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New research will reduce environmental impact of oil recovery

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Scientists from the Canadian Light Source and Alberta Innovates Technology Futures have embarked on a research project that is changing what we know about oil recovery and could result in more environmentally efficient methods of getting oil.

Several important factors involved in the process of oil recovery were observed – oil, sand and water specifically. Through a unique live imaging experiment at the CLS synchrotron, scientists were able to see how the three materials interacted with one another in a dynamic way. As most processes for heavy oil are more complicated and involve the addition of solvents, steam, and other things, scientists were hoping a simpler recovery process is possible.

"This is about using waterflooding to recover heavy, viscous oil. It is an old and well-established method for conventional oil, and is being applied to heavy oil, but the way it works there is not understood," said Mike London, senior research engineer with AITF. "It is a simple non-thermal process and so is relatively cheap, in addition to having a small carbon footprint."

For the experiment, Mike and his team built a unique synchrotron-ready pressure vessel filled with sand to represent an oil reservoir in the midst of an recovery process. By slowly adding oil, water and pressure to the vessel, the oil, sand and water begin to move and change.

These changes were observed using powerful X-ray imaging techniques on the Biomedical Imaging and Therapy (BMIT) beamline– an experimental station at the CLS that is used primarily for medical imaging but also has many other capabilities.

As the pressure built up in the vessel, London said the oil began moving upwards through the sand in a unique pattern:

"We expected to see water channeling through isolated pore-scale paths. That, in itself, would have been interesting, but we never saw pores full of water – only swelling films of water on the grain surfaces. This contrasts greatly with the conventional picture of waterflooding, carried over from recovery of light oil."

AITF is one of several industrial groups visiting the CLS every year to conduct world-class research at the synchrotron.

"Anytime you can reduce the cost of something, or find a more efficient way of doing something, you are talking the same language as industry," said Jeremy Olson, CLS industrial science associate. "These experiments may give insight that will allow companies to understand the interactions between heavy oil, water and sand during recovery processes. Understanding these processes may also point to ways to make the entire process more environmentally sustainable.

"I hope these findings will help provide valuable insight for the oil industry and reduce the environmental impact of recovery," added Olson. "Dynamic studies are always interesting. To be able to image or sample something at the same time it is occurring is always fascinating. Normally as scientists we get a snapshot of something at a certain fixed time. In this experiment we were able to follow the process as it happened."

AITF will continue to analyze their data and the high-resolution 3D images they acquired from the synchrotron and London believes they have made great strides into better oil recovery techniques.

"About 24 per cent of Saskatchewan's oil is currently under waterflood. The contribution of heavy oil to petroleum production will continue to increase as conventional reserves dry up," added London. "Heavy oil waterflooding is an active area of research for us, as oil producers need to understand how to apply it effectively. For us, that means understanding the basic mechanisms."

Provided by Canadian Light Source

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