ELEMENTIS

A global specialty chemicals company

Application Leaflet

BENTONE® DE

Hyperdispersible Hectorite clay—Influence of pH on aqueous slurry performance

Key Benefits

- Optimized storage stability of slurry
- Desired low pregel viscosity

Introduction

BENTONE® DE has been based on hyper-dispersible hectorite clay for easy incorporation into aqueous paint, coating and other systems. Due to a special beneficiuation of the Hectorite clay, BENTONE® DE has got a significantly reduced water demand for proper delamination and activation which allows the formulator to increase the active content of clay to up to 15% and to keep the viscosity still on a decent level which allows to pump and manage the slurry properly.

However, the experience has shown that BENTONE® DE pregels act strongly dependent on pH which is especially visible over longer storage periods. Also the viscosity and the rheological characteristics of the pregel is strongly affected by the pH.

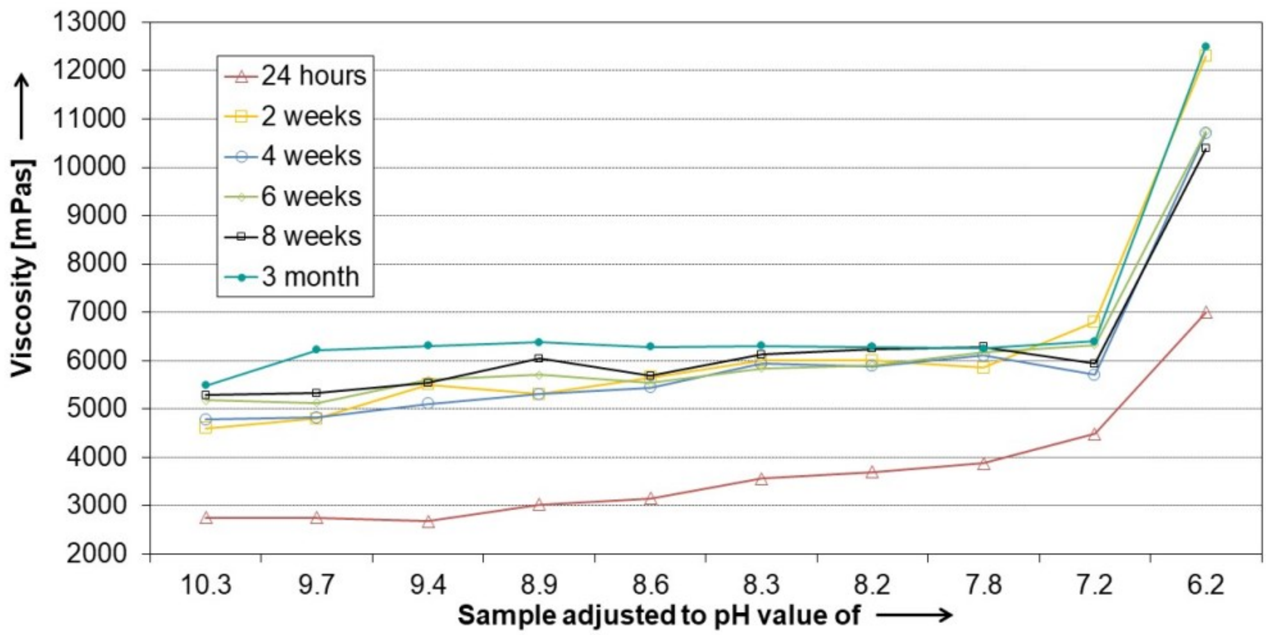
Composition	Highly beneficiated Hectorite clay
Appearance	Milky-white, soft
Specfic gravity, [g/ml]	1.03
Active solids, [%]	100
Density, [g/cm³]	2.5
Particle size, [% through 200 mesh]	94

Test system

- BENTONE® DE dispersed at a concentration of 15% in demineralized water
- Samples individually adjusted to pH values between original and 6 with acetic acid

