



## BIOTEQ SOLVES SULPHATE SCALING ISSUES

Sulf-IX was designed for the mining sector, but the Vancouver clean tech company is targeting other industries.

BY MATT POWELL, ASSISTANT EDITOR

Water is big business these days, and the riches aren't limited to those companies that produce the type bottled for human consumption.

It's the life breath of industrial sites everywhere, especially those that extract resources from the ground. In fact, water infrastructure spending is expected to exceed \$13.6 billion by 2014, according to a 2012 report by UK-based industry research firm Global Water Intelligence.

These are notoriously dirty industries. Chemically enhanced treatment solutions are necessary. But governing bodies around the world are tightening environmental regulations.

That's where BioteQ Environmental Technologies Inc. comes into the picture. The Vancouver-based clean technology company, which employs a team of 78 worldwide, including 30 at two Lower Mainland facilities, develops industrial wastewater treatments for the mining and energy sectors, and is aiming for a slice of the multi-billion water infrastructure pie.

Its efforts are paying off.

The company's revenues ballooned by 27% to \$9.4 million last year, thanks in part to the introduction of its Sulf-IX ion exchange technology, which removes sulphate and calcium from wastewater treatment plants in the mining sector.

BioteQ claims its technology recovers up to 99% of feed water for re-use, and compared to alternate processes such as membranes, cuts life-cycle costs for water treatment because it lowers capital and energy costs, energy consumption

and reduces a facility's carbon footprint.

"Mining companies are looking to treat wastewater to a higher standard, an objective driven partly by regulation, but also as a cost relief tool to cut water costs," says David Kratochvil, BioteQ's president and chief technology officer.

An increased reliance on low-grade ores requires more water per tonne of refined product.

"When you think about who's consuming the most water, its industrial. Those industries include mining and power generation, and most mineral processes depend on water, so our opportunities are significant."

Sulf-IX was initially developed for the mining industry to remove calcium hardness and sulphate from lime plant discharge, and to comply with tighter sulphate regulations.

"Until recently, regulators were confident lime addition was enough to clean up the water in mining operations – it worked fairly well," says Kratochvil. "But lime addition doesn't remove sulphate, which can cause major headaches."

Metals and the associated acidity in wastewater have typically been removed by precipitation and neutralization by adding lime, normally as calcium hydrox-

ide. A reaction with lime removes metals as hydroxides and also causes the removal of sulphate as gypsum dihydrate.

But the effluent from a lime plant will always contain soluble sulphate due to the solubility of gypsum. Consequently, lime plants in many jurisdictions can't produce effluents with a sulphate concentration low enough to meet current regulated values. Most metals are extracted from ore bodies containing minerals that contain sulphur atoms that oxidize to sulphate during the metal extraction process, or due to natural oxidation processes in the waste rock and tailings.

"Sulf-IX gives us the capacity to selectively remove hardness and sulphate, and clean the water up to the point that it's reusable without the possibility of scaling," says Kratochvil.

### Lower sulphate limits

Sulphate is a form of salt that's found in a range of industrial activities, including lime plant effluent, metallurgical process streams, refinery wastewaters, shale gas frac water, cooling tower blow-down and make-up water, flue gas desulphurization blow-down, ash pond water, steel manufacturing wastewater and landfill



Columns house fluidized beds where the ion exchanges process takes place.



Top: BioteQ's Sulf-IX demonstration plant in Arizona was commissioned in the summer of 2012. Above: Clarifiers thicken and precipitate gypsum during resin regeneration. PHOTOS: BIOTEQ

leachates. Regulators are pushing for increasingly stringent sulphate limits. For example, the state of Minnesota has proposed sulphate limits as low as 10 parts per million (ppm), which is several orders of magnitude below effluent found in a lime plant, according to a Sulf-IX research report.

Sulphate is not toxic except at high levels, but it can cause taste and odour problems in drinking water, affect agriculture and cause scaling in industrial processes where water re-use is necessary.

"When you're not addressing a sulphate issue, you'll have water that's incredibly hard to treat because of the high concentrations," says Kratochvil.

Sulf-IX uses cation exchange resin to remove calcium and magnesium; anion exchange resins remove sulphate. They're regenerated using low-cost reagents.

Feed water passes through a series of cationic columns to load calcium onto the cationic resin. Water then passes through anionic columns to load sulphate onto the anionic resin.

The resins, which have a finite loading capacity, must be re-generated once they're fully loaded. Sulphuric acid is

used to regenerate cationic resin, while lime is used to regenerate the anionic resin. Both form a resalable solid gypsum by-product that's separated from spent regenerant solution in a clarifier.

Sulphuric acid is added to the re-freshed regenerant, while the solution is recycled for resin generation in subsequent resin cycles.

In the right application the cationic and anionic stages operate independently. The cationic stage can be used as a stand-alone water softening system for the removal of calcium, while the anionic stage treats a stream of dilute waste sulphuric acid.

BioteQ says the gypsum product is a pure, non-toxic, non-hazardous solid product that could be used as a building product in-fill and as a fertilizer ingredient.

