

New options in scale, bacteria management

New control chemistries help operators keep wells producing and prevent degradation of production value.

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In the business of recovering oil and gas and keeping wells producing at high yield, scale and bacteria are unwanted obstacles. Specialty chemicals such as polymeric scale inhibitors and microbiocides play an important role in removing these obstacles as well as reducing the risk of related side effects such as microbiologically induced corrosion. Choosing the right specialty polymer to prevent the buildup of topside scale and to inhibit the formation of scales downhole can mean all the difference in uninterrupted well production and prolonging the need for squeeze treatment. Equally important is choosing the proper specialty microbiocide that can effectively control sulfate-reducing bacteria (SRB), which can lead to souring of gas, as well as acid-producing bacteria (APB), which can lead to premature corrosion.

High-performance scale inhibition

As more wells are being drilled at greater depths, higher temperatures and higher pressures are being encountered. In these harsh environments, typical low-cost scale control agents like phosphonates functionally fail as they cannot withstand such high pressures and temperatures. Additionally, in an HT/HP environment, the rate of inorganic scale formation increases greatly, thus exceeding the typical performance profile of phosphonates and requiring high-performance scale inhibitors that can control not only common scale species like barium sulfate and calcium carbonate but also iron and difficult-to-remove scales such as lead sulfide and zinc sulfide.

Further complicating an operator's choice of scale inhibitor options is that in some areas regulations have been developed that limit the use of certain chemistries based on

their profile of persistence (in the environment), bioaccumulation, and toxicity. In the North Sea, for example, UK and EU operators tend to adopt the requirements of the Convention for the Protection of the Marine Environment of the Northeast Atlantic (also known as the OSPAR Convention). North Sea operators are often concerned about the environmental profile of chemical treatments, particularly biodegradability. Like phosphonates, typical biodegradable polymers such as polyaspartate (PASP) also fail in HP/HT environments.

New oilfield anti-scalant

In response to these regulations and the general industry need for high-performance scale inhibitors that work under HP/HT conditions, BWA Water Additives has introduced Bellasol S65, a biodegradable anti-scalant effective for both barium sulfate and calcium carbonate scale inhibition and hydrothermally stable to 180°C (356°F) at pH Level 12. Bellasol S65 meets the highest OSPAR standards and also is biodegradable (70.2% in 28 days per Test 36 by the OECD). Bellasol S65 is compatible with other oilfield additives and is not weakened by the presence of oxidizing biocides used at normal dosages.

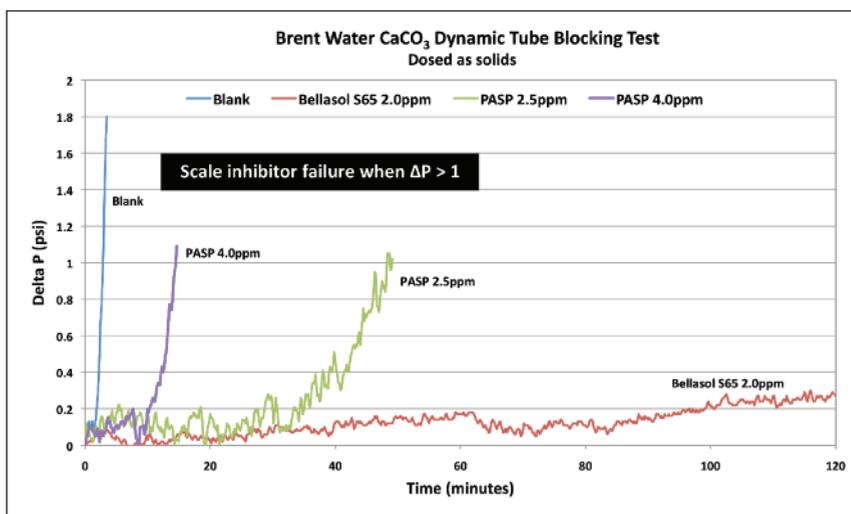


FIGURE 1. Dynamic tube block tests show that Bellasol S65 outperforms PASP for calcium carbonate inhibition even at lower dosages than PASP. (Images courtesy of BWA Water Additives)

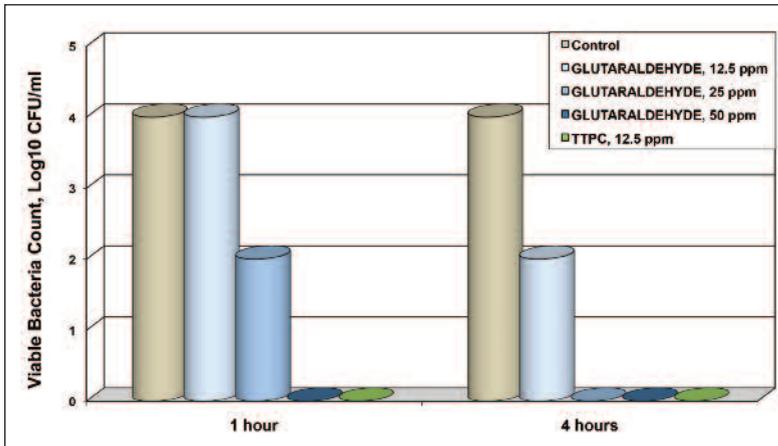


FIGURE 2. Bellacide 350 exhibits rapid biocidal activity against SRBs under typical hydraulic fracturing conditions.

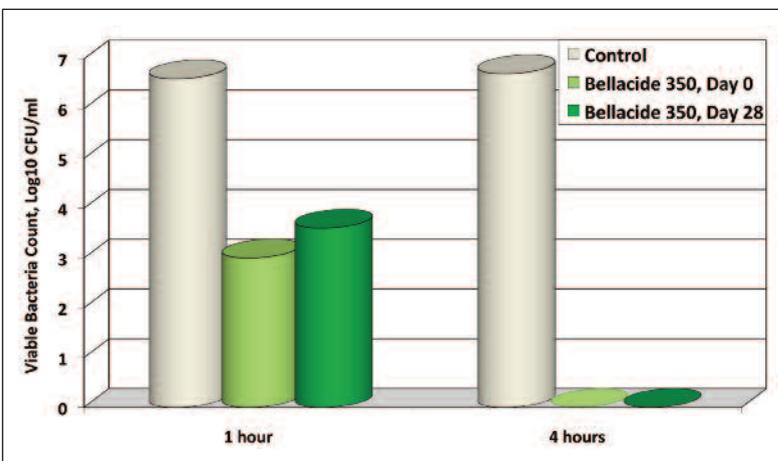


FIGURE 3. This figure shows Bellacide 350's effectiveness against APBs after 28 days.

Although Bellasol S65 was developed with a goal of achieving best-in-class biodegradability, BWA is finding that global oil and gas companies are choosing it purely for its performance profile. Figure 1 depicts simulation of actual oilfield conditions via dynamic tube block tests that are more severe than typical static jar tests. This figure shows that Bellasol S65 outperforms PASP for calcium carbonate inhibition even at lower dosages than PASP. When dosed at 4 ppm and 2.5 ppm, PASP fails in less than 30 and 60 minutes, respectively, as evidenced by a change in pressure greater than or equal to 1 psi. Bellasol S65, however, continues to inhibit calcium carbonate even after two hours.

Biocides for improved health, safety

Biocides are commonly used to kill bacteria and to prevent the accumulation of biofilm. Biofilm is difficult to remove, accumulating downhole and adhering to the surface casing of the well. Once accumulated, biofilm can cause energy issues due to increased frictional resistance and can provide an active food source for bacteria such as SRBs and APBs. SRBs can lead to souring and formation

plugging, and APBs can cause premature corrosion of well infrastructure.

One of the oldest, cheapest biocides used in the industry is bleach, which presents significant worker safety and handling risks and can prematurely corrode infrastructure. Other widely used biocides include nonoxidizers such as glutaraldehyde and glutaraldehyde blends. These nonoxidizing biocides provide fast but not long-lasting kill of bacteria and, more importantly, present safety and handling risks as glutaraldehyde is classified as a skin sensitizer. Oil and gas companies have been abandoning such biocides in favor of chemistries that are easier and safer to handle.

Fast-acting, long-lasting biocide

In response to the industry's desire for better biocides that are safer to handle, BWA introduced Bellacide 350, a high-performance nonoxidizing biocide and safer alternative to traditional biocides used in the oil and gas industry. Bellacide 350 is based on tributyl tetradecyl phosphonium chloride, one of the first biocidal actives approved by the US Environmental Protection Agency nearly a decade ago. Bellacide 350 is not a skin sensitizer, is not subject to any exposure limits, and thus is safer to handle than glutaraldehyde.

Although Bellacide 350 was developed with a specific safety and handling goal in mind, BWA is finding the industry is choosing its new biocide due to its unusually high performance. Unlike typical oxidizers that are simply fast-acting and typical nonoxidizers that are simply long-lasting, Bellacide 350 exhibits both capabilities.

As shown in Figure 2, the biocide exhibits rapid biocidal activity against SRBs under typical hydraulic fracturing conditions (with pH Level 7 and total dissolved solids content of 20,000). In one hour Bellacide 350 achieved complete kill at dosages 75% less than glutaraldehyde.

At typical high downhole temperatures, this biocide has a long-lasting complete kill impact on APBs, thus controlling microbially induced corrosion. Figure 3 shows its effectiveness against APBs after 28 days.

Another important advantage of Bellacide 350 is its compatibility with oilfield treatment fluids, which can become damaged by biocides that interact negatively with viscosifier or friction-reducer components. Compared to traditional biocides, Bellacide 350 is more tolerant of anionic polymers and is well suited for use in combination with cellulosic fracturing fluids. **ESP**