Test results

Figure 1: Brookfield viscosity depending from pH over time

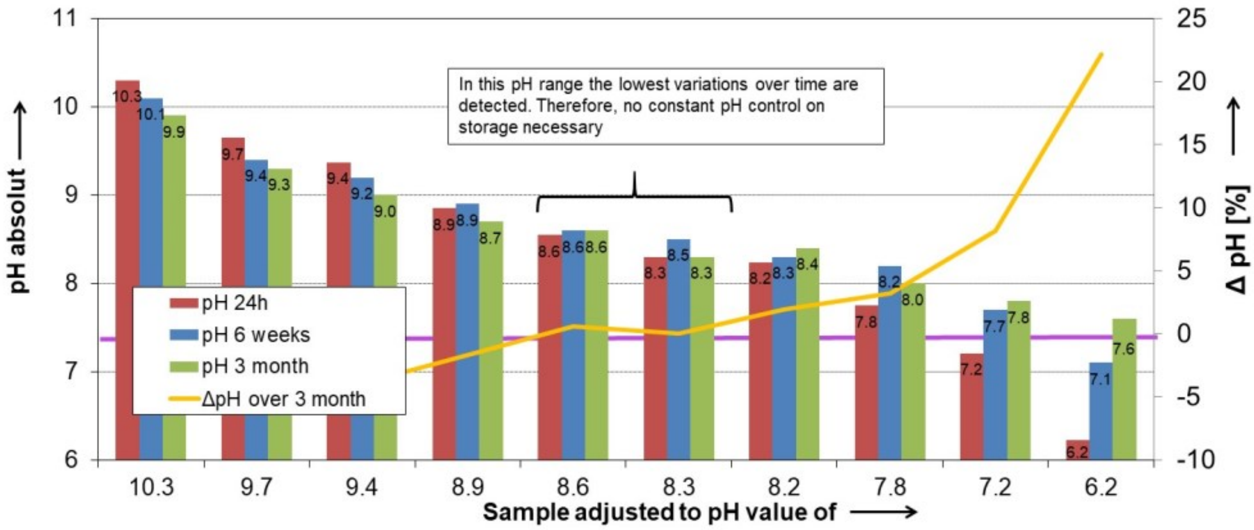


Initial viscosity values remain almost stable in a pH range from 10.3 to approximately 8.6. At pH values of below 8.5 a slight to moderate viscosity increase has been noticed. At pH values of below 7, a strong viscosity rise can be seen.

Over storage time these tendencies can be confirmed. However, a constant parallel shift upwards, towards higher viscosities has been detected. The most significant shift takes place within the first two weeks. Over longer storage only slight to moderate shift can be measured.

Figure 2: pH variation over time

Figure 2 displays the pH variations over a storage period of the pH adjusted slurries of 4 weeks.

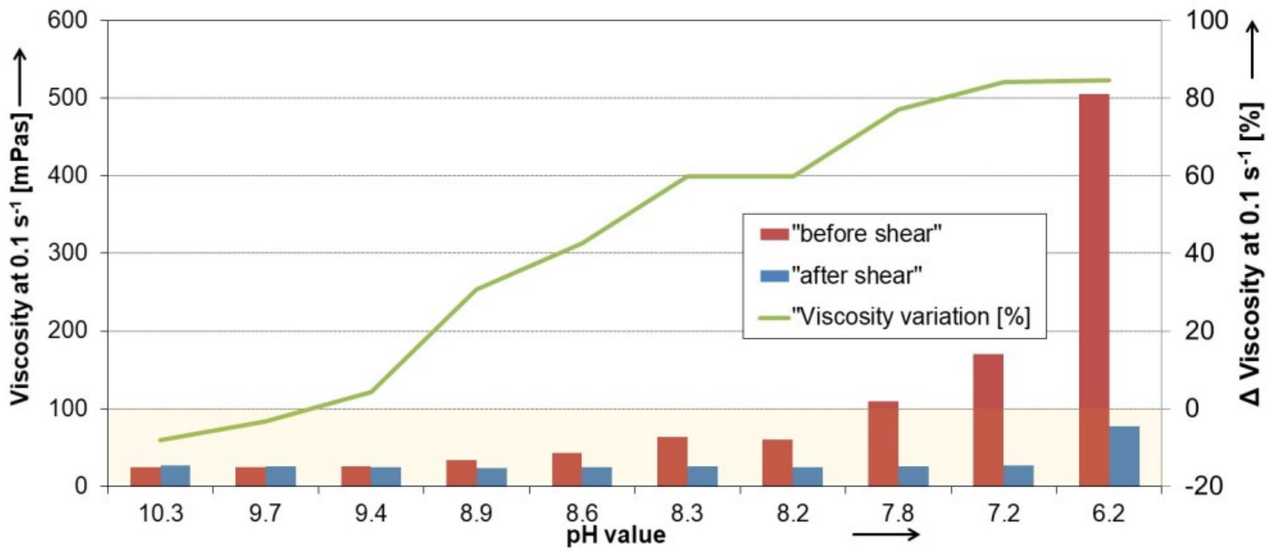


In a range of adjusted pH from initial 10.3 down to 8.9 a slight drop in pH is noticed if not constantly controlled and re-adjusted. In the pH range from 8.6 to 8.3 (marked by sigma sign) only very slight variation could be detected. Below pH values of 8.2, slight to moderate pH increases can be found.

Figure 3: Low shear viscosity difference

The figure 3 the difference of the low shear viscosity (0.1 s^{-1}) before and after shear application of the BENTONE® DE samples in dependence from the pH is illustrated.

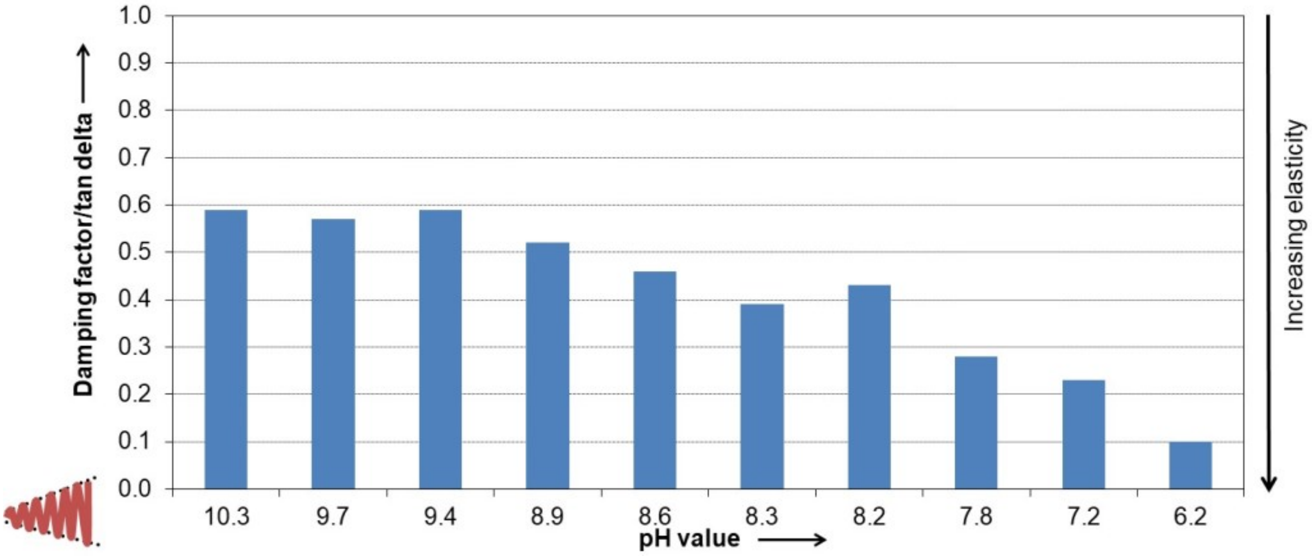
The red bar describes the viscosity at a shear rate of 0.1 s^{-1} before shear has been applied whilst the blue bare shows the viscosity at 0.1 s^{-1} after shear removal (read of the recovery curve). Consequently, the difference between both measured viscosity values describes the viscosity recovery an can be seen a synonym for the thixotropy (indicated by the green line in the graph).



It is obvious, that BENTONE® DE slurries with a pH of above almost do not show any thixotropy. In case of lower pH, any remarkable differences between low shear viscosity values before and after shear are detected. If the pH goes

Figure 4: pH influence on the viscoelasticity of BENTONE® DE pregels

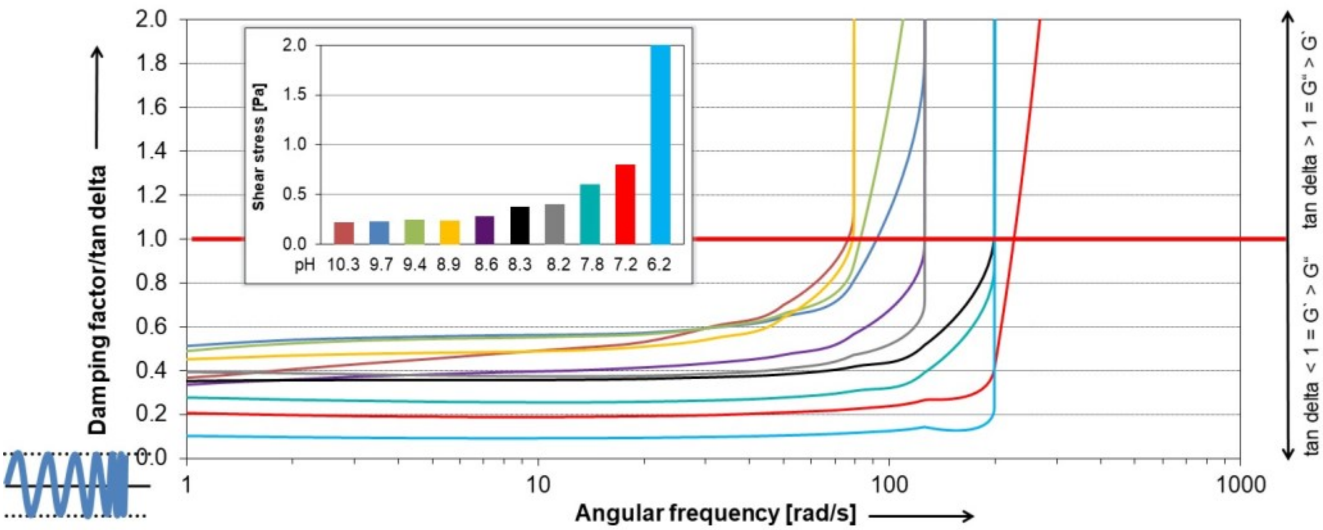
Data displayed have been extracted from an amplitude sweep test and are representing the damping factor/tan



