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A successful small scaled field testing of surfactant flooding in a waxy oil reservoir, Tanjung field, Indonesia - A case study

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Small scaled surfactant flooding test was implemented field at Tanjung Field. Zone A reservoir selected for this test has estimated IOIP at 193.7 MMSTB. The current recovery factor is 16.3%. This field had been produced since 1961 under primary depletion until 1989. At 1990 pilot waterflood was started and since 1995, this field has been undergoing full scaled water injection until today using peripheral pattern. Zone A is a very tight conglomeratic sandstone layer that has effective porosity (Φ) of 21%, average initial water saturation of 35%, and permeability (k) of tens to hundreds md. The oil gravity is 40°API, wax content is 36%, dead oil viscosity (μ_o) is 7.9 cP (live oil viscosity is 1.14 cp), initial reservoir is 1600 psi, bubble point pressure is 1357 psi and reservoir temperature is 150°F. A type of Alkyl Carboxy Etoxylate surfactant was used and was formulated further suited to oil and characteristic of reservoir. This formulation was optimized using salinity scan method and addition of co-solvent to obtain Type III phase behaviour and low IFT of 10-2 mN/m (initial oil-brine IFT was 18.3 mN/m). It was stable up to 150°F for three month. Core flooding experiment was conducted using native core, brine and oil. After saturation of core to established initial water and oil saturation, brine was injected until 100% water cut followed by slug of 0.2 PV surfactant solution (2% w/w concentration) then by water injection. Incremental oil recovery was 25%. Small scaled field testing was conducted by selecting pair of injector-producer that was at close distance and has good connectivity between them. The primary objective is to confirm the surfactant performance at the field. The response should be quick enough and be cost efficient to enable further review. The injection pattern was a line drive like with target reservoir pore volume is 10,625 bbl. Total cost of this test was only USD 61,812 (include chemical and operational costs) and oil production was increase up to three times. This surfactant flooding test is started at 18th of January, 2016 and injected continuously for four days followed by water injection. First oil production gain was recorded after surfactant slug was completed and it has been maintained until 22nd of June, 2016 and counting. Incremental recovery of this small scaled testing is 72.4%.

Biography

Taufan Marhaendrajana obtained his PhD degree from Texas A&M University and currently he is Head of Graduate Study Program of Petroleum Engineering at Institute Technology Bandung.

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