Additive cuts oil field water usage

Huge savings in water use during crude oil extraction can be achieved with a versatile polymeric additive developed by Global Green Products

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US-based Global Green Products (GGP) has developed *Water-Tek*, a biodegradable and environmentally friendly polymer product that can reduce the amount of fresh water needed to operate oil wells. It works by inhibiting the formation of sodium chloride and other mineral scales in extraction equipment.

In a number of oil-producing areas, the water that comes up with the oil is a saturated brine. When the temperature or pressure in the system is reduced, the sodium chloride crystallises out of the water, plugging the pumps and oil lines and potentially shutting down the well.

To solve this problem, operators pump fresh water down the well to dilute the brine. Last year, the 12,000 wells in the Bakken oil shale area in North Dakota, US, used 70m barrels of fresh water. The cost of pumping, transporting and disposing of the water amounted to around $16/barrel, or over $1.1bn in total last year.

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LARRY KOSKAN
President, Global Green Products

Using *Water-Tek* means up to 80% less fresh water is required. An added bonus is an increase in oil yield of up to 10% because with less water in the system, more oil can come out of the well.

"The cost savings realised by using *Water-Tek* are significant. Operators are just starting to take notice," says Larry Koskan, president of GGP.

Water-Tek resulted from a request by a customer who wanted something to stop sodium chloride from crystallising so he could reduce the amount of fresh water he was using. Koskan was sceptical initially as he did not know of anything that could prevent the crystallisation of sodium chloride. But he saw an opportunity to open up a new market if he could develop a technology that could meet the customer's needs.

It took researchers at GGP nearly two years to develop the chemistry in *Water-Tek*. Commercial production started in 2012 and *Water-Tek* is now used in hundreds of wells. It has applications across the world in areas with similar conditions, such as Texas in the US, Canada, the North Sea and the Brazilian and West African offshore fields, as well as the Middle East.

The *Water-Tek* molecules work by providing a medium on which mineral crystals can nucleate, halting their growth and preventing the crystals from sticking to surfaces or settling out in the water. The process also gives the mineral crystals an electrostatic negative charge that stops them from attaching to other particles.

The starting point for *Water-Tek* is the amino acid L-aspartic acid. GGP makes a polymer from the L-aspartic acid that resembles a protein. Using catalytic chemistry, GGP has developed a series of products based on the same peptide backbone but with different molecular weights, which are suitable for inhibiting different types of scale in addition to the sodium chloride.

For example, the shorter-chain polymers are good at inhibiting calcium carbonate build up, whereas the longer-chain ones work well for barium sulphate scales. Which product a customer uses will depend on a number of factors, such as the dissolved minerals in the water, pH, and temperature and pressure of the well.

"*Water-Tek* is a multifunctional polymer system," says Koskan. "It not only inhibits the formation of sodium chloride, but also handles other scales such as calcium carbonate, calcium sulphate and barium sulphate scale that eventually form from the use of fresh water."

Using the same peptide backbone, GGP is also working on attaching different functional groups to the polymers and has several patents on this technology. The company is also developing a corrosion inhibitor for the oil and gas industry using this approach and has started work to develop a dry product and engineered feed system for oil field applications.

Global Green Products

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R&D APPROACH

GGP's research and development (R&D) is driven by a combination of market awareness and environmental stewardship. This comes from its relationships with customers and operators all over the world. The company, located in the Chicago area, operates laboratories within Trinity Christian College. It leases the lab space and works cooperatively with the college.

Koskan sees plenty of potential for the next 20 years. "Our technology allows us to develop a broad array of different chemicals and chemistries," he says. "In the lab we've made things like superabsorbents using the same type of polymer chain. We're looking forward to getting this chemistry into additional industries such as industrial water treatment, as well as detergents and cleaners. Everywhere that a polyacrylic acid or phosphorus-containing material is used that's not biodegradable or environmentally friendly, our material can substitute," says Koskan.

"There's a lot of room to grow in the next 20 years or more," he says. ■