In a pH range from 10.3 downwards to approximately 8 a low to moderate increase of the elasticity indicated by decreasing tan delta values have been noticed. From pH values of lower than 8 strongly rising elasticities has been noticed.

Figure 5: Influence of pH on the flow points

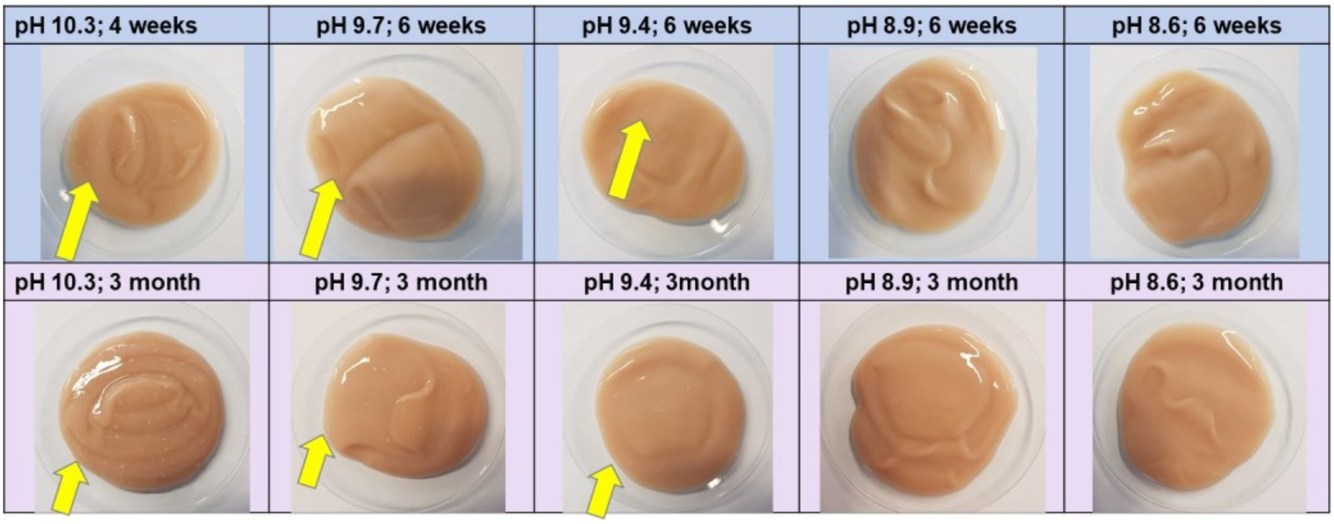
In the graphic below the shear stress data necessary to exceed a tan delta values are plotted. The flow data have in this specific case been detected on a frequency sweep.



Samples with a pH value of above 8.6 only show smaller variations in the flow points. However, at pH of below 8.6, a strongly rising flow points were determined alongside with decreasing pH.

Figure 6 & 7: Particle formation of BENTONE® DE gels in dependence from pH

In some cases BENTONE® DE slurries tend to particle formation when stored for a longer period. However, it is known that this tendency is strongly pH dependent. In the following, the particle formation is illustrated depending from slurry pH and storage time.



Ít is obvious that with increasing pH the risk of particle formation already on short term storage is rising. Samples adjusted to pH of around 10 start seeding already after 4 weeks. The period in which no particle are noticed can be elongated with decrasing pH. At pH values of below 8.5 no particle formation could be observed anymore.

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