



Ozonation and Biofiltration for Water Purification

How ozonation and biofiltration can be used together to dependably and cost-effectively purify water

White Paper

This white paper describes the advantages of using ozonation and biofiltration in combination to optimize water purification.

This paper also explains how water treatment facilities can use ozonation/biofiltration systems to dependably and cost-effectively produce clean, aesthetically pleasing water that complies with all EPA standards.

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About the ozonation/biofiltration solution

Twelve times stronger than chlorine, ozone is a powerful oxidizing agent that has been used to decontaminate both water and air worldwide for about 100 years. Biofiltration has also proved highly effective in removing contaminants from water and air. And unlike some other purification techniques, both ozonation and biofiltration systems have proved to be safe and environmentally friendly.

When used alone, each of these technologies can effectively decontaminate water. However, using *both* ozonation and biofiltration processes in water treatment systems greatly improves the efficiency and effectiveness of filtration, producing cleaner water while reducing treatment costs.

The ozonation/biofiltration process

At the water treatment facility, influent water is first ozonated to enable the oxidation and/or subsequent breakdown of undesirable products in the untreated water, which will enhance the effectiveness of the biofilters downstream.

The ozonated water then passes through a biofilter, where micro-organisms indigenous to the native water occupy the spaces between the particles in the filter. The micro-organisms either absorb the oxidized compounds or metabolize them into harmless by-products such as carbon dioxide, water, and salts. (These micro-organisms are safely locked within the bio-filter matrix; no potentially harmful bacteria are released into the effluent water.)

Common biofilter media include:

- Granular activated carbon (GAC)
- Powdered activated carbon (PAC)
- Sand
- Straw

The treated water emerges from the biofilter safe to drink — free of contaminants and unpleasant tastes and odors — and is then piped to homes, offices, factories, or other facilities.

Advantages of combining ozonation and biofiltration

Using both ozonation and biofiltration optimizes the water treatment process in several ways:

- **Optimizes filtration.** Using ozone to oxidize compounds before filtration removes significantly more pollutants than either ozonation or biofiltration alone. Ozonation/biofiltration removes:
 - Up to 99% of total organic carbon and also removes bacteria, Protozoa, algae, and viruses
 - Geosmin and Methyl-isoborneol
 - Volatile organic compounds
 - Hydrogen sulfide

In addition, ozonation/biofiltration minimizes the potential for the formation of Dibutyl Phosphate.

- **Destroys pollutants.** Filtration systems only *displace* pollution, either producing large amounts of sludge (for example, precipitation with salts and flocculation with polymers) or producing a concentrate of this pollution (for example, with membranes). When ozonation is used in conjunction with biofiltration, pollution is *eliminated*.
- **Increases filter life expectancy.** Ozonating water before it enters the biofiltration system lengthens the life-span of the filter equipment.
- **Reduces maintenance.** Ozonating water before it enters the biofiltration system reduces organic matter and bio-sludge accumulation in the filter system.
- **Removes unpleasant colors, odors, and tastes.**
- **Provides clean water without producing harmful by-products.**

Applications

Municipal water treatment

Ozonation/biofiltration is often the most efficient, safe, and cost-effective method for treating water in small and large municipal water treatment plants. Ozone has been used for drinking water purification for about 100 years.

Now, as stringent water quality standards are implemented across the United States, ozone will replace chlorine as the most effective means of purifying water, offering advantages such as:

- Elimination of dangerous biological contaminants.
- Reduction of mechanical problems.
- Removal of offensive colors, odors, and tastes.

Ozonation/biofiltration can be used to treat surface water, ground water, and waste water.

Industrial water treatment

Ozonation/biofiltration provides a cost-effective method for treating water for industrial applications:

- Disinfects water from industrial and chemical sources.
- Oxidizes industrial off-gasses.
- Leaves no toxic by-products.

Aquaculture

Ozonation/biofiltration systems are ideal for zoos and other animal, avian, and aquatic environments, providing a safe, cost-effective means to provide clean water for aquatic life:

- Removes solids.
- Eliminates biological contaminants.
- Removes nitrites.
- Disinfects.

Water treatment facility system requirements

Ozonation/biofiltration systems can be implemented in new facilities or can be retrofitted into existing facilities.

Water treatment plants that currently utilize GAC, PAC, sand, or other filtration media can update their backwash system to provide a non-chlorinated water reservoir in order to prompt the development of an active bio-filter.

As with all water treatment systems, the effectiveness of ozonation/biofiltration depends on the chemical, biological, and physical characteristics of the influent water. Temperature, acidity, and natural organic matter, as well as several other water profile characteristics are significant variables to consider when determining the best treatment solution. If the system is to be retrofitted into an existing facility, additional issues to consider are Empty Bed Contact Times (EBCT) and filter media. In many cases, ozonation/biofiltration proves to be the most efficient, cost-effective, safe, and dependable solution.

Summary

Ozonation enhances the ability of biofilters to eliminate dangerous and unpleasant components from water.

Ozonation/biofiltration systems are often the best solution for water treatment facilities, providing safe, dependable, cost-effective water treatment for a variety of applications.

Ozonation/biofiltration systems reduce chlorine usage and lower water treatment, maintenance, and personnel costs.

Ozonation/biofiltration systems safely produce clean water without harmful, unwanted by-products.

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