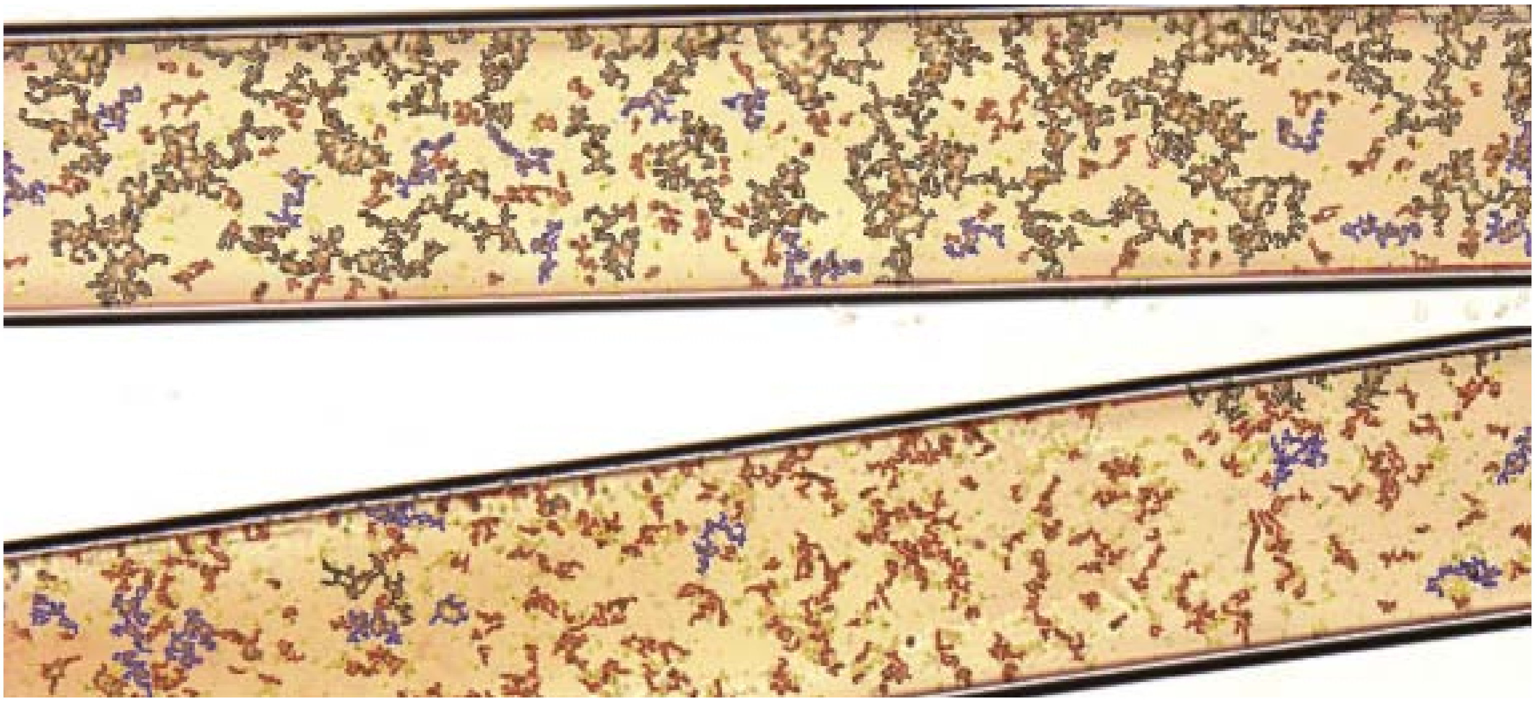


Images: Clariant

CAPILLARY ACTION: Image shows the raw output of a microscopy technique in which Clariant precipitates asphaltene crystals in a capillary, and the software colours them and counts them, making it a quantitative method. The top capillary is untreated, while the bottom capillary is treated.

Additive testing beyond the binary

Targeting the prevention of asphaltene-related flow assurance problems, a customised quantitative analysis method devised by one specialist company enables inhibitor chemistry to be optimised for improved performance. Jennifer Pallanich has the details.

Traditional methods of inhibitor treatment testing such as the laser dispersion test offer little more than a binary response that yes, the chemistry works, or no, it does not, according to Jonathan Wylde, global head of application development at Clariant Oil Services. Sometimes, he says, this semi-quantitative answer is sufficient to make a decision, but it also has the drawback that it does not make it possible to optimise the treatment's chemistry.

When one deepwater operator was having quality control issues, Clariant developed a means of providing more quantitative answers about inhibitor chemistries.

"We devised an advancement of the capillary microscope technique," Wylde explains. "It's significantly more quantitative." For the test, a scientist will fill a glass capillary with crude oil from the reservoir in question, place it under the microscope and look at the asphalt crystals that form in situ.

