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THE UNIFORM EFFECT

DEEPA: improving water injection rates in San Andres dolomite

"The uniform increase in rock permeability that DEEPA can achieve is extremely impressive and completely different to the results obtained with conventional acidizing systems."

Core Lab Manager.

In addition to the growing use of DEEPA for increasing well production, using DEEPA to improve injection rates can improve water flooding operations. Deployed in a water injection well in the San Andres field in West Texas, DEEPA exceeded the target of a 20% injectivity improvement by increasing the matrix permeability of the dolomite formation, without any increase in injection pressure.

The challenge

The operator wanted to increase water injection rates by 20% to enhance oil production but did not want to fracture the injection wells, as this would have been likely to have a highly adverse effect on sweep efficiency. The previous injectivity of the first well to be treated had been about 44 bwpd at 1840 psi. The operator believed that a rise in injectivity could be achieved by improving the formation matrix permeability. Modelling indicated that a threefold increase in matrix permeability across a zone of 10 foot radius should produce an injectivity rise of 20% – but only with the right treatment.

The solution

Until DEEPA was developed, uniform acidizing to improve rock permeability has been almost impossible to achieve with conventional acids which react on contact with the carbonate formation, forming wormholes rather than uniformly acidizing the whole rock matrix. Theoretical studies have shown that the ideal matrix acidizing system is one where no reaction takes place while the acid is pumped into the reservoir. DEEPA is proving to be close to that ideal.

With DEEPA matrix acidizing treatments, over 95% of the total acid produced is generated in-situ, downhole after the treatment fluid is pumped to fill the rock matrix. This provides excellent uniform acidizing throughout the zone and highly effective matrix stimulation.

DEEPA in action

Laboratory evaluation confirmed that the rock permeability could be increased by applying the DEEPA treatment formulation. Core plugs were cleaned with chloroform and methanol, and were then measured to determine helium porosity and air permeability. Once the cores were ready, they were flooded with the DEEPA formulation. Following treatment, the permeability to 3% KCl was measured again. The DEEPA treatment resulted in a threefold increase in permeability. Increased permeability is due to organic acid, produced by DEEPA, dissolving carbonate material (dolomite) within the core.

The same DEEPA formulation was used in the field. The components were mixed on site and pumped about 3 metres (10 feet) into the rock matrix. After leaving for the required period of time for in-situ acid generation to take place, the spent treatment fluid was back produced.

The result

Following DEEPA treatment, injectivity rose from about 44 bwpd at 1820 psi before the treatment to a sustained 60 bwpd at 1800 psi, which was greater than the 20% increase predicted in the modelling.

Analysis showed elevated levels of calcium ions in the back produced water, compared to the make-up and formation waters, indicating that dissolution of carbonate had Indeed occurred.

The well was undamaged initially, indicating that the increase was a result of an increase in the matrix permeability, and not damage removal. Increasing the injection rate through deep matrix acidizing avoided the need to fracture, which could have had highly adverse effects on sweep efficiency.

The operator was so impressed with the San Andres results that further DEEPA treatments were carried out at many more of their wells.

Get in touch

Cleansorb has a team of DEEPA specialists to advise you on the best strategy for your circumstances. Please e-mail **contact@cleansorb.com** for more information.

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