

CASE STUDY: Recover Acid from Acidic Waste

At a Glance

Industry:

Oil and gas, power generation, water treatment

Wastewater:

Highly acidic wastewater (~pH 0.3)

Treatment

Requirements:

Recover acid from wastewater for beneficial reuse and acidity reduction

Product:

ElectroChem Acid Recovery

Results:

Reliably treated acidic wastewater (~pH 0.3) for an acid recovery of 91%

Economics:

Site and water chemistry dependant. Lower cost than procuring new acid.

Challenge

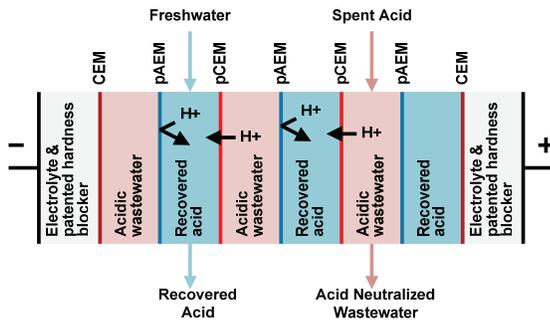
Waste acid holds value. However, it is often “polluted” and hinders process value. If relatively pure acid could be recovered economically, it could be reused, thereby reducing chemical procurement cost, improving safety by reducing transport and handling of dangerous goods, and reducing liabilities associated with waste fluids. Saltworks has developed a groundbreaking ion exchange membrane that enables recoveries of acid previously impossible, and an electrochemical system to concentrate the acid. A project was initiated to demonstrate effective recovery of acid from a representative ion exchange (IX) regeneration wastewater.

Many industries use ion exchange (IX) resin technology to treat hardness for boiler or reverse osmosis feed water. The spent IX resins are regenerated with an acid wash which results in an acidic wastewater requiring disposal (acid regen waste). Other industries, such as metal pickling, also produce acidic wastewater. If local sewers are unwilling to accept acidic wastewater, then options are limited to on-site neutralization with lime, off-site treatment at an authorized facility, or injection into a deep well. An alternative is now available: recover the acid, reduce cost, and reduce waste.

Solution

Saltworks’ ElectroChem Acid Recovery system achieves over 95% recovery. This improves upon traditional diffusion dialysis, which is passively driven and previously lacked anion exchange membranes capable of preventing proton back diffusion. ElectroChem is electrically driven, consuming nominal electrical energy but enabling much higher acid concentration and less membrane area. The process uses Saltworks’ proton selective IonFlux pCEM and pAEM membranes, which are specifically designed to respectively transport and block protons. The membranes’ pH operating limit is as low as 0. ElectroChem is a modular stack comprised of alternating IonFlux membranes and gasket separators, embedded in a system with electrode fouling protection and automated self-cleaning capabilities. The modular stacks allow easy plant maintenance and capacity expansion.

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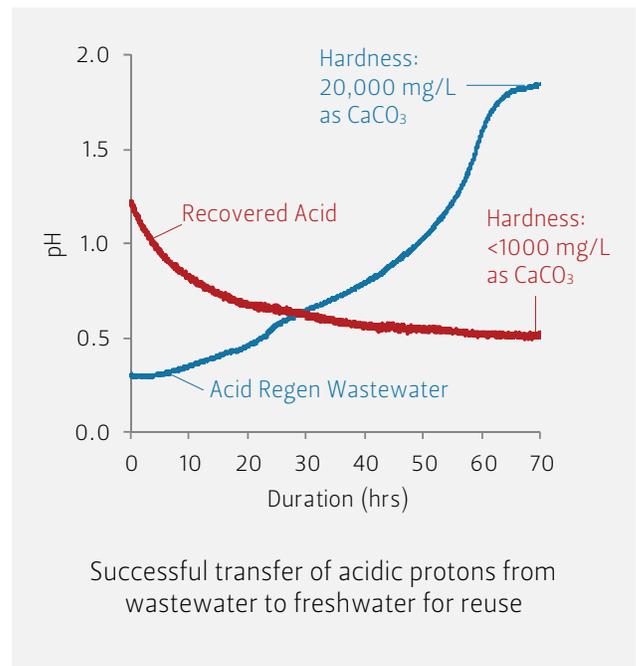
ElectroChem Acid Recovery Stack

ElectroChem systems operate at 100 kPa without pressure differences across the ion exchange membranes. Under an electrical potential, acidic protons in the acid wastewater are fluxed through Saltworks' resilient proton selective IonFlux membranes to an acid accepting water stream, typically freshwater, de-acidifying the wastewater. The freshwater stream becomes an acidic product which can be reused. The acid wastewater is partially neutralized, reducing its chemical waste liability.

Results

ElectroChem Acid Recovery successfully and reliably recovered acid from a representative acid regen wastewater. The acid was transferred to freshwater, demonstrating successful operation of ElectroChem with proton selective IonFlux membranes:

- Acid recovery of 91%
- Acidic wastewater de-acidified from ~pH 0.3 to ~pH 1.9
- Successfully transferred acid to freshwater stream (pH 6.5 acidified to ~pH 0.5), small amounts of make-up acid can be added to decrease pH further
- Hardness concentration in the recovered acid was <1000 mg/L as CaCO₃ (<5% of the hardness in the acid regen wastewater) enabling reuse in subsequent ion exchange resin regeneration batches



Summary

Saltworks successfully demonstrated recovery of acid from ion exchange regeneration acidic wastewater. Cost savings are approximately 30% over procuring new acid, excluding the disposal savings and risk reduction benefits. We are seeking a partner to pilot this ground breaking technology, built up from our commercial components with a simple membrane swap. The partner will not only save money, they will demonstrate innovation, safety, and environmental benefits to their stakeholders.

Saltworks would be pleased to complete an ElectroChem Acid Recovery performance and economic assessment of your acidic wastewater treatment project. Please contact projects@saltworkstech.com. Lease and pilot plants are available.