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Research and application of compound viscosity reducer in ultra-heavy oil wells

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Heavy oil is an important part of the world's oil and gas resources, accounting for 53% of the total. Along with the decreasing of light oil recoverable reserves, the efficient development of thick oil will largely reduce oil shortage situation. However the exploration of ultra-heavy oil has become China and even the world's most representative and challenging problem. The ultra-heavy oil reserves of Tahe oil field proved 750 million tons is the most abundant in China. Currently, the main chemical technology of reducing viscosity in Tahe oil field is oil-soluble viscosity reducer and water-soluble emulsification viscosity reducer. But oil-soluble viscosity reducer can work well only when it interacts well enough with resin and asphalt molecules in heavy oil and the conditions at the bottom of the wells have great effect on its application. Normal water-soluble viscosity reducer cannot emulsify ultra-heavy oil and has problems of demulsification hard and difficult to deal with the sewage. So, it was urgent to develop more efficient viscosity reducer for ultra-heavy oil. In this paper, a new compound viscosity reducer SDG-2 was researched. The efficient compound viscosity reducer combines dispersion and emulsification effects. It can achieve the aim to reduce viscosity of ultra-heavy oil dramatically through strong synergistic effect. Field testing of the new developed compound viscosity reducer was carried out in the Tahe Oil field of Xinjiang.

Emulsification effect comparison of SDG-2 and water-soluble viscosity reducer: The compound viscosity reducer SDG-2 and emulsifier was added respectively to the system in which w(water):w(heavy oil)=8:2 and the both fraction was 1%. The two obtained mixtures were homogenized simultaneously at 6,000 rpm for 4 min at 50°C using FM200 high speed homogenizer. And then their emulsification effects were observed. The solid ultra-heavy oil with viscosity of 1.81×10^5 mPa.s was converted into liquid with SDG-2, while commercial water-soluble viscosity reducer cannot; there was still a part of heavy component difficult to disperse existing.

Influence comparison of SDG-2 and oil-soluble viscosity reducer on oil-water interfacial tension: SDG-2 and oil-soluble viscosity reducer were added to 10% Tahe1# model oil, separately, with different concentrations ranged from 0.2 wt% to 1 wt% , and stirred to make the oil phase, and formation water was used as aqueous phase to study the oil-water interfacial tension.

Field test of the SDG-2: The field test of the SDG-2 was carried out for two months in two machine pumping wells Tahe2# (containing water well) and Tahe3# (not containing water well). The results showed that after using SDG-2, oil recovery was enhanced by 24% and 21%, in normal circumstances, the relative savings rate of light oil was 76.25% and 64.4% each day, respectively.

Biography

Yuqi Yang is a Student from China University of Petroleum, China.

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