

Removal of Scales in Petroleum Production Tubing Utilising High Pressure Atomisers

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Abstract

Scale is a mineral deposit usually formed on surfaces in contact with water. Scale deposition in petroleum production wells can be attributed to mixing of incompatible waters, changes in thermodynamic, kinetic and hydrodynamic conditions in oilfield operations.

Scale creates serious problems in producing, injection and waste disposal wells. It may restrict and completely plug off production in the formation, tubing or in flow lines. Scale prevention using chemical and mechanical methods are limited in application and depend on the type of well completion method used. This investigation proposes a new technique to address the problem and lay the foundations for a methodology for descaling in-situ production in oil and gas wells. The technique uses flat fan atomiser to produce high water pressure of 6 MPa, flow rate of 23 l/min and high impact force of 0.657 MPa which are used to dislodge scales build-up along the production tubing. Simulated laboratory scale removal rig was designed and built to demonstrate the effects of using overlapping flat fan spray atomisers to remove scales that were formed in oil and gas production tubing. This non-destructive method provides significant advantages over current scale removal methods that involve the use of chemicals or other harmful substances which are impediments to the environment and can also affect the integrity of the pipe.

Three scale samples from oil and gas wells from North Africa and one laboratory prepared candle wax scale were tested using single flat fan atomiser and a combination of two and three high pressure and high impact force atomisers. The Volume of Scale Removed (VSR) was measured experimentally using a combination of atomisers, at different spray angles, downstream distances, and water supply pressures and spraying times. The maximum quantity of scale removed using the soft candle wax was found to be 53 cm³ at spray cone angle of 30 degree at 75 mm downstream distance from the atomisers exit. Moreover, the volume of scale removed from other three samples was found to be 11.688 cm³ for the soft gas scale, 13.750 cm³ for the oil wax scale and approximately 0.989 cm³ for hard scale sample at 75 mm downstream distance.

KEYWORDS: Scale removal, Flat-Fan atomiser, Overlapping spray

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