MEOR Presents Another Opportunity To Improve Recovery

I had the opportunity to attend the 19th SPE Improved Oil Recovery Symposium last month in Tulsa. This biennial event, which is held in the heart of the Mid-Continent, has established a track record over the past 40 years of showcasing the latest research and innovations in improved oil recovery. Originally developed to serve the needs of operators working in mature fields, the theme of this year’s event was “Explore the Possibilities,” and it included technological advances in traditional IOR as well as the emerging development of improved recovery technologies for unconventional reservoirs.

As many operators know, improved oil recovery has been a staple of operations in the United States for many years. However, as oil demand grows around the world, and with new discoveries being made each day, IOR practices and technology are being embraced internationally. In fact, more than 30 countries were represented at this year’s IOR Symposium—each looking for insights and techniques aimed at enhancing production in its home fields of operation.

One emerging technology that struck me at this year’s event was the significant interest in microbial enhanced oil recovery. In its most basic terms, the MEOR process uses “bugs”—actually microorganisms—in the reservoir to improve oil recovery. These microorganisms can be either naturally occurring within the reservoir or injected into the reservoir, depending on the goals of the operator and the natural abilities of the resident organism population.

For the bugs resident within the reservoir, nutrients designed to increase the population of desirable micro-organisms are injected to speed the natural beneficial processes of those organisms. In other cases, bugs selected to meet the needs of a certain reservoir are injected directly down hole to achieve the same result.

Using micro-organisms can improve oil recovery in a variety of ways, including by releasing gases that can increase the pressure of the reservoir naturally, modifying permeability by forming biofilm, or producing surfactants and extracellular polysaccharides, which can improve mobility control.

In “The Effectiveness of MEOR Permeability Modification beyond the Wellbore” (SPE 169060), Scott Jackson and his colleagues discuss how biofilms produced from microbes can reduce the permeability of high-perm streaks and improve sweep efficiency. The authors’ approach is to inject a specific microbe that, under the right nutrient conditions, will produce biopolymer and cells that form a film on the surface of the rock grains.

This “biofilm” can restrict the size of pore throats and reduce permeability, which can be beneficial, unless it occurs near the wellbore, in which case it can cause loss of injectivity. To address this issue, the researchers developed a protocol that not only modifies the permeability, but also controls its placement well beyond the injector wellbore, thereby avoiding wellbore formation damage. The authors maintain their process is very reliable, although variations can occur, depending on the specific treatment used.

Another paper discussing MEOR technology presented a workflow case study conducted on a field in Germany. “An Integrated MEOR Project: Workflow to Develop a Pilot in a German Field” (SPE 169151) was a collaboration between university and commercial researchers in Germany and the United States. In this case study, researchers took advantage of existing microbes within a reservoir and provided nutrient stimulation tailored for particular characteristics, including high salinity.

Micromodel, sand pack and core flooding experiments conducted with dead oil indicated potential benefits on capillary forces within the reservoir and in situ generation of carbon dioxide, which resulted in reducing oil viscosity and improving sweep efficiency because of selective pore plugging.

MEOR technology was only a small segment of this year’s SPE IOR Symposium. However, it is an important emerging process that ultimately will contribute to the suite of improved oil recovery processes. Many of these technologies are easily obtainable from a variety of sources as another option for operators working in mature fields.

Combined with continued improvements in traditional enhanced oil recovery processes, MEOR is sure to play a key role in the continued recovery of resources previously thought to be unrecoverable or uneconomic. Continued access to resources and technology such as those at the IOR conference will be key to operators’ ability to improve the success of their operations over the years.

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