"The gypsum by-product is actually cheaper to get rid of because it doesn't require the additional treatment or special handling that liquid brine and other environmentally harmful waste products would need," says Kratochvil.

Sulf-IX also has applications in power generation. It can be used as a cooling media in blow-down scenarios. Traditionally, about 60% of a plant's energy and fuel aren't turned into power. Instead it becomes heat that must be dissipated with water.

"After that water is heated, it has high levels of sulphate and calcium, which makes it hard to re-use. Sulf-IX addresses those issues."

In April, BioteQ sold its stake in a mobile Sulf-IX™ pilot plant to strategic partner Newalta Corp. for \$500,000. Newalta, an industrial waste management and environmental services firm based in Calgary will tour the pilot around industrial sites for on-site field testing, specifically in the mining sector.

The partnership may also allow BioteQ to see how Sulf-IX performs in oil and gas operations, where Newalta does most of its work.

"Newalta is looking to us to provide them with a tool to enter new markets, such as mining," says Kratochvil.

The company, which was founded in 1998 as Biomet Mining, now holds contracts with mining companies, utility operators and regulators to build and operate industrial water treatment plants in Canada, the US, Mexico, Australia and China that handle more than 24,000 cubic metres per day.

Because of BioteQ's small size, it's able to handle custom projects that often carry higher profit margins.

"You've got giants like General Electric and Siemens that are the commoditizers; they're all about volume," he says. "They have the technology, but they're focused on membrane technology, and about 95% of that market is focused on desalination."

That leaves only 5% of the total membrane market for customized industrial type treatments.

And as sulphate regulations for industrial sites tighten, that's where BioteQ intends to dominate.

Comments? E-mail [mpowell@plant.ca](mailto:mpowell@plant.ca).

# No APOLOGIES

## OUR FUTURE AND THE OIL SANDS

Canadians need to better understand how responsible energy development will fuel the country's prosperity.

BY BRUCE GRAHAM

At its core, Canada is an export nation. Our largest export is oil and gas and we're lucky to have the third largest oil reserves in the world – 97% of them located in the oil sands in Northern Alberta.

We've gained the skills to exploit these reserves in an environmentally responsible manner and to export them primarily via pipelines using innovative technology that is subject to tough environmental regulation.

During the next 25 years, the oil sands are expected to contribute over \$2.1 trillion to the Canadian economy – about \$84 billion a year. That money goes to all parts of Canada creating jobs and fuelling industry. Over that same period, the oil sands are expected to contribute about \$311 billion in federal taxes to help pay for Canada's health, education and social programs. And new oil sands investments are predicted to grow Canada's oil sands-related jobs from 75,000 in 2010 to 905,000 in 2035 – creating 126,000 jobs in provinces other than Alberta.

The energy sector remains the largest employer of Aboriginal people, and in 2010 purchased about \$1.3 billion in goods and services from Aboriginal-owned businesses.

So why, given the enormous importance of this industry, does the energy sector need to apologize? Canada has some of the toughest environmental and human rights laws and regulations. Oil sands greenhouse

gas emissions account for 1/600th of the world's carbon emissions and, through the ingenuity of Canadians, those emissions have been declining since 1990, by 26%.

Canada is also developing world-leading carbon capture and storage projects. In fact, a Calgary-based company is among the finalists in the Virgin Earth Challenge for carbon negative technology.

Alberta's oil sands and Canada's extensive pipeline network are highly regulated and closely monitored.

New proposed pipelines such as Northern Gateway will be among the most advanced and safest pipelines in the world, which will include sophisticated computerized monitoring systems, aerial patrols, routine inspections and detailed education outreach to local landowners and communities.

Unfortunately many Canadians simply don't understand how important the oil sands and the pipeline networks that transport this oil are to the nation.

As the University of Calgary's Jean-Sebastien Rioux notes, Canada is in danger of having a general population that's divorced from the process of wealth creation from the responsible development of renewable and non-renewable resources. They account directly for more than 15% of GDP, and about 20% if the purchase of goods and services such as construction, machinery, professional services and transportation are included.

Canadians need to realize the importance of diversifying our energy market beyond the US. Canada loses \$50 million a day or \$17 billion a year because the US demands a discount on the international market price.

If Canadian oil could reach tidewater via a pipeline system such as the Northern Gateway to the West Coast, we could export to other nations – China being one – and eliminate this discount, meaning more



Alberta's oil sands and Canada's extensive pipeline network are closely monitored.

PHOTO: THINKSTOCK

money in provincial and federal coffers, and more jobs. Similarly moving product east via TransCanada's converted gas pipeline to Quebec and New Brunswick provides additional opportunities for export.

Building and operating pipelines can be done in a safe and environmentally sound manner. The focus must now be on doing a better job of educating Canadians on the importance of this natural resource.

Bruce Graham is the president and CEO of Calgary Economic Development. This column is distributed by Troy Media in Calgary. Visit [www.troymedia.com](http://www.troymedia.com).



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