Applications of peroxone as a disinfectant

What are the applications of peroxone?

Peroxone, as a combination of ozone and hydrogen peroxide, is a new and advanced oxidation process that can be used for the treatment of polluted soils, groundwater and wastewater. Peroxone can be activily used to decompose pollutants, such as volatile organic compounds, chlorinated solvents, munition, diesel, volatile organic hydrocarbons, PAH's (polinuclear aromatic hydrocarbons), other hydrocarbons, petrol, metals and TNT. It can also be applied in drinking water disinfection.
The peroxone process uses ozone (O_3) combined with hydrogen peroxide (H_2O_2). During this process very persistent particles are formed; the so-called hydroxyradicals (OH). These radicals react with or oxidize most organic pollutants in a solution.
The United States and Germany use peroxone in the drinking water preparation process for the removal of color, flavor and pollutants, such as pesticides, from water. The addition of hydrogen peroxide accelerates the dissolution of ozone, causing the hydroxyradical concentration to be enhanced. The net free hydroxy radical production rate is 1 mol per mol of ozone.

Peroxone oxidation can take place in two ways:
- Direct oxidation of substances by liquid ozone (O_3(aq))
- Oxidation of compounds by hydroxyradicals produced during ozone decomposition

Both oxidation reactions use the same types of substances. Direct oxidation by molecular ozone is a relatively slow process compared to oxidation by hydroxyradicals. However, the ozone concentration is high. Hydroxyradicals react rapidly, but concentrations are relatively low under normal circumstances.
The peroxone process mainly depends on the hydroxyradical potential. When the peroxone process takes place, little ozone residu remains. Peroxide that is added during the process enhances the decomposition of ozone. Peroxone oxidation is a faster and more reactive process than ozonization. The oxidation potential of hydroxyradicals and ozone is as follows:

Oxidation reactions of peroxone

Oxidation by free readicals is much more effective than oxidation by ozone. As a result, peroxone is widely used for the removal of organic compounds such as flavor and odor and chlorinated organic compounds, which are very difficult to oxidize.
Neither ozone, nor peroxone diminish the Total Organic Carbon (TOC) content of the water. Peroxone oxidizes saturated organic compounds and produces byproducts that resemble ozone disinfection byproducts, such as aldehydes, ketons, peroxides, bromate ions and biodegradable organic compounds.
The peroxone reaction mechanism is based on the hydrogen peroxide and ozone reaction, forming hydroxy (OH^-) radicals. These persistent, reactive compounds oxidize organic pollutants in the water.

Conditions of peroxone disinfection

Like in the ozone disinfection process, the effectivity of the peroxone disinfection process is determined by pH and bicarbonate alkalinity. Both bicarbonate and carbonate react with hydroxyradicals when alkalinity is high. Excessive amounts of peroxide can limit hydroxyradical formation and can reduce peroxone affectivity.

Discharge demands

When cooling tower water is tapped from a river or lake, and must be discharged into the same water body after it has been used, it must meet certain discharge demands. Aditionally, the water temperature may not be too high, because warm water has a low oxygen content, which promotes algal growth. This can cause fish mortality and a decrease in water biodiversity.

United States

Discharge demands for cooling tower water in the USA are mentioned in the Clean Water Act (CWA) and are established by the Environmental Protection Agency (EPA).

More information on water disinfection?:

Introduction water disinfection Necessity water treatment History of drinking water treatment

What is water disinfection? Necessity of drinking water disinfection History of water disinfection Waterborne diseases Factors that influence disinfection Conditions of water disinfection Regulation drinking water disinfection EU USA

Swimming pool treatment Swimming pool pollutions Swimming pool disinfection Swimming pool disinfection & health

Cooling tower water Cooling tower water pollutions Cooling tower water disinfection Cooling tower water legislation

Chemical disinfectants Chlorine Sodium hypochlorite Chloramines Chlorine dioxide Copper silver ionization Hydrogen peroxide Bromine Peroxone Peracetic acid

Disinfection byproducts Types of disinfection byproducts Research on health effects of disinfection byproducts

Chlorinator system

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