

# **CORROSION OF PLASTIC PIPES AFTER LONG TERM USE OF CHLORINE DIOXIDE DISINFECTION**

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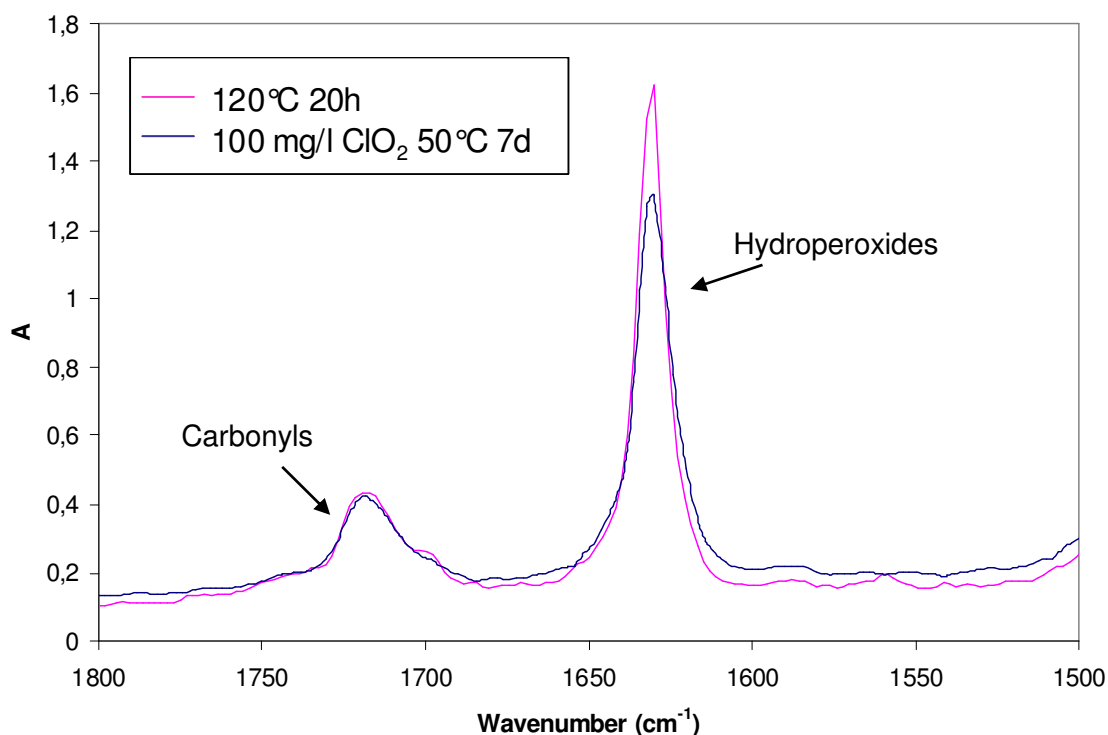
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Chlorine dioxide is becoming more and more popular as a disinfectant; partly due to its advantage over chlorine is its efficiency in Legionella prevention. Since chlorine dioxide generators are relatively simple and cost-effective to use and maintain, hospitals, hotels, and other facilities where there is an increased risk of Legionnaires' disease in the water pipe systems are now equipped with their own chlorine dioxide generators.

This paper presents the results from both laboratory investigations of UHMWPE (Ultra High Molecular Weight Polyethylene) exposed to chlorine dioxide and an investigation of polypropylene pipes used in a number of hospitals using chlorine dioxide generators. The pipes had been used for up to 10 years. Some of the pipes had failed and some had been used successfully without failure. All the pipes were found to be attacked by the chlorine dioxide but the pipes that had failed showed signs of low quality with regards to processing.

Chlorine dioxide has an unpaired electron but is not regarded as being reactive enough to abstract a hydrogen from a hydrocarbon.<sup>1, 2</sup> There have been a number of alternative mechanisms proposed for how chlorine dioxide changes the rate of oxidative degradation.<sup>3</sup> Figure 1 shows FTIR scans of an unstabilised UHMWPE sample oxidised in air at 120°C for 20 hours and one which had been exposed to 100 mg/l chlorine dioxide at 50°C for 7 days after reaction with NO-gas to mark the hydroperoxides. As can be seen in the figure the oxidation products are about the same in the two samples. The effect of the chlorine dioxide is thus the same as an increased temperature.

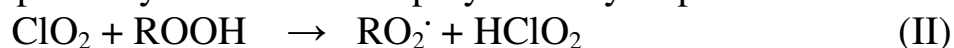


**Figure 1.** Unstabilised UHMWPE exposed in air at 120°C for 20 hours and to 100 mg/l ClO<sub>2</sub> for 7 days at 50°C. The reaction products are almost identical (carbonyls at 1720 cm<sup>-1</sup> and hydroperoxides after NO reaction at 1630 cm<sup>-1</sup>).

Chlorine dioxide is known to react with hydrogen peroxide



It can thus most probably also react with polymeric hydroperoxides



Reaction II will thus also be a chain branching reaction just as thermal degradation of hydroperoxides and is proposed to be the reason for the accelerated rate of oxidative degradation in chlorine dioxide.

## References

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2. Stevens A.A, Seeger D.R. In: Rice R.G, Cotruvo JA, editors. *Ozone/chlorine dioxide oxidation products of organic materials*. Cleveland, OH, USA: Ozone; 1978. p. 383e99
3. Colin X., Audoin L., Verdu J., Rozental-Evesque M., Rabaud B. and Martin F. et al., *Polym Eng Sci* **49** (2009), p. 1429.