ELEMENTIS

A global specialty chemicals company

Application Leaflet

BENTONE® DY

Organically modified clay-based rheological additive for waterborne systems

Key Benefits

- Excellent storage stability
- Excellent syneresis control
- Stable viscosity build even in extreme pH range

Introduction

BENTONE® DY is an organically modified, powdered, clay-based rheological additive. The product is designed for waterborne systems; primarily interior, decorative DIY latex paints to give excellent storage stability and sag resistance.

Composition	Organically modified and beneficiated smectite clay
Form	Off-white, finely divided soft powder
Particle size, [μm]	80% < 125
Bulk Density, [g/cm³]	ca. 0.65

Key benefits

- Provides excellent storage stability and sag resistance.
- Provides excellent stability with further water dilution.
- Is extremely pH stable.
- Gives reproducible, shear-thinning flow behavior.
- Highly efficient and easy to use
- VOC and APEO free
- 100% active-clay based powder

Incorporation

BENTONE® DY additive is very easy to process. No increased temperature is required. A pregel can be prepared as follows.

Add BENTONE® DY gradually, with stirring, to a vessel containing only water. Mix at highest practicable speed for 10 minutes.

In this way, 3% to 8% pregels can be made. Typically a 5% pregel is recommended, which can in the following be added to the formulation at any convenient stage, including post addition to the complete system. As the BENTONE® DY disperses easily, high-shear mixing is not required during post-addition of the gel. If the pregel has to be stored, a biocide should be incorporated.

BENTONE® DY can also be added as a powder at the start of the mill-base. It should be allowed to wet-out and swell before the other ingredients are added.

For highly-filled systems, the pregel method with later addition is recommended. This will avoid problems of a too thick or “heavy” mill-base.

Level of use

Typical addition levels are 0.3 - 1.5% BENTONE® DY additive by weight of total formulation, depending upon the degree of suspension, the rheological properties or viscosity required. For standard decorative latex paints, 0.5% is a good starting point.

Storage recommendations

Store in a dry cool place. Keep product dry. BENTONE® DY will absorb atmospheric moisture if stored under high humidity conditions.

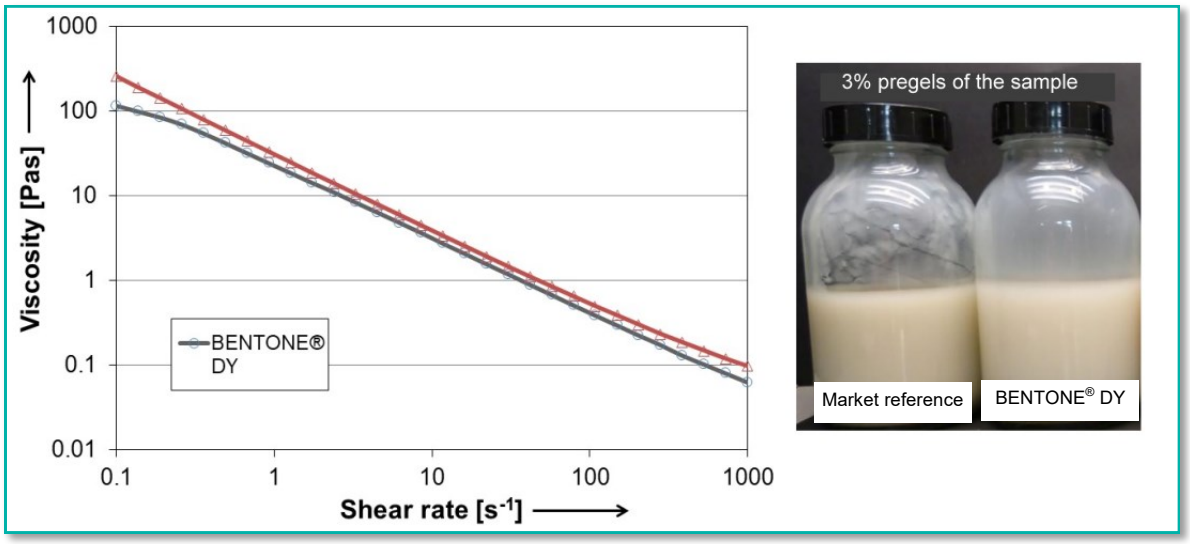
Product tested

Excellent storage stability

In the following practical examples, BENTONE® DY was tested as a 3% pregel and in a standard high PVC latex paint based on styrene acrylic, in comparison to a benchmark competitor bentonite clay.

Pregel viscosity

Figure 1 : Flow behavior - 3% pregels after 24 hours



The appearance of the 3% pregels and the flow characteristics are nearly identical.

Latex paint test results

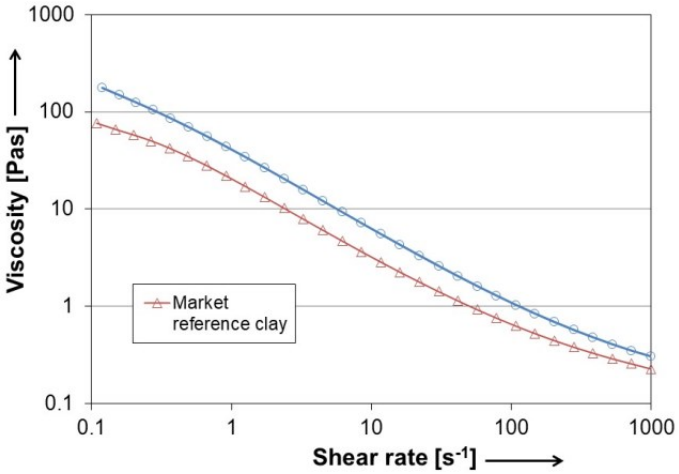
The clays were evaluated in a PVC 77.5% paint based on styrene acrylic.

Table 1 : Viscosity results - paint PVC 77.5% Acronal S 790

Products	Concentration	KU viscosity	ICI viscosity	Brookfield viscosity at _ rpm [mPa.s, spindle No.6]			
	[%]	Units	[cP]	10 rpm	20 rpm	50 rpm	100 rpm
BENTONE® DY	1.1	99	1.3	17900	10250	4880	2820
Market reference	1.2	97	0.9	15400	8650	4280	2530

BENTONE® DY outperformed the the reference product in terms of effectivity, visