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Research on the microscopic movability characteristics of tight oil with different injection media huff and puff based on NMR technology: A case study of Qinghai Oilfield

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Huff and Puff is an important means to supplement formation energy in the development of unconventional petroleum resources. In this paper, the physical simulation experiments of different injection media huff and puff are carried out by taking the plunged-sample cores of Qinghai oilfield as experimental samples. By means of nuclear magnetic resonance(NMR) technology, the characteristics of oil movability in pore throats of different sizes are quantitatively studied from a microscopic perspective.The influence of soaking time, permeability and wettability on recovery degree is analyzed.The results show that the oil displacement efficiency increases exponentially with the increase of soaking time.The soaking time of water and fracturing fluid huff and puff should not be too long. On the premise of ensuring economic cost, the soaking time of surfactant huff and puff can be appropriately extended. The soaking time of CO2 huff and puff should take into account the pore structure and permeability characteristics of the reservoir, because gas channelling will occur in the reservoir with fractures if the soaking time is longer. Reservoir wettability is of great importance to the development effect of water and surfactant huff and puff. During water huff and puff, imbibition in small pores is dominant in hydrophilic reservoirs, while large pores are mainly movable in lipophilic reservoirs by displacement pressure difference. The movability of small pores is dominant in the early stage and that of large pores in the latter stage. If the surfactant is well performed on the reservoir, the oil film stripping of large pores is faster and predominates. If the surfactant is poor performed on the reservoir, the imbibition of small pores dominates. CO2 huff and puff mainly moves oil in large pores. In a comprehensive comparison, CO2 has the best huff and puff effect and water has the worst huff and puff effect. The oil displacement efficiency of fracturing fluid and surfactant huff and puff depends on the compatibility of the selected surfactant with the reservoir. This study provides a theoretical basis for the selection of injection medium and soaking time for the development of tight oil reservoirs in Qinghai oilfield.

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