

SULFATEQ™

SULFATEQ™ removes sulphate to less than 300 mg/l and converts it into hydrophilic (non-clogging) elemental sulphur. In addition, it recovers valuable metals such as copper, nickel and zinc as marketable metal sulphides.

Lime treatment for sulphate removal no longer meets the authorities' requirements for sulphate concentrations or total dissolved solids. Reverse osmosis and ion exchange do not completely solve the problem either. They merely concentrate the pollutants, whereas SULFATEQ™ converts the pollutants into a valuable product.

The typical range for the application of SULFATEQ™ is an influent sulphate concentration of 1,000-25,000 mg/l and a pH level of 2-8. SULFATEQ™ is used as a standalone installation or as the final treatment at a lime-gypsum plant.

The power of this technology lies in its ability to solve multiple problems with one installation: sulphate removal and simultaneous metal recovery.

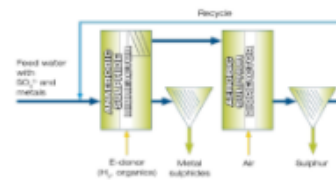
Typical applications of SULFATEQ™

- ▶ Effluent treatment in the metal industry
- ▶ Wash tower acid treatment
- ▶ Brine treatment of reverse osmosis in combination with metal recovery to increase overall water recovery
- ▶ Acid mine drainage treatment in combination with metal recovery
- ▶ Effluent treatment and metal recovery in the viscose industry for the removal of metal, sulphate and COD
- ▶ Integration with lime neutralisation plant to improve the effluent, reduce total dissolved solids and reduce the sludge whilst improving the quality, resulting in less liability

Advantages of SULFATEQ™ over traditional/alternative methods for sulphate removal

- ▶ Effective removal of sulphate to less than 300 mg/l
- ▶ Use of intermediate product (sulphide and alkalinity) to recover metals or produce elemental sulphur
- ▶ Removal of ions responsible for hardness (calcium and magnesium) to less than 100 and 4,000 mg/l respectively
- ▶ Removal of acidity without consumption of neutralisation agents such as caustic

Process scheme



- ▶ Removal of ions responsible for hardness (calcium and magnesium) to less than 100 and 4,000 mg/l respectively
- ▶ Removal of acidity without consumption of neutralisation agents such as caustic
- ▶ Applicable for stream that is pH-neutral (e.g. sodium sulphate solutions)
- ▶ A safe process at ambient conditions
- ▶ Better selectivity of metals, higher product quality
- ▶ Removal of 'difficult' dissolved metals such as manganese, selenium and thallium
- ▶ A flexible, robust and proven process used in 15 years of full-scale installations
- ▶ No noticeable release of smell
- ▶ Reduced eco-toxicity of effluent

Working principle

The core of SULFATEQ™ is a two-step process. The first step reduces biological sulphate by converting it into dissolved sulphide in high-rate bioreactors. This bioprocess uses an energy source such as alcohol or hydrogen gas. The second step oxidises the sulphide to elemental sulphur with plain air and separates it from the liquid. An additional step can be added to the core processes for the recovery of valuable metals.

Related products: [THIOTEQ™](#) for metal removal/recovery of effluent that contains low metal concentrations.

SULFATEQ™ cases

Anglo Coal



Acidic mine water treatment without lime...

Nyrstar Zinc Refinery



Zinc refinery free of solid waste ...

Lenzing AG



Viscose fibre producer solves three problems with one soluti...

Anglo Coal

3000 m³ päivässä vastaa 1 100 000 kuutiota vuodessa. $7\,000\text{kg} / 3000\text{m}^3 = 2.33\text{ g/L}$ lähtöpitoisuus.

en.paques.nl/about-us/subpages/cases/anglo-coal-en/3



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Anglo Coal

Acidic mine water treatment without lime

South African Coal Estates (SACE) is a division of Anglo Coal and operates the coalmine at Landau Colliery in South Africa.

Processing of the coal results in a sulphate-rich effluent. Part of the sulphate is removed with lime precipitation but this produces an effluent that is oversaturated with gypsum. As a result, scaling occurred piping that resulted in high maintenance costs.

