BYK

APPLICATION INFORMATION

DEFOAMERS FOR WATER-BASED DRILLING FLUIDS

OG-A 3

A member of ALTANA

Contents

BYK defoamers for water-based drilling fluids

Foam-stabilizing substances are inherent in water-based drilling fluids. Defoamers are therefore used to avoid the formation of foam (anti-foam) and/or to destroy existing foam (defoamer) as rapidly as possible. Foam interferes with the functions of a drilling fluid. The negative effects of foam can include the entrained gas reducing the mud weight, which can lead to hole problems. Moreover, foam reduces the efficiency of the pumps, which will make hole cleaning less efficient. Additionally, excessive foam can spill over the mud pits and be a potential pollutant.

Anti-foam functionality is essential to prevent foam from reforming as the drilling fluid is continually agitated during circulation.

To meet these needs in daily drilling activities, BYK recommends five differentiated oilfield defoamers, all of which are VOC-free:

- A mineral oil emulsion defoamer containing silicone: **BYK-038**
- A mixture of foam-destroying polymers with hydrophobic particles: **BYK-GO 8750**
- An emulsion of foam-destroying polymers with hydrophobic particles and silicone: **BYK-1641**
- A mixture of foam-destroying polysiloxanes and hydrophobic solids in polyglycol: **BYK-022**
- An emulsion of hydrophobic solids, emulsifiers and foam-destroying polysiloxanes: **BYK-1610**

Note

To ensure the best appearance and full functionality, please open in Adobe Acrobat.

Defoaming and anti-foam performance

The BYK defoamers were tested in a seawater sodium lignosulfonate drilling fluid (formulation 1) and in a brine HEC polymer drilling fluid (formulation 2). Total foam reduction was measured using the initial fluid height in a 1,000-ml graduated glass cylinder minus the 3-minute fluid height. The liquid portion of the formulation measured in milliliters was factored out so that only the foam generated and removed was included in the final calculations. Foam reduction efficacy at 0.05, 0.1 and 0.2 lb/bbl of each additive was measured after one-, two- and three-minute periods. In addition, samples of both formulations were re-agitated after treatment and minimal to no foam regeneration was observed. All five products demonstrated excellent anti-foam performance.

Watch the **performance of BYK defoamers:**
Video 1
Video 2

Example 1: Seawater sodium lignosulfonate drilling fluid

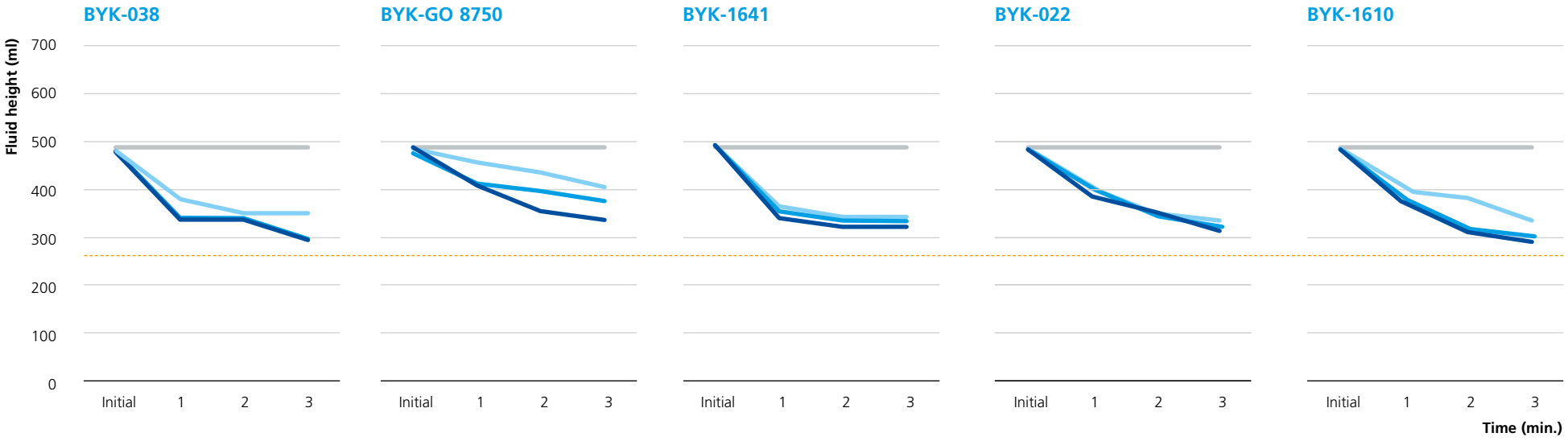
A sodium lignosulfonate formulation was used as formulation 1 (T. 01). This is a common classification of water-based drilling fluids that can be used in all aqueous drilling environments, including freshwater and brines. For our test protocol, the formulation was mixed under high shear conditions. Xanthan gum was added to stabilize the air entrained during mixing. The five defoamers were each tested and measured as previously described. The efficacy of the defoamers can be compared to the foam of the untreated control. Without the addition of defoamers, there was no foam reduction within three minutes. The test results for the five BYK defoamers in sodium lignosulfonate drilling fluid are shown in Figure G. 01 and G. 02.

