SASKATCHEWAN RESEARCH COUNCIL

Chemical EOR Evaluation

Rising oil prices and technology improvements have reignited interest in chemical flooding as an attractive option for field-scale enhanced oil recovery (EOR) projects. The right design of chemical system can increase the recovery factor by 15 to 20% and add millions of barrels of reserves to an operator's balance sheet, all at limited extra cost compared to existing waterflood practices.

However, not all oilfields are ideal candidates for chemical EOR, and not all chemical EOR processes can be used for any reservoir. The chemical formula and injection scheme need to be tailored to suit specific reservoir conditions and fluid properties.

The Western Canadian Sedimentary Basin (WCSB) boasts a variety of oil resources, from unconsolidated heavy oil deposits, to consolidated carbonate/sandstone medium/light oil and ultra-tight oil reservoirs. With over a decade of experience in chemical EOR design for WCSB oil reservoirs, SRC knows how to bolster the success of operators' ventures in either mature oilfields or newly exploited reservoirs.

SRC provides a complete suite of initial screening and feasibility studies to determine if chemical flooding techniques are suitable for your reservoir and, if so, which techniques are most technically viable and cost-effective. We focus on the newest concepts and chemical applications in these areas:

- Polymer flooding for heavy oils
- ASP (alkali–surfactant–polymer) flooding for heavy and medium oils
- Surfactant flooding for ultra-tight oils

CONTACT

Mars (Peng) Luo
Saskatchewan Research Council
129 - 6 Research Drive
Regina, SK Canada S4S 7J7
T: 306-787-5652
F: 306-787-8811
E: luo@src.sk.ca

Fluid-Fluid Analysis

Specific measurements include:

- Water chemistry
- Interfacial tension
- Polymer rheology (viscosity, screen factor, filter ratio)
- Polymer degradation (chemical and mechanical)
- Phase behaviour

Fluid–Rock Analysis

- X-ray diffraction analysis
- Wettability/contact angle (including imbibition testing)
- Static/dynamic adsorption
- High throughput polymer injectivity evaluation

Coreflood Displacements

Corefloods are carried out in micromodel, linear and radial coreflood apparatuses as well as a large 3D physical model with full size cores to evaluate various chemical EOR processes. Scenarios include:

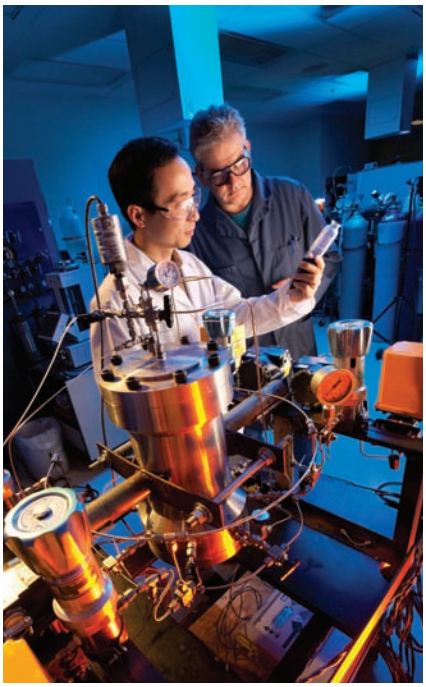
- Alkaline-surfactant-polymer flooding
- Surfactant-polymer flooding
- Alkaline-polymer flooding
- Polymer-alone flooding
- Enhanced foam flooding
- Conformance control/profile modification
- Water shut-off (higher permeability or open channels, stability and longevity of treatment scenarios, optimization of shut-off agent placement strategies)
- Clay stabilization/injectivity improvement

Numerical Simulation

Laboratory results are scaled up to field scale.

A fine-tuned black oil model is built according to the measured experimental data. The capillary number increases due to lower oil–water interfacial tension and higher water phase viscosity. As this occurs, different sets of oil-water relative permeability curves need to be specified to history-match the waterflood, chemical injection, and theoretical miscible processes.

The chemical injection simulation can also be scaled up to a field model to provide better scope for your field operation design.



Examining samples from a radial coreflood apparatus.

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