Increase in RO-capacity and membrane lifespan by upstream water conditioning

COSUMA 21.03.2018

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Aquaminerals’ product palette

- Arsenic and fluoride removal
- Potable water production, also for remote areas
- Mine water treatment/Process water treatment
- Removal of contaminants by adsorption
- Stabilization of hazardous waste
- Under investigation metal recovery strategies (CMEco project)

Advanced membrane conditioning, e.g. for sulfate removal in mine effluent
The adsorbent, AQM PalPower M10: technical details

- Surface area 11.9 m²/g
- Density 1.0 g/ml
- Particle size distribution 1–65 µm
- Consists of modified natural minerals
- Non-hazardous
- Will not release metals at pH 4-11
- After use: non-hazardous waste
- Water recovery > 96 %

- Removal of metals and anions is based on adsorption and pH adjustment, quantitative removal of metals, above 95 %

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AQUA pilot testing of Mn and Fe removal in RO-feed

90 min continuous test, samples every 30 min

Mobile trailer based piloting unit

<table>
<thead>
<tr>
<th>mg/l</th>
<th>RO-in</th>
<th>RO-reject</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ca</td>
<td>396</td>
<td>926</td>
</tr>
<tr>
<td>Fe</td>
<td>0,56</td>
<td>&lt;0,15</td>
</tr>
<tr>
<td>K</td>
<td>14,4</td>
<td>34,8</td>
</tr>
<tr>
<td>Mg</td>
<td>6,93</td>
<td>15</td>
</tr>
<tr>
<td>Mn</td>
<td>0,17</td>
<td>&lt;0,05</td>
</tr>
<tr>
<td>Na</td>
<td>1910</td>
<td>4160</td>
</tr>
<tr>
<td>SO₄</td>
<td>5100</td>
<td>12000</td>
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</tbody>
</table>

Untreated Lab results Piloting

<table>
<thead>
<tr>
<th>M10</th>
<th>t [min]</th>
<th>Fe [µg/l]</th>
<th>Mn[µg/l]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>560</td>
<td>170</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>&lt;25</td>
<td>&lt;2,0</td>
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<tr>
<td>100</td>
<td>30</td>
<td>&lt;25</td>
<td>&lt;2,0</td>
</tr>
<tr>
<td>200</td>
<td>30</td>
<td>&lt;25</td>
<td>&lt;2,0</td>
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<tr>
<td>300</td>
<td>30</td>
<td>&lt;25</td>
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<tr>
<td></td>
<td>0</td>
<td>515</td>
<td>162,5</td>
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<tr>
<td>100</td>
<td>10</td>
<td>&lt;15</td>
<td>&lt;5</td>
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AQUApilot testing of Mn and Fe removal in RO-feed

Continuous use possible with changing feed concentrations
Customer case

**WATER CHARACTERISTICS:**
- Sulphate ~ 1500 mg/L
- Chloride ~ 200 mg/L
- Sodium ~ 300 mg/L
- Magnesium ~ 80 mg/L
- Calcium ~ 50 mg/L
- pH 7.5
- TDS ~ 5000 mg/L
- 750 m³/h
- During operation also Mn, Al, Fe, possibly As

**Current solution:**
- Total effluent about 620 m³/h, TDS < 1000 mg/L (Na, Cl)
- \( SO_4 < 250 \text{ mg/l} \)
- \( K_a(CaCO_3) = 14 \text{ mg/l} \)
- \( K_a(CaSO_4*2H_2O) = 2100 \text{ mg/l} \)

**Two RO-plants**
- RO 500 and RO 250 running at ~50 % efficiency

**Improved and modified gypsym precipitation by nanofiltration**
- Increased capacity by proper pretreatment of membranes, removal of \( Ca^{2+}, Mn^{2+}, Al^{3+}, Fe^{3+} \)
Summary
• Nano-filtration can be used for sulfate removal, membrane can be pretreated to remove metals and metalloids for increased life span
• Excellent lab-scale results and piloting results
• Customer case for whole value chain of membrane conditioning and sulfate removal below 200 mg/l

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