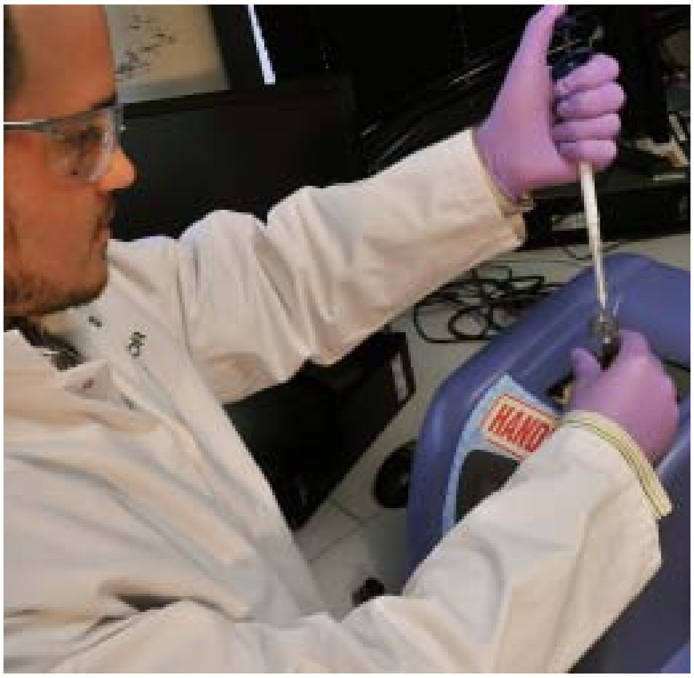
"We can look at how the crystals agglomerate," he says. "In looking at some of the ways in which the crystals behave, we can truly quantify asphaltene behaviour. Whereas the laser dispersion test looks at a transmission of light through the capillary, so it can't tell you as much information as the microscopy technique, we can determine that this chemistry is 67% efficient or 98% efficient. That's the real trick. Because, if we can identify that, we can start building up structure-performance relationships with the chemistry."

Being able to tailor the chemistry for each crude composition and then confirm its efficiency, he says, is a breakthrough.

"Until now, with regards to asphaltene inhibitors, the industry has been somewhat general," Wylde says. "We can now look at the molecules and custom design them for a specific application. We can blend them with different components to come up with bespoke and more fit-for-purpose products."

When it comes to inhibitors, it is "not normally one molecule that does the job for you, it's blends of molecules," observes Wylde, who has a BSc in geology and a PhD in physical chemistry. "The real value is how to blend these molecules of the formulation in a synergistic way."

In the deepwater case,



TESTING TIMES: At the Clariant laboratory in The Woodlands, Texas, a laser dispersion tester is used to determine the efficacy of asphaltene inhibitor chemistries.

WAX WORKS: Testing wax inhibitor products on coaxial shear testing units.

Wylde notes, Clariant was able to provide greater quality control over the chemistry. Not only is the inhibitor "highly customised," he says, the operator "has the assurance it's going to work."

The inhibitor is designed for a field in over 900 metres of water in the Gulf of Mexico. To start, the microscopic capillary technique was "specifically designed and used for this project", Wylde says, but several additional operators with fields in an area with a "pocket of challenging asphaltenes" have requested the service. The capillary test can also be used on other organic depositions like paraffins and bitumens.

Asphaltenes can be problematic in certain fields. In one case, Clariant provided a Flotreat DF product to inhibit asphaltenes from precipitating out of crude oil in subsea flowlines for a North Sea operator. The DF designator is for DepFlux, which indicates the inhibitor has undergone rigorous testing and is umbilical approved for subsea delivery.

"This product has to go through a transport phase before it gets to where we want it," explains Tom Swanson, Clariant Oil Services USA business manager.

In the UK North Sea, the operator injected Flotreat into an eight inch flowline in 100 metres water depth flowing from a well with 102° C reservoir temperature and 5000 psi pressure to a host floating production, storage and offloading vessel. The Flotreat product, which has to be filtered to a cleanliness specification of NAS-6 to ensure deliverability subsea, was designed using a synergistic coupler to keep the asphaltenes in check. According to Clariant, the treatment has been continuously applied since 2004 with no evidence of asphaltene deposits.

In one ongoing case history, the client originated use of Flotreat in 2008 and continues to use the inhibitor as winter weather comes into play for a heavy oilfield onshore California. As the ambient temperature falls, the viscosity of the crude builds, which limits its flow.

The crude oil is "like shoe polish, and you mix water in there, and it becomes very viscous, very thick", Swanson says of the problematic fluid. A Flotreat solution was designed to break the emulsion of oil and water and reduced the viscosity of the 15° API oil, thereby allowing year-round production, he adds. "The customer has now stipulated this as a standard procedure. As the winter months start to come into play, they initiate the injection of the Flotreat."

"We can now look at the molecules and custom design them for a specific application."

Jonathan Wylde, Clariant

He says the operator in question treats "upwards of a two hundred" sucker rod pump wells in the San Joaquin Valley with between 50ppm and 300ppm of Flotreat, depending on the severity of the emulsion and the ambient temperature, which can drop to 0° C (but averages around 10° C).

In a different ongoing cold-weather scenario, this time in Alberta, Canada, Clariant has been providing Flotreat Foto year-round to remove solid deposits, sands and clays from production tubing. "This product was designed to resolve the emulsion to reduce viscosity, then, secondly, combined with a proprietary solvent/dispersant to prevent the agglomeration of solids in the sand screen, which otherwise would have caused a blockage," Swanson notes.

He says application of the treatment led to production increases of more than 50% in several hundred wells in Lloydminster, Northern Alberta, where the operator's wells are producing 13° to 15° API oil. The ambient surface temperature is typically minus 30° C, while the produced fluid temperature is usually 26° to 38° C.

Swanson explains: "That's pretty ground-breaking for that type of oil, so it's essential that you resolve that emulsion so it can flow. Solids are a consistent issue for them."

Treatment there began in 2005 and continues today, he adds. U