

## Alternative Regenerants for the MIEX® Process

### BACKGROUND:

The MIEX® Technology was originally designed for the removal of dissolved organic carbon (DOC), a precursor to the formation of THMs and HAAs, from drinking water supplies. More recently, the MIEX® Technology is finding many more applications for the removal of a range of contaminants across many industries.

Traditionally, DOC-loaded MIEX® Resin has been regenerated using brine, a concentrated solution of sodium chloride that replaces the DOC on the resin with chloride. The regenerated resin is then returned to service.

Increasingly, applications are being found where the use of the MIEX® Technology can benefit from the use of other salt solutions as regenerants.

Test work has been done using a range of alternative salts to demonstrate their capacity to act as effective regenerants in the MIEX® Process. This case study describes two of these sets of tests.

### TESTS:

MIEX®DOC Resin was loaded with DOC from two sources, a raw water from Airey's Inlet Water Treatment Plant in Victoria, Australia and a Pulp Mill effluent stream from a site in New Zealand.

Each loaded resin was regenerated by mixing the resin for 20 minutes with 3.3 bed volumes of regenerant. Three regenerants were used, a brine using sodium chloride and two alternative salt solutions using sodium sulfate and sodium bicarbonate. Each regenerant was made up at saturation concentration.

The performance of each alternative regenerant was compared to the saturated brine.

Tests were conducted at three pH values; 7, 8.5 and 10 (NB. at each of these pHs, the dominant anion species in the bicarbonate regenerant is bicarbonate).

### RESULTS:

DOC removal rates and regeneration efficiencies (relative to chloride) for Airey's Inlet loaded resin and pulp mill effluent loaded resin using bicarbonate and sulfate regenerant are shown in Tables 1 and 2 respectively.

In the case of resin loaded using Airey's Inlet raw water, relative regeneration efficiencies of 86% and 83% are achievable using bicarbonate and sulfate respectively

(Table 1). pH does not have a particularly strong influence with sulfate, although with bicarbonate, more DOC is removed at higher pH.

**Table 1. Airey's Inlet Raw Water Results**

Regenerant	pH	DOC Removed (mg/L)	Relative Efficiency
Brine	7.0	74	N/A
	8.5	77	N/A
	10.0	79	N/A
Sodium Bicarbonate	7.0	52	70%
	8.5	52	67%
	10.0	68	86%
Sodium Sulfate	7.0	62	83%
	8.5	61	78%
	10.0	66	83%

The Pulp Mill effluent results (Table 2) show similar trends, although the regeneration efficiency relative to chloride is lower at 58% for bicarbonate and 48% for sulfate.

**Table 2. Pulp Mill Effluent Results**

Regenerant	pH	DOC Removed (mg/L)	Relative Efficiency
Brine	7.0	2921	N/A
	8.5	3523	N/A
	10.0	3408	N/A
Sodium Bicarbonate	7.0	868	30%
	8.5	678	19%
	10.0	1992	58%
Sodium Sulfate	7.0	1125	38%
	8.5	1704	48%
	10.0	1206	35%

### SUMMARY:

Loaded MIEX Resin can be effectively regenerated using a range of salts. This series of tests has demonstrated the effectiveness of sulfate and bicarbonate salts. Previous work has also confirmed the effectiveness of alternative chloride salts, such as potassium, magnesium, calcium and ammonium.

Alternative regenerants provide the opportunity to use the MIEX® Process where the presence of sodium and/or chloride in treated water, other treated process streams or the waste regenerant itself is an concern.