

## CASE STUDY –

### Brine Softening Using Ion-Exchange Resin in a Chlor-Alkali Plant

#### 1. Application in brief

Brine softening by ion-exchange resin is applied in Chlor-Alkali Industry to remove impurities like Calcium ( $\text{Ca}^{2+}$ ), Magnesium ( $\text{Mg}^{2+}$ ), Barium ( $\text{Ba}^{2+}$ ) and Strontium ( $\text{Sr}^{2+}$ ) from concentrated brine. This protects sensitive ion-exchange membranes, maintains low cell voltage, improves current efficiency and increases membrane life. **INDION BSRM** is chelating resin with dual-functional group containing Amino phosphonic & Imino-diacetic Acid. The application involves **polishing of pre-treated brine** before membrane electrolysis to:

- Remove residual hardness ions ( $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ )
- Achieve < **10 ppb total hardness**.
- Control  $\text{Ba}^{2+}$  and  $\text{Sr}^{2+}$  to < 60 ppb.
- Protect membrane electrolyzers from fouling and scaling

Ion-exchange chelating resin columns are used downstream of clarification and filtration as the **final purification step**.

#### 2. System details

- Industry: **Chlor-alkali Industry**
- Typical brine concentration: **~300–305 g/L NaCl**
- Feed brine flow: **≈ 290 m<sup>3</sup>/h**
- Inlet hardness: **≈ 3-4 mg/L  $\text{Ca}^{2+}$  +  $\text{Mg}^{2+}$**
- Outlet hardness target: **< 10 ppb as  $\text{CaCO}_3$**
- Configuration used: **Merry-go-round**
- Typical operating conditions:
  - Temperature: **66–68 °C**
  - pH: **8.5–10.5**
  - Linear velocity: **20–25 BV/h**
- Regenerant: **7% HCl and 4% NaOH**

#### 3. Product details

Characteristics	
Appearance	Opaque off white to brown beads
Matrix	Macroporous crosslinked polystyrene
Functional Group	Amino phosphonic acid and Imino-diacetic acid
Ionic form as supplied	Sodium
Total exchange capacity in H form	2.1 meq/ml, minimum

Moisture holding capacity	60 - 70%
Shipping weight*	690 - 750 kg/m <sup>3</sup>
Particle size range	0.42 to 1.2 mm
> 1.2 mm	5.0%, maximum
< 0.420 mm	1.0%, maximum
Uniformity co-efficient	1.2- 1.4
Effective size	0.45 to 0.60 mm
Maximum operating temperature	80° C
Operating pH range	8 to 11
Reversible volume change	H to Na, < 45 %, H to Ca, < 20 %

\*Weight of resin, as supplied, occupying 1m<sup>3</sup> in a unit after backwashing and draining.