

Chlorine Dioxide Disinfectant for Drinking Water – Effect on pipe and seal materials

A variety of methods are used to disinfect drinking water in Australia. The major water agencies primarily use either chloramines or chlorine. However, some operators of smaller, remote water treatment plants may have chosen to use chlorine dioxide.

Chlorine dioxide has been shown to function differently from the other commonly used disinfectants in that it oxygenates rather than chlorinatesⁱ.

Chlorine dioxide has been shown to be more aggressive towards polyolefins such as polyethylene than the other water treatment chemicals^{i, ii, iii, iv}. Especially at service temperatures above 20°C, chlorine dioxide will shorten the service life of polyethylene pipes. **For this reason chlorine dioxide water disinfection should not be used with polyethylene, polypropylene or polybutylene (i.e. polyolefin) pipes. This applies to distribution, reticulation, and plumbing applications.**

Moreover, the aggressiveness of chlorine dioxide with polyethylene creates a complex situation such that the usual Arrhenius relationship (rate process model) is not appropriate^v. Predicting long-term performance of PE in the presence of chlorine dioxide is therefore more complicated.

Whilst it has been shown that PVC is not attacked by chlorine dioxide at normal concentrations^{vi}, consideration must be given to its effect on other parts of the system.

Chlorine dioxide is suspected of having an adverse effect on a number of elastomers commonly used in seals in water applications, for example pipe seals, O-rings and gaskets. These elastomers can be found throughout a water pipe network - distribution, reticulation and plumbing applications all use elastomeric materials and it is recommended a comprehensive analysis be undertaken to assess the impact of chlorine dioxide disinfection on the total system.

For more information on the performance of polyethylene in piping systems utilising chlorine or chloramine disinfectants reference may be made to **POP018 Polyethylene Drinking Water Pipes in Contact with Chlorine and Chloramine Disinfectants**.^{vii}

ⁱ S. Chung, K. Oliphant, P. Vibien, J Zhang, *An examination of the relative impact of common potable water disinfectants (chlorine, chloramines and chlorine dioxide) on plastic piping system components*, ANTEC 2007, p2940.

ⁱⁱ *Evaluating the compatibility of chemical disinfectants with plastic pipe materials use for potable water distribution*, Technical Memorandum, Carolla, Austin, Texas, August 2008.

ⁱⁱⁱ M. Rozenthal, *The life cycle of polyethylene*, ASTEE Conference, Nice 2009.

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- ^{iv} X. Colin, L. Audouin, J. Verdu, M. Rozental-Evesque, F. Martin and F. Bourguine, *Kinetic modelling of the aging of polyethylene pipes for the transport of water containing disinfectants*. Plastics Pipes XIII, Washington, 2006.
- ^v S. Chung, T. Li, K. Oliphant, P. Vibien, *The mechanisms of chlorine dioxide oxidation of plastic piping systems*, Plastics Pipes XIV Conference, Budapest, 2008.
- ^{vi} J. Fumire, *Resistance of PVC pipes against disinfectants*, Plastics Pipes XIV Conference, Budapest, 2008.
- ^{vii} Plastics Industry Pipe Association of Australia, "*Polyethylene Drinking Water Pipes in Contact with Chlorine and Chloramine Disinfectants*", Industry Guideline POP018, PIPA, Chatswood, 2018.

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