Technical Note

Nanofiltration Treatment of MIEX® Process Waste

Introduction

In TOC removal applications, the MIEX® Process produces around 250 to 450 gallons of waste brine waste brine per million gallons of water treated. The actual volume of waste produced is dependent on the raw water characteristics, which determine the amount of resin that needs to be regenerated over time. The waste brine typically consists of a 10% NaCl and 0.2 to 1% TOC solution. While the volume of waste is relatively small in relation to the volume of water treated, it still may cause problems with sewer disposal due to the TDS loading and if there is no sewer available for disposal, hauling costs for off-site disposal can be prohibitive.

Waste brine can be treated by Nanofiltration (NF) to filter out over 98% of the TOC, allowing over 75% of the waste to be reused, which significantly reduces the volume of waste requiring disposal and also recovers much of the salt used for regeneration.

Several trials have been conducted at different full-scale MIEX® Installations to demonstrate the effectiveness of NF treatment of waste brine. This technical note summarizes how NF can be applied to recycle waste brine, significantly reducing waste volumes and making the MIEX® Process a much more sustainable alter-native for TOC removal applications.

Performance Data

Nanofiltration membranes can be used to separate the organic material from the salt, therefore producing a concentrated organic reject stream and a clear permeate stream (Figure 1). This treatment can recover up to 80% of the brine for further reuse, while reducing DOC levels by up to 98%.

Figure 1: Initial Feed (Left) Concentrate (Middle) Permeate (Right)

Several extended trials have been conducted to determine the amount of brine that can be recovered for different waste compositions (Figure 2). While flux rates are relatively low, this is not a concern as the size of the NF system required for waste treatment is so small, i.e. for a 30 MGD MIEX® System the capacity of a NF system to treat all of this waste would be less than 7 gpm.

Figure 2: Unit Treating Waste from a 185 gpm MIEX® System

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A summary of feed, permeate and concentrate characteristics from NF treatment of waste brine is shown in Table 1. NF treatment of waste brine produced from MIEX® Treatment of this water source reduced the waste brine requiring disposal by around 80% to 54 gal waste per million gallons of water treated. In addition to reducing the waste volume, the ability to recycle permeate for resin regeneration will significantly reduce the amount of replacement salt required for the MIEX® Process by up to 50%.

Table 1: Summary of Input and Output Stream Characteristics NF Treatment

Parameter	Waste Feed	Permeate*	Concentrate
Chloride (g/L)	45	45	45
Sodium (g/L)	39	39	39
TOC (mg/L)	5,900	129	32,100
Volume (gal/MG)	300 (100%)	246 (80%)	54 (20%)
Salt Load (lb/MG)	210	172	38

*Returned to regeneration process.

Operational Considerations

The NF waste treatment system requires minimal operator attention and is best operated continuously. Permeate is pumped directly back to the MIEX® Process regeneration system for reuse. Operating costs for membrane replacement, power and cleaning are less than $10 per million gallons of MIEX® System throughput.

Conclusion

- Nanfiltration treatment can reduce the volume of brine waste produced by the MIEX® Process by up to 80%, which will significantly reduce waste disposal costs.
- Recycling NF permeate back into the regeneration process will reduce the amount of salt consumed in resin regeneration by up to 50%.
- The ability to recycle waste brine via NF treatment significantly enhances the sustainability of the MIEX® Process in TOC removal applications.

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