

New Chemical EOR Process for Bakken Shale

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There is a new chemical EOR process available for the Bakken shale. In this concept a custom surfactant agent may be incorporated into standard hydraulic fracturing treatments in these rock units to increase oil recovery. These are from the Late Devonian to Early Mississippian age occupying about 200,000 square miles (520,000 km²) of the subsurface of the Williston Basin, covering parts of Montana, North Dakota, and Saskatchewan. The rock formation consists of three members: lower shale, middle dolomite, and upper shale. The shales were deposited in relatively deep marine conditions, and the dolomite was deposited as a coastal carbonate during a time of shallower water. The middle dolomite member is the principal oil reservoir, roughly two miles (3.2 km) below the surface. Both the upper and lower shale members are organic-rich marine shale.

There are significant reservoirs of oil in the Bakken shale. An April 2008 USGS report estimated the amount of technically recoverable oil in the Bakken Formation at 3.0 to 4.3 billion barrels. Production from the Bakken has been limited in the past, but now has become a very active area of development with the widespread advent of drilling horizontal wells and large-scale hydraulic fracturing treatments. A key to the economic production rates of oil from these formations is to have an intense, well-connected fracture system.

Laboratory experiments demonstrate that specialized surfactant formulations may be created that will interact with this mixed- to oil-wet low permeability formation to produce more oil. Specifically, including such a surfactant chemical formulation in an aqueous phase (e.g. hydraulic fracturing fluids) will promote the spontaneous imbibition of this fluid into the tight matrix containing high oil saturation. This promotes expulsion of oil otherwise trapped in place to appear in the fracture system and then be produced into the wellbore. Thus including this surfactant agent in fracture fluids or in other aqueous-based well treatment fluids will produce additional oil.