Technical Note

Downstream Benefits of MIEX® Pretreatment

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Introduction

The primary application for MIEX® Pretreatment is for dissolved organic carbon (DOC) removal in order to reduce disinfection by-product (DBP) formation. Water treatment plants, which have installed MIEX® systems, have realized additional treatment benefits in processes such as:

- Coagulation
- Disinfection
- Filtration
- Granular Activated Carbon (GAC)
- Dissolved Air Flotation (DAF)

Removal of DOC as the initial step in the treatment process leads to many additional, measurable benefits downstream.

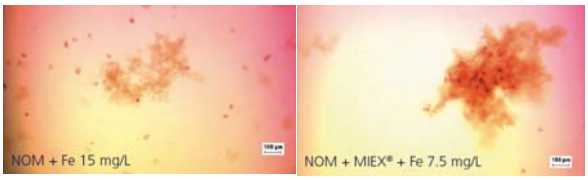
Coagulation Pretreatment

One benefit is the reduction in water treatment chemicals that results from the upfront removal of DOC. MIEX® Pretreatment typically removes the low to medium molecular weight fraction of the DOC that can be difficult to remove through coagulation. With MIEX® Pretreatment, coagulant dose can typically be reduced by 50 to 80%. This equates to further advantages including:

- Less alkalinity scavenged
- Lower amounts of pH adjusting chemicals used
- Less corrosive water in the distribution system
- Less sludge production

MIEX® Pretreatment increases quality of the floc formed with respect to its strength and speed of settling. An AWWA Journal article by Jarvis et al (January 2008)[1], showed that the floc formed in MIEX® Pretreated water settled almost three times faster than in water without MIEX® Pretreatment. The MIEX® Pretreated water required 50% less coagulant for effective floc formation. This work also showed that floc formed after MIEX® pretreatment, when sheared, will reform faster and stronger than non-MIEX® treated floc.

Figure 1: Example of flocs formed from Albert Raw Water with: 15mg/L Fe (left), MIEX® Pretreatment and 7.5mg/L Fe (right)



Disinfection Pretreatment

Disinfection can also benefit from MIEX® Pretreatment. Many utilities select MIEX® Pretreatment in order to use free chlorine as a disinfectant. DOC removal early in the treatment process may allow the utility to prechlorinate without forming high levels of DBPs. DOC removal also lowers chlorine demand, reducing the amount of chlorine that must be applied in order to maintain a residual. Utilities will notice:

- Disinfectant dose reduced by 25-50%
- Residual persists in the distribution system for a longer period of time
- Reduced heterotrophic plate count values
- Reduced likelihood for bacteriological outbreak
- Slower, less time-dependent DBP increase in the distribution system

Membrane Pretreatment

MIEX® Pretreatment can improve the performance of membrane filters. MIEX® Pretreatment can reduce the downstream coagulant dose by more than 50%, which can decrease the solids loading on the membranes. DOC removal by MIEX® Pretreatment also decreases the rate of organic fouling of the membranes. In full and pilot scale applications, MIEX® Treatment has been shown to achieve the following:

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- Improve flux rate by 30%
- Reduce Trans Membrane Pressure (TMP) and hold TMP more stable
- Extend membrane life
- Reduce frequency of Clean In Place (CIP)
- Reduce membrane waste volumes by 50%

The benefits of MIEX® Pretreatment apply to the entire spectrum of membrane filtration, ranging from microfiltration to reverse osmosis.

GAC Pretreatment

Operating costs of MIEX® Systems are independent of the raw water DOC concentration. This is not the case for Granular Activated Carbon (GAC) systems, where operating costs are directly dependent on the amount of DOC removed. The higher the concentration of DOC in the water, the more frequently GAC requires replacement or regeneration, and the more costly GAC is to use.

MIEX® Pretreatment has the potential to significantly extend GAC life by removing 40-90% of the raw water DOC, reducing DOC loading on the GAC. By removing the bulk of the DOC at the head of the plant, MIEX® Pretreatment can extend the life of GAC exponentially, typically paying for itself over a projected life cycle.

Figure 2: UF membrane backwash after pretreatment with in-line coagulation (left) versus MIEX® Pretreatment (right)

DAF Pretreatment

MIEX® Pretreatment also benefits Dissolved Air Flotation (DAF) systems. DOC removal prior to DAF results in reduced coagulant demand and the formation of a stronger, better quality floc, ultimately resulting in better treatibility of the water downstream.

In pilot scale studies, MIEX® Pretreatment to DAF has been shown to reduce coagulant dose, increase floc size by nearly 70%, and increase its growth rate and strength. This has the downstream effect of reducing filter loading and backwash frequency and reducing treated water particles counts by 95%.

All of these benefits serve to optimize the DAF process and increase throughput and filter run times.

Summary

MIEX® Pretreatment is an effective means of reducing raw water DOC in order to meet D/DBP Rule requirements. This DOC reduction has a number of additional treatment benefits, including:

- Reduced demand for chemicals resulting in significant cost savings
- Improved treatment and overall water quality
- Increased plant capacity
- Reduced plant footprint
- Lower plant waste volumes
- Less maintenance and improved productivity

The cost savings and improved efficiencies that result from using MIEX® Pretreatment prior to coagulation, disinfection, membranes, GAC and/ or DAF make it an ideal addition for any water treatment plant.

Resources

[1] Jarvis, et al, 'Treatment options and their effect on NOM', AWWA Journal, January 2008

[2] Jarvis, et al 'Impact of magnetic ion exchange (MIEX) resin on floc properties: a pilot plant evaluation', 2007 AWWA WQTC, Charlotte, NC.

[2] Galjaard et al, 'Influence of NOM and Membrane Surface Charge on UF Membrane Fouling', IWA Conference. Water Intelligence Online. IWA Publishing (2005).

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