Reduction of TOC and DBP Formation Potential in State Project Water

BACKGROUND:

Many Southern Californian water treatment facilities use or are considering using State Project water (SPW) as their raw water supply. SPW is characterized as containing organics (DBP precursors) that are different to remove using enhanced coagulation. Moreover, these organics are particularly reactive and SPW yields high levels of disinfection by-products when chlorinated. Therefore, SPW-source utilities that need to use free chlorine for disinfection have to remove more TOC to prevent their treated water exceeding the EPA stage 1 DBPR.

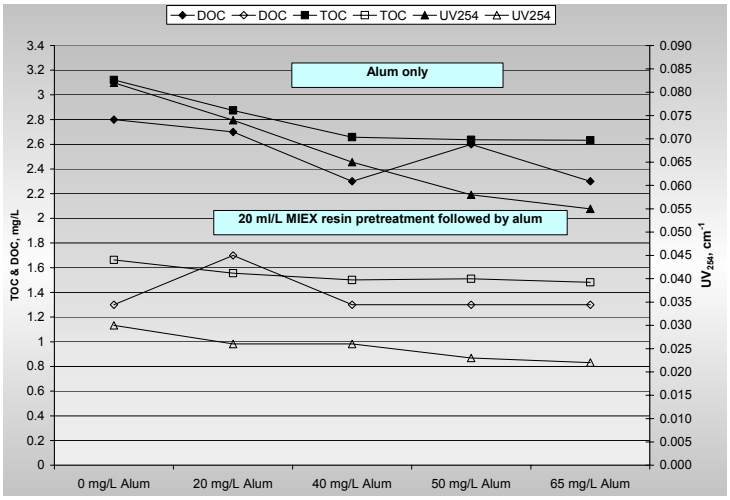
The MIEX® resin technology is specifically designed for the removal of dissolved organic carbon (DOC - contributing 80-95% of TOC), a precursor to the formation of THMs and HAAs, from drinking water supplies. Enhanced coagulation with aluminum sulfate improves precursor removal but distribution disinfection by-product levels can still be above the EPA Stage 1 standards. MIEX® resin's affinity for low molecular weight DOC that is not removed by coagulation allows greater removal of precursors and a reduction of downstream coagulant demand.

Treatment with the MIEX® technology has been proven to remove significant levels of DOC and reduce DBPFP (THMFP and THAAFP) to below the EPA mandated levels, not only on SPW, but on a wide range of source waters of varying quality.

RESULTS:

Treatment with MIEX® followed by alum coagulation on SPW, compared to alum treatment only, shows the benefit of the MIEX® process (Fig 1.). Without MIEX® pretreatment, Alum doses of 40 mg/L are required to remove TOC before alum can be effective in removing turbidity. Above 40mg/L (enhanced coagulation) little further TOC is removed. Pretreatment with MIEX® resin is so effective in removing TOC that little additional TOC being removed by coagulation at any alum dose.

Figure 1. DOC Removal Performance on SPW



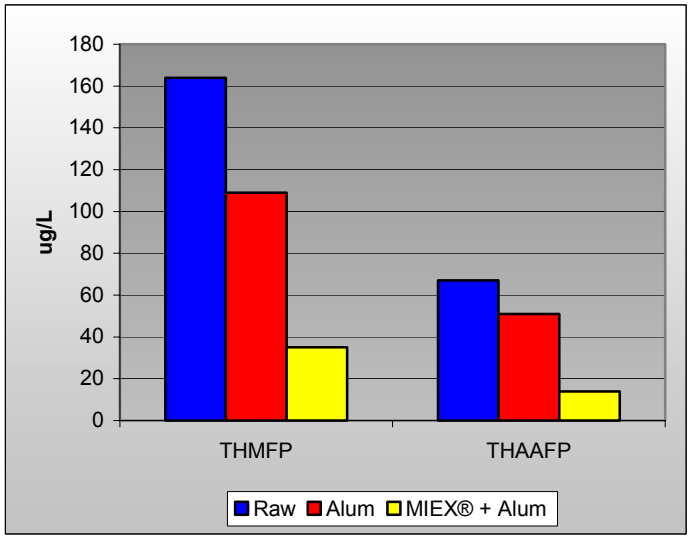
This means that the alum treatment is targetted to reducing turbidity without the requirement to remove TOC.

Separate tests on SPW sourced from the Metropolitan Water District of Southern California shows how the inclusion of a MIEX® pretreatment step can reduce DBPFPs below the EPA Stage 1 DBPR (Singer *et al*).

In this trial, when alum coagulation was used without MIEX® pretreatment, alum was applied at doses of 30 mg/L and TOC levels were reduced from 2.8 to 2.0 mg/L, a 29% reduction. With a MIEX® pretreatment, TOC reductions of 79% were observed, with a far lower alum dose of 10 mg/L.

The impact of the MIEX® pretreatment on DBPFP in the same tests is shown in Figure 2. Treatment with Alum only could not reduce THMFP to below the EPA Stage 1 DBPR standard of 80 µg/L, while the THAAFP was close to the standard of 60 µg/L. The MIEX® pretreatment reduced the THMFP to well below the EPA mandated standard, while also reducing the THAAFP to very low values.

Figure 2. DBPFP Reduction Performance on SPW



SUMMARY:

The MIEX® process can remove significantly more TOC than alum coagulation alone on SPW. These results also show that for a new installation the combination of the MIEX® process and microfiltration can be considered, eliminating the chemical demand associated with coagulation treatment.

REFERENCE:

Philp Singer, Katya Bilyk, "Enhanced Coagulation using an Magnetic Ion Exchange Resin", Water Research, 36 (2002), 4009 – 4022.

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