Color Removal Using Ozone

Color is an important concern for water treatment plant operators since it is responsible for a significant number of customer complaints about water quality. In addition, many color problems are associated with fulvic or humic acids. These compounds are also precursors to the formation of chlorinated organics in drinking water. So their control is important for more than aesthetic purposes.

Color in water is due to either the presence of particulate matter which scatters light, apparent color, or dissolved species such as fulvic or humic acid, true color. Filtration with membranes having 0.45 micron pores can effectively treat problems associated with particulates, apparent color. Even in situations with dissolved organics, true color, conventional treatment processes (coagulation, flocculation, sedimentation and filtration) can remove a substantial portion of color. Activated carbon can be used, but depending on the level of color, activated carbons can have a short life time in this service.

Ozone is an effective oxidizer of color and won't create chlorinated organic compounds. The use of ozone will decrease the final amount of chlorine required. For fulvic and humic substances ozone doses of 1-3 mg ozone/mg of carbon can affect nearly complete removal of color.[1,2] Other studies have shown that 1 mg ozone/l can remove 10 color units (CU).[3]

Rakness [4] provides successful examples of ozone treatment of highly colored water. In one case, 7-10 mg/l of ozone with 10 minute hydraulic detention time (HDT) reduced water with 60-80 CU to 5-8 CU consistently. In another case, 18 mg of ozone/l with a contact time of 10 minutes HDT reduced water with 135-140 CU and a small amount of hydrogen sulfide to 5-8 CU.

At any dose there appears to be a threshold limit to the amount of color that can be removed using. If the threshold color limit is acceptable to the customers, further treatment may not be necessary. If additional treatment is required, ozone should be used as part of a treatment train to remove virtually all of the color. The combination of ozone with activated carbon has been shown to provide overall removal of color (90-95%).[5]

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Design Considerations

The following are some design considerations for the use of ozone in color removal.[6] If only direct filtration is employed, pre ozonation should be used. If conventional treatment is employed (settling and filtration) the point of ozone feed should be tested before settling, before filtration and two step ozonation. The reaction of ozone with color appears to have two phases, a fast phase and a slow phase. The ozone dose should be designed to satisfy the first fast reaction phase to most efficiently use ozone. Roughly half of the ozone dose to reach the threshold limit will produce 60-70% of the color removal. Other methods can then be used to further reduce the color. As with most ozone applications, dynamic pilot studies should be used versus laboratory data for designing an ozonation system for color removal.

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Spartan supplies a wide range of ozonation equipment which has been used for color removal applications. You can learn more about Spartan and our products at our website: www.SpartanWaterTreatment.com.

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