In 2003, Paques commissioned a SULFATEQ™ plant that removes seven tonnes of sulphate per day from 3000 m³ per day. Sulphate is removed to 300 mg/l and metals like iron and manganese are removed. The water is re-used as process water on the site.

Client



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Olettaen, että toisella Sulfateq:illa on sama kapasiteetti käsiteltävän veden määrä on
 $230 \text{ m}^3/\text{h} \times 24 \text{ h} \times 365 \text{ h/a} \times 2 = 4\,200\,000 \text{ m}^3/\text{a}$

Nyrstar Zinc Refinery

Zinc refinery free of solid waste

Nyrstar operates a zinc refinery in Budel-Dorplein in the Netherlands where 450 employees produce 260,000 tonnes of zinc per year. The subsidiary is owned 100% by Nyrstar, the world's biggest producer of zinc and a leading company in lead, silver, gold and copper. The production process produces two bleed streams that require treatment: a weak acid from the wash tower and an electrolyses bleed.

Traditionally, acidic streams are treated using lime to neutralise acid and to precipitate metals. This conventional treatment created a large amount of contaminated gypsum that was stored around the smelter. In over a hundred years of zinc refining the contaminated groundwater underneath the plant had become polluted with sulphate and heavy metals like zinc and cadmium. A geohydrological containment system (GHS) was installed to avoid further spreading of the pollution.

In 1992, Paques designed and built the first full-scale SULFATEQ™ to treat the water from the GHS with a design flow of 230 m³/h.

From July 2000, legislation prohibited further production of solid residues at the site. This meant that an alternative had to be found for the lime neutralisation of acid bleeds from the gas treatment and zinc electrolysis.

Various alternative water treatment processes were studied to find a process that avoids the production of solid or liquid waste. A second SULFATEQ™ installation was commissioned to neutralise the acid with calcine, and to convert the dissolved zinc sulphate into zinc sulphide and elemental sulphur, which are recycled to the roaster. As a result, the site does not produce solid waste and can be regarded as the first solid waste-free zinc refinery.

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Cargill

Sulphate removal from starch processing water

A Dutch operation of starch processing company Cargill treats its sulphate-rich water with an anaerobic bioreactor. This produces biogas that is rich in hydrogen sulphide. Cargill chose THIOPAQ® technology to remove the hydrogen sulphide, which enables them to meet the legislation for sulphate discharges. Also, two of Cargill's production sites in the USA apply THIOPAQ® biogas desulphurisation.

Client



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Lenzing AG

Viscose fibre producer solves three problems with one solution

Lenzing A.G. from Austria is a world leader in viscose fibre production from wood. In 2009 they produced 568,600 tonnes. Their main site is in Lenzing, Austria.

The manufacture of viscose fibres from wood produces a range of secondary compounds. Some streams, such as polluted sodium sulphate, cannot be reused and need to be discharged. Waste organic pollutants are degraded in a large aerobic wastewater treatment plant. In 2001, the maximum allowable sulphate discharge was reached which hindered further expansion of the production site.

A SULFATEQ™ system was installed in 2002 to treat three different streams, both acidic and alkaline. This installation converts three types of dissolved compounds: organic material (COD), sulphate and zinc. The plant produces sulphur and zinc sulphide. Here is a simplified representation of the flow scheme:

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LENZING

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Hulshof Royal Dutch Tanneries

Treatment of complex tannery wastewater with Paques technologies

The Hulshof Royal Dutch Tanneries was founded in 1876. It is one of the largest European producers of high quality upholstery leather, processing many thousands of hides every week for the furniture and aviation industry. The leather is both produced and specially finished at the Royal Dutch Tannery.

Motivated by the wish to reduce the amount of solid waste produced combined with increasing demands for the removal of sulphate, chloride and nitrogen, Hulshof outsourced their wastewater treatment to Waterstromen BV in 2001. Paques constructed a new plant for Waterstromen two kilometres outside the town of Lichtenvoorde where the tannery is located.

The new plant consists of anaerobic treatment of sludge and wastewater combined with biological sulphide oxidation and the Paques' process for nitrogen removal. COD, sulphate, sulphide, chromium and nitrogen are all removed to low levels. The amount of solid waste was significantly reduced compared to the earlier physical/chemical treatment. The biogas generated in the treatment process is used to produce electricity.