Formulation 1

Component	Amount
Deionized water	262.5 ml
Sea salt ASTM	11.0 g
Sodium lignosulfonate	2.3 g
Xanthan gum	0.2 g
OCMA clay	11.3 g
NaOH (solid)	1.1 g

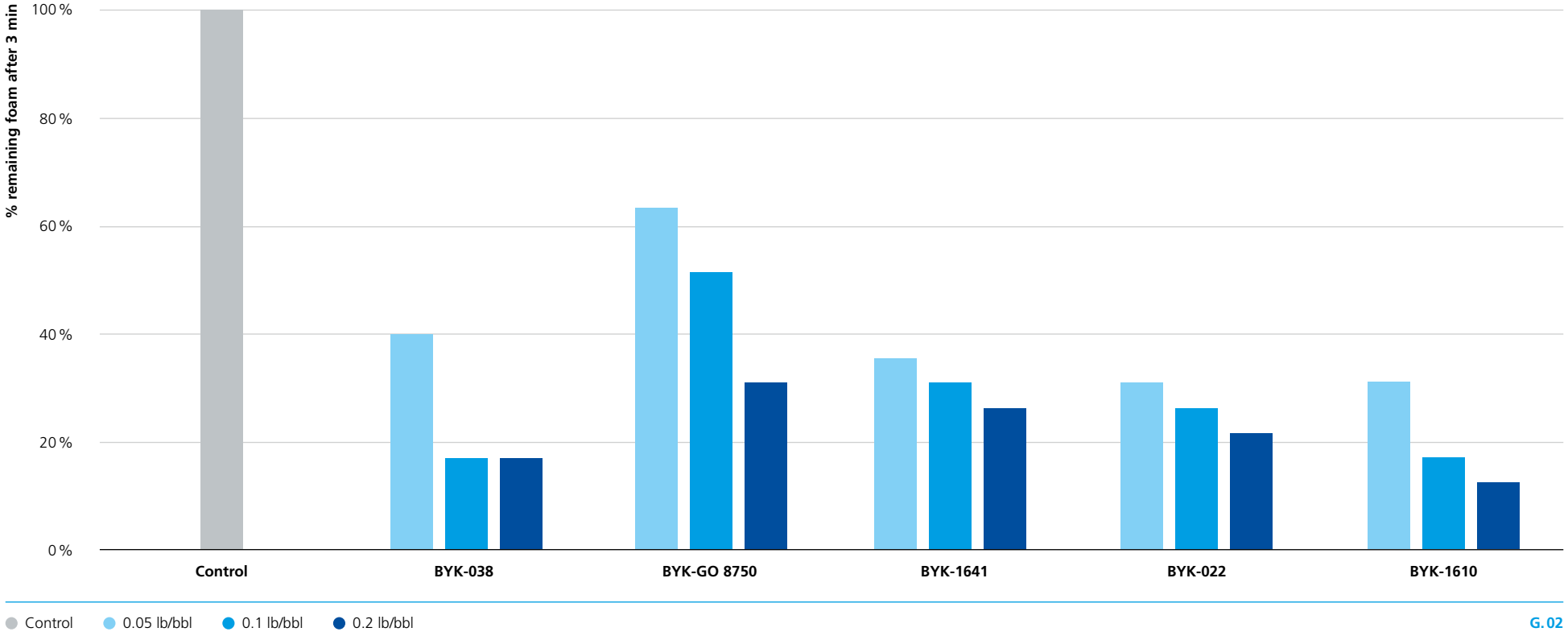
T. 01

Results of defoaming tests in sodium lignosulfonate formulation



G. 01

Defoaming performances in sodium lignosulfonate formulation



G.02

In the sodium lignosulfonate system, the performance of the five defoamers ranged from 60–88 % foam removal:

- **BYK-1610** achieved the best results with 88 % foam reduction after 3 minutes at a dosage of 0.2 lb/bbl.
- **BYK-038** showed the peak foam reduction of 83 % at just at 0.1 lb/bbl.
- **BYK-GO 8750, BYK-1641, BYK-022** and **BYK-1610** all continued to increase foam reduction as more defoamer was added. This suggests the total foam reduction capabilities would increase with higher treatment levels.

Each of the five additives tested is chemically unique and interacted differently with the lignosulfonate drilling fluid. To further demonstrate the efficacy of BYK's family of defoamers, a second system that generates foam via a different mechanism was tested for comparison.

Example 2: HEC polymer drilling fluid

The second system was a HEC polymer brine solution (T.02). This system was mixed under the same high shear conditions as formulation 1. The result was a firm, stabilized foam. The five defoamers were again all tested according to the protocol described above. No foam reduction occurred during the three minutes without the addition of defoamers.

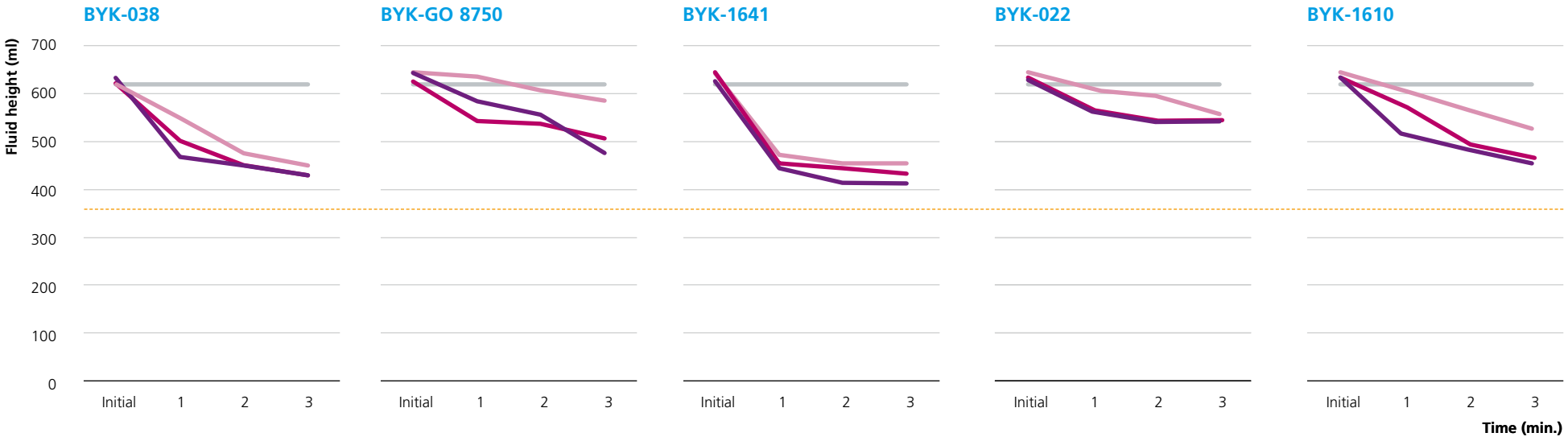
The test results for the five BYK defoamers in HEC polymer drilling fluid are shown in Figure G.03 and G.04.

Formulation 2

Component	Amount
Saturated NaCl brine	350 ml
HEC Polymer	0.75 g

T.02

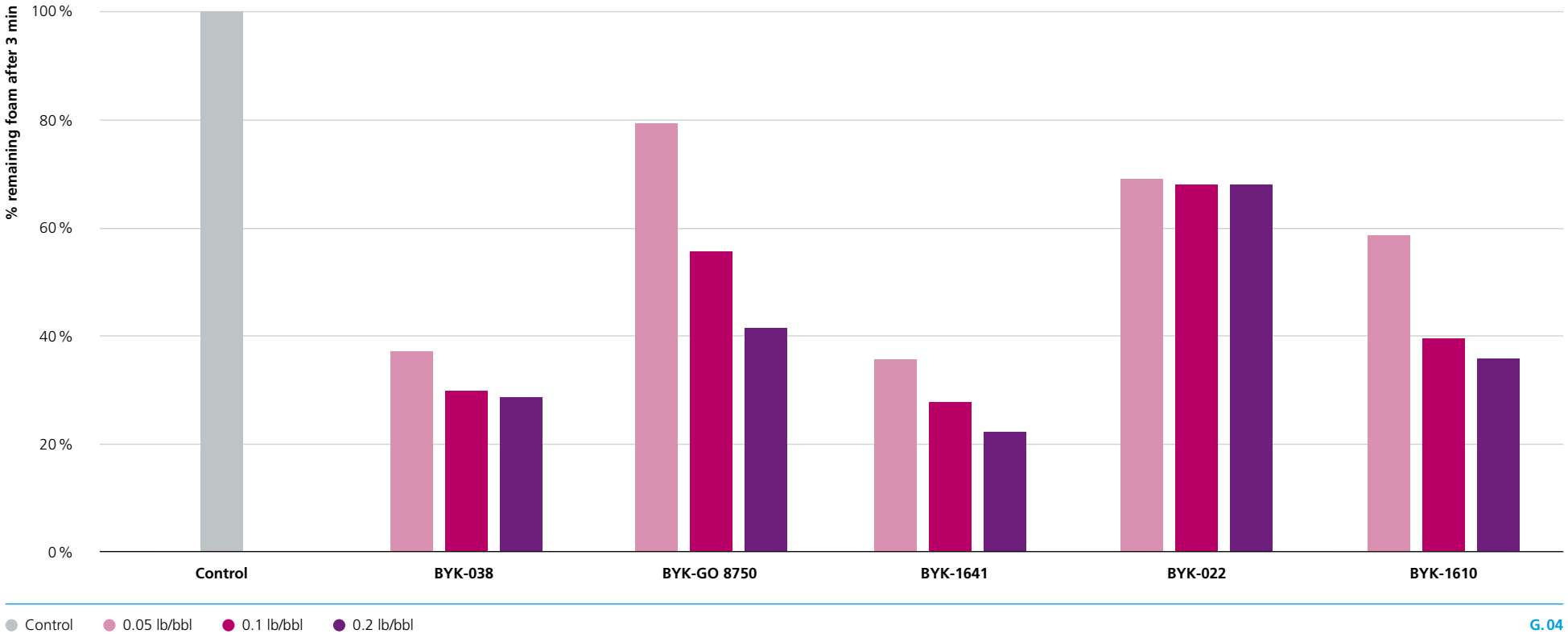
Results of defoaming tests in HEC polymer formulation



Control 0.05 lb/bbl 0.1 lb/bbl 0.2 lb/bbl

G.03

Defoaming performances in HEC polymer formulation



G.04

In the HEC polymer system, the performance of the five defoamers ranged from 32–78 % foam mitigation after the three minutes:

- **BYK-1641** performed best in this system with a progressive foam mitigation as the dosage increased, reaching 78 % at 0.2 lb/bbl.
- **BYK-038** destroyed 70 % of the foam at a treatment of 0.1 lb/bbl. Additional defoamer did not improve the foam reduction.
- **BYK-GO 8750** required a treatment of 0.05 lb/bbl to reduce foam by 21 %. An incremental treatment of 0.2 lb/bbl improved performance to 59 % foam reduction.
- **BYK-022** required a treatment of 0.05 lb/bbl to destroy 32 % of the foam. Higher dosages did not result in better foam reduction.
- **BYK-1610** destroyed 41 % of the foam at a treatment of 0.05 lb/bbl. Increasing to 0.2 lb/bbl improved performance to 64 % foam reduction.

Conclusions

The results of the evaluation show that the maximum defoaming efficiency depends on the suitability of the applied defoamer for the system. The two test systems demonstrate the compatibility of the BYK defoamers and the different ways in which foam is produced and destroyed.

In the seawater sodium lignosulfonate drilling fluid (formulation 1), the defoamers must function at high pH levels and in the presence of multivalent cations (Ca^{2+}, Mg^{2+}) found in seawater. The foam is generated by the anionic lignite and stabilized by xanthan gum. In this formulation, BYK-1610 had superior defoaming performance.

The HEC polymer drilling fluid (formulation 2) tests the defoamer's ability to operate without free water and with a high electrolyte content. The HEC polymer produces high viscosity and entrains the air. In this system, BYK-1641 and BYK-038 were the most effective products.

Key benefits

BYK has an extensive range of defoamers beyond the five shown. The chemistry includes mineral oil, polymer and polysiloxane defoamers with and without hydrophobic particles. Our experience in surface chemistry is one of our core strengths. BYK has a defoamer and anti-foam solution to meet your formulation needs.

Which one is best for your system?

Our application labs are here to assist you. For more information on BYK's extensive line of defoamers, visit byk.com.

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This issue replaces all previous versions.