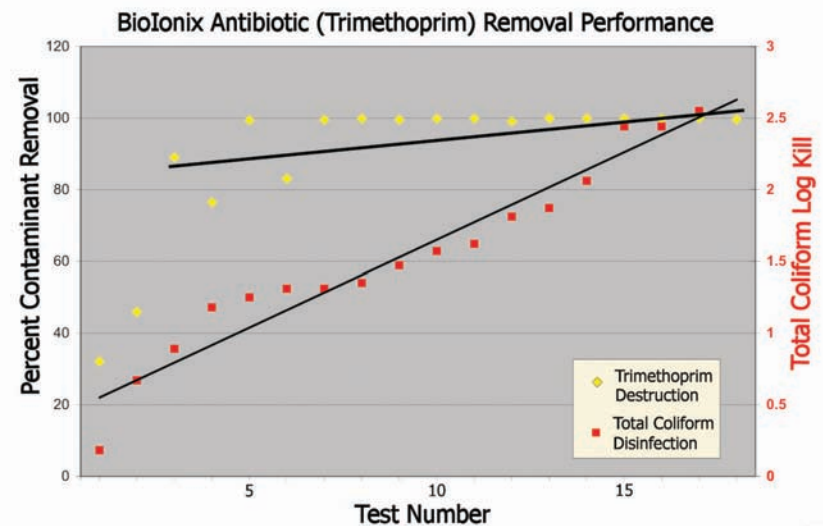
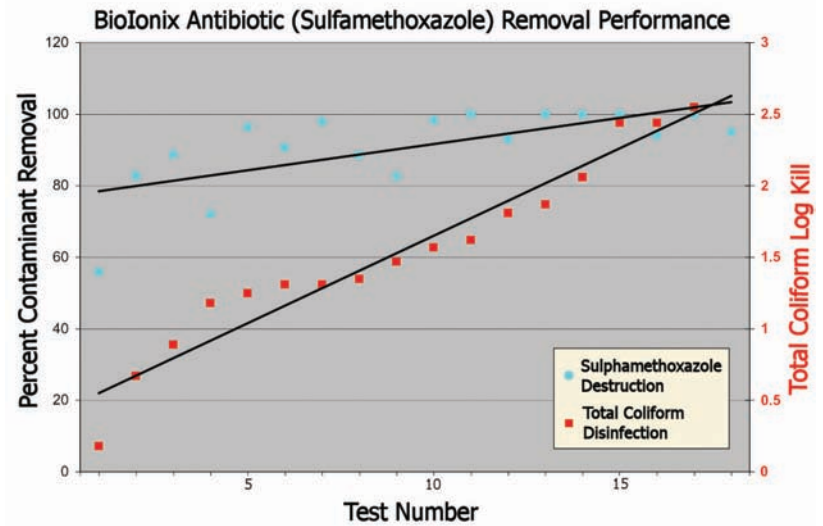
Pharmaceuticals - Antibiotics Removal

Sulfamethoxazole is a sulfonamide bacteriostatic antibiotic. It is most often used as part of a synergistic combination with Trimethoprim. Its primary activity is against susceptible forms of Streptococcus, Staphylococcus aureus, Escherichia coli, Haemophilus influenzae, and oral anaerobes. It is commonly used to treat urinary tract infections.

The BioIonix process effectively removed up to 100% of the antibiotic Sulfamethoxazole in wastewater samples while simultaneously achieving up to 2.5 log kill of total coliform.

Trimethoprim is a common bacteriostatic antibiotic mainly used in the prophylaxis and treatment of urinary tract infections. It belongs to the class of chemotherapeutic agents known as dihydrofolate reductase inhibitors.

The BioIonix process effectively removed up to 100% of the antibiotic Trimethoprim in wastewater samples while simultaneously achieving up to 2.5 log kill of total coliform.



The Company

BioIonix, Inc., is located in the Madison, Wisconsin area, home to many high technology companies. BioIonix specializes in the design and manufacture of electrochemical disinfection and oxidation systems using a breakthrough, patented and patent-pending process that ensures long running times with challenging liquid streams. This energy-efficient, environmentally-friendly electrochemical process solves serious biological disinfection and water reuse problems facing food processors worldwide.



BioIonix, Inc. is located on the southeast side of Madison, Wisconsin.

The BioIonix FS Product Line

Designed to 3A sanitary standards, the BioIonix FS food safety product line is engineered to meet the demanding needs of food processors. FDA approved materials are used for all process liquid contact surfaces. The power and control system is housed in a watertight, stainless steel, NEMA 4X enclosure.

Using a modular, readily-expandable design, flow rates can range from 20-700 gallons per minute in a single unit. Additional reactor plate and power modules can be added at a later date to increase capacity to accommodate process volume growth.

Test Lab and Field Pilot Units

BioIonix maintains a well-equipped test lab at its plant to demonstrate and evaluate the performance of the BioIonix process for customers and to develop new process applications. Field pilot units, with flow rates approaching commercial volume in scale, are available to permit the on-site evaluation of the BioIonix process in customer plants.



*BioIonix 650 gpm installation
Kidron, Ohio*

CONTACT INFORMATION

To find out more about the BioIonix pharmaceutical residual removal process or to talk to a company representative about our pilot programs please contact:



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