RINGKASAN

Lapangan Ramba yang dikelola oleh PT Pertamina Hulu Rokan Zona 4 di Sumatera Selatan menghadapi tantangan serius dalam produksi migas, khususnya pada struktur Bentayan. Penurunan produksi yang signifikan, yaitu *decline rate* sebesar 15% per tahun, banyak disebabkan oleh kenaikan kadar air (*water cut*), seperti RA-130 dan RA-128. Permasalahan ini diperparah oleh buruknya kualitas semen di belakang casing serta rendahnya keberhasilan water shut off akibat penggunaan semen konvensional (*Class G*) yang sulit menembus zona *tight* di *Talang Akar Formation* (TAF). Oleh karena itu, dibutuhkan evaluasi dalam *squeeze cementing* untuk mengatasi *channeling* yang menjadi sumber utama masalah.

Metode yang digunakan dalam tesis ini mengacu pada analisis teoretis dan praktis dalam teknik *squeeze cementing*, termasuk evaluasi log CBL-VDL, USIT, dan *Chan Diagnostic Plot* untuk mendeteksi jenis dan lokasi masalah produksi air. Selanjutnya, digunakan ultrafine cement dengan ukuran partikel 3–5 mikron yang memiliki kemampuan tinggi untuk menembus mikro anulus dan pori-pori di belakang casing. Prosedur teknis mencakup perhitungan volume *slurry*, tekanan *squeeze*, serta metode pemompaan. Evaluasi keberhasilan dilakukan melalui peningkatan *cement bond index*, *compressive strength*, dan pengamatan perubahan performa produksi pasca perlakuan.

Penerapan *ultrafine cement* terbukti efektif dalam menutup saluran air dan meningkatkan kualitas penyemenan, terbukti dari penurunan nilai CBL amplitude (<10 mV), compressive strength Sumur RA-130 meningkat menjadi 1051 psi dan bond index mencapai 0,76, compressive strength SNA-01 mencapai 1729 psi dan bond index meningkat menjadi 0,87. Selain itu, Sumur RA-130 mengalami peningkatan laju produksi minyak sebesar 34 BOPD dan WC menurun dari 100% menjadi 97%, Sumur SNA-01 meningkatnya laju produksi minyak sebesar 151 BOPD dan WC turun dari 99,5% menjadi 83%. Kesuksesan *Ultrafine cement* dapat menjadi solusi *squeeze cementing* khususnya di *tight reservoir*, sehingga memberikan dampak positif terhadap efisiensi biaya dan keberlanjutan produksi.

Kata Kunci: ***Chanelling, squeeze cement, ultrafine cementing, tight formation.***

ABSTRACT

Ramba Field, operated by PT Pertamina Hulu Rokan Zone 4 in South Sumatera, faces significant challenges in oil and gas production, particularly in the Bentayan structure. The field experiences a high production decline rate of approximately 15% per year, largely attributed to increasing water cut levels, as observed in wells RA-130 and RA-128. This issue is exacerbated by poor cement quality behind the casing and the low success rate of water shut-off operations due to the use of conventional Class G cement, which is difficult to inject into the tight Talang Akar Formation (TAF). Therefore, an evaluation of squeeze cementing is necessary to address channeling, which has become the primary cause of excessive water production.

The methodology used in this thesis is based on both theoretical and practical analysis of squeeze cementing techniques, including the evaluation of CBL-VDL logs, USIT, and Chan Diagnostic Plots to identify the type and location of water production issues. Ultrafine cement with a particle size of 3–5 microns was utilized, which provides superior penetration capability into micro-annuli and pore spaces behind the casing. The technical procedures included slurry volume calculations, squeeze pressure determination, and pumping methods. The effectiveness of the treatment was evaluated through improvements in the cement bond index, compressive strength, and observed changes in well production performance post-treatment.

The application of ultrafine cement proved to be effective in sealing water channels and improving cement bonding quality. This was evidenced by the reduction in CBL amplitude values (<10 mV), the increase in compressive strength of Well RA-130 to 1051 psi with a bond index of 0.76, and for Well SNA-01 to 1729 psi with a bond index of 0.87. Additionally, Well RA-130 showed an oil production increase of 34 BOPD and a water cut reduction from 100% to 97%, while Well SNA-01 achieved an oil production gain of 151 BOPD and a water cut decrease from 99.5% to 83%. The success of ultrafine cement demonstrates its potential as a viable squeeze cementing solution, especially in tight reservoirs, offering positive impacts on operational cost efficiency and long-term production sustainability.

Keyword: Chanelling, squeeze cementing, ultrafine cement, tight formation