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New Drilling Fluids Meet Shale Needs

By Colter Cookson

If a drilling fluid engineer from 10 years ago looked at the fluids used today, much would seem familiar. Barite still is a common weighting agent, uintahite remains a popular fluid loss-control additive, and oil-based muds still see more play than their water-based counterparts in particularly demanding wells.

However, all those truths may change with time as bright minds in the drilling fluids sector refine old technologies and develop new ones to create fluid systems that offer greater performance, lower costs, and smaller environmental footprints. The latest innovations include liquid lubricant that stays in a protective shell until it is needed.

In most cases, new ideas come from companies with a long history of serving oil and gas producers. But in others, new entrants to the industry originate the ideas. For example, Solazyme Inc., which uses algae to efficiently produce renewable lubricants and other oils, is entering the oil and gas industry with Encapso™, a lubricant for water-based fluid systems that the company says provides superior performance using a novel approach.

"We encapsulate the lubricant in tiny hydrophilic polysaccharide shells that stay in solution and continuously circulate through the drilling fluid system until they get stuck between a point of friction, such as between the drill bit and formation or the drill string and formation," outlines Ray Nagatani, a company employee. "That friction breaks the shell, releasing its lubricant right where it is needed."

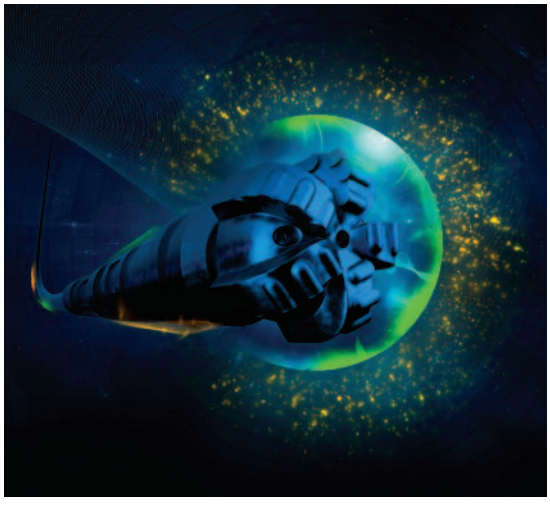
Without the protective shell, much of the lubricant would associate with cuttings or the formation, rather than a point of friction, as is common with liquid lubricants, Nagatani says. Such unintended associations waste the lubricant, so traditional lubricants generally are employed only after the driller encounters a problem.

"Because Encapso is protected until it is needed, drillers can be proactive and add it at the beginning of their operations," Nagatani says. "Rather than watching their rate of penetration drop and then adding the lubricant once the drill string gets stuck, they can lubricate throughout drilling and avoid some of the problems created by friction before they occur."

To test this concept, Solazyme rented rig time at the Catoosa Geophysical and Drilling Technology Testing and Evaluation Facility in Hallett, Ok., and compared drilling performance with and without the targeted lubricant. "The lubricant increased the rate of penetration by 20 percent," Nagatani reports. "It also reduced the rotational torque as much as 45 percent, with an average between 25 and 30 percent across the measured points. Drag fell as much as 50 percent, with a similar average."

Since Solazyme did the initial proof of concept at Catoosa in June 2013, it has used the technology in 28 commercial wells in the United States and Canada, Nagatani reported in early October. "We have seen the same benefits we saw at Catoosa in the field: torque reductions and ROP improvements that reduce the time it takes to drill. In some places, we are taking as much as 2.3 days off a 10.0- or 11.0-day well," he reports.

The time savings stem not only from



To minimize the effects of friction during drilling, Solazyme offers Encapso™, tiny, lubricant-containing shells that burst only if they encounter points of friction. The company says that with Encapso in the drilling fluid system, operators can address friction as it occurs, improving penetration rates and often taking days off drilling times.

faster drilling but also reduced nonproductive time, Nagatani says. "Reducing torque decreases the amount of mechanical stress placed on the bit and the measurement-while-drilling tool, so they last longer, which reduces the need for trips," he explains. "In North Dakota–one of the areas where it has been used most–Encapso reduced overall nonproductive time by 50 percent."

In many applications, Nagatani says, much of the lubricant can be recycled. "A capsule that never encounters strong friction stays intact, so a number of operators take the WBM they have at the end of one operation, check how much Encapso remains by measuring the oil concentration, add as much as is necessary to get to the target concentration of 3 percent, treat the water with biocides, and move it to the next well on the pad," Nagatani relates.

The product is 100 percent biodegradable, he comments. "Because it is a naturally derived lubricant and polysaccharide shell, it has no, or extremely low, levels of benzene, toluene, ethylbenzene and xylene; no aromatics; and no petroleum-based hydrocarbons," he says. "This can make disposing of cuttings much cheaper."

With its low environmental impact, Nagatani says the targeted lubricant is ideal for environmentally sensitive regions that require WBMs or that impose steep treatment and disposal costs on OBMs. He adds that it is effective enough to enable WBMs to offer lubricity comparable to OBMs and compete in new markets.

Nagatani predicts the lubricant soon will be used in OBMs as well. "Although these muds are extremely lubricious, laboratory tests suggest that adding Encapso reduces their coefficient of friction by 20 percent," he says. "We have been able to increase penetration rates in OBMs in the field by more than 50 percent. Those results are early, but we are looking forward to doing more trials to see whether that trend continues." ❐