

WATER TREATMENT TECHNOLOGY

FACT SHEET



OZONE

Process Description

Ozonation is a water treatment process that destroys bacteria and other microorganisms through an infusion of ozone, a gas produced by subjecting oxygen molecules to high electrical voltages. In addition, the oxidizing properties can also reduce the concentration of iron, manganese and sulfides. Ozone is a form of active oxygen that is commonly produced by exposure to UV light or high voltage electric arc. Ozone is highly reactive, with a short half-life (120 minutes in distilled water).

The use of ozone in conjunction with ultraviolet light to remove organics and sterilize fracturing fluids is being applied in the shale gas industry to reduce the need of biocide treatment and to reduce RO fouling

Treatment Company	Ozone	Shale Gas Basin				
		Marcellus	Barnett	Haynesville	Fayetteville	Woodford
Ecosphere			√		√	√

Technical Capabilities

From a financial and functional perspective, the use of ozone is considered a more effective disinfectant (relative to chlorine), even though residual levels of disinfectant are lost once the molecule is converted to normal oxygen. In the shale gas industry, ozone is applied in conjunction with ultraviolet light to remove organics and sterilize fracturing fluids to reduce the need of biocide treatment and/or to reduce RO fouling.

As with UV, the advantages of ozonation is that it is capable of removing bacteria without producing waste by-products, which require further handling, and treatment equipment is usually small

KEY CONSIDERATIONS

- A relatively new technology being applied in the shale gas industry with oxidizing properties that can reduce the concentration of iron, manganese and sulfides.
- The technology is also capable of removing bacteria in conjunction with UV light without producing waste by-products, which require further waste handling.
- Disadvantages include expensive costs, complex chemistry, and toxicity issues association with ozone generation.

Technical Limitations

The long-term disinfectant power of ozone is directly related to the Chemical Oxygen Demand (COD) of water. When shale's formed in an anaerobic environment, constituents concentrated in flowback water for instance, are in a reduced state when they are brought to the surface. These reduced state constituents create the COD of the produced water as these constituents are now in an aerobic (oxygenated) environment. To determine if ozone can be left in excess to further disinfect the water downhole, the concentration of ozone must exceed the demand necessary to oxidize the COD of the water, as well as kill the bacteria. For example, water being re-used in the shale gas industry, anions such as sulfides are often present. The oxidation of sulfide requires four oxygens to form sulfates, so the demand to an ozonation treatment system is four times greater for sulfides than for disinfecting bacteria.

Other limitations include high operational costs, it does not inhibit re-growth like biocides and there is toxicity issues associated with ozone generation.

Costs

In the shale gas industry, ozone is not used as a standalone treatment, but is instead used in conjunction with UV light to remove microbes from produced and flowback water. In other industries capital costs for ozone treatment are estimated near to \$0.01/gpd. According

Note: Information is from vendor, however specifications may have changed. Contact vendor for updates.

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to Ecosphere, who implements ozonation in their advanced oxidation treatment process, estimate costs to treat water ranges from \$0.60 to \$0.75 per barrel (bbl); the technology is capable of processing up to 10 bpm.

References

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