Treatment of Acid Mine Drainage

DESCRIPTION

The mine drainage water is treated with various processes prior to reaching EFC plant(s). The concentrated brine stream is pre-cooled and fed to the EFC crystallizer (-9˚C). As temperature drops, the solubility of sodium sulfate decreases, and it starts crystallizing. Upon further cooling the eutectic point of the solution is reached and ice starts crystallizing simultaneously with the salt. Then the mixed ice and salt slurry is fed into the EFC gravitational separator where the ice fraction floats and the salt fraction precipitates. Subsequently, the ice and salt slurries are fed to two separate vacuum filters, where the solid fractions are filtered. The filtered ice is fed to an ice melting section, where it melts and its cold is recovered (melting enthalpy). A bleed stream is extracted from the process to prevent the crystallization of other impurities, i.e. magnesium sulfate. This bleed stream is fed to an (almost) identical second EFC process (-15˚C) where magnesium sulfate is recovered. A small bleed stream is extracted from the second EFC stage to prevent chloride precipitation.

OPERATING CONDITIONS

- Feed flow to the EFC plants is 122 t/day
- Water production from both plants is 65 t/day with TDS<1-wt%
- Amount produced of $Na_2SO_4.10H_2O$ is 6.4 t/day with a purity >98%.
- Amount produced of $MgSO_4.11H_2O$ is 15.4 t/day with a purity >88% (contains un-depleted sodium sulfate)
- Bleed stream (from both EFC plants) is 33 t/day with TDS of 18.4-wt% of mainly chloride salts.
- Overall EFC plants conversion rate is 73%.
- (Near) ZLD is possible with a third EFC stage for chloride recovery.

EFC plants feed stream composition

Na (wt%)	Mg (wt%)	Ca (wt%)	K (wt%)	SO_4 (wt%)	Cl (wt%)	TDS (wt%)
1.2%	1.7%	0.01%	0.34%	6.5%	2.4%	12.2%

COOLSEPARATIONS
The experts in low temperature crystallization

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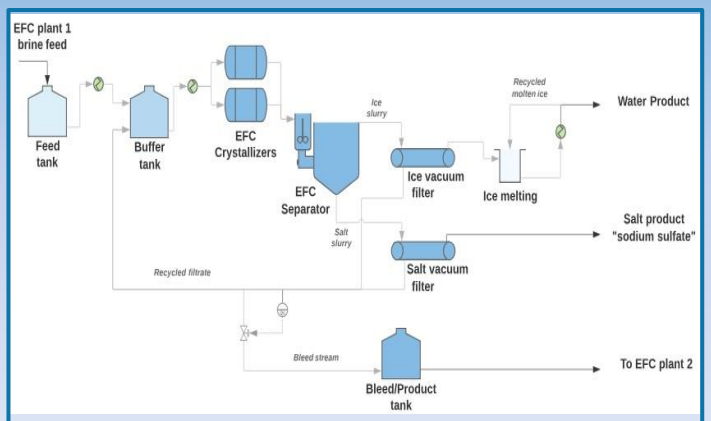
APPLICATION

Cool Separations Eutectic Freeze Crystallization (EFC) process is an economically competitive and environmentally advantageous solution treating acid mine drainage in ZLD treatment plants.

*Integrated with a full mine drainage treatment plant, EFC converts the mine brine into **pure salt(s) and clean water** that is suitable for reuse.*



EFC process flow for mine drainage treatment

Sequential salt precipitation

using EFC technology at ANGLO COAL site with PROXA

Fractional crystallization of sodium sulfate and magnesium sulfate from acid mine drainage

UTILITIES

- Total electrical energy consumption ranges between < 40 kWh/ton feed combined for both EFC plants.
- Process water of 35 m^3/h @ 3bar and 15˚C (This water is used for the cooling installation and recycled within the plant without treatment, including the cold recovery).
- Pressurized air of 4 m^3/h @ 6bar.

FEATURES OF THE EFC TECHNOLOGY

- Efficient and maximum separation between magnesium and sodium sulfate salts.
- Efficient and maximum separation between common chloride and sulfate salts.
- The recovered salts are of high purity, minimizing the disposal costs significantly.
- High purity water is produced with less than 1-wt% TDS. Further purification is easily achieved by integration with (existing) RO units.
- No scaling issues, no need for chemical additives, and much less corrosion tendencies.
- Much less sensitive in handling variations in the feed stream quality compared to evaporative processes.
- Requires electrical energy only, with no need for heat or steam generation.
- Lower capital and operational costs up to 40% compared to evaporator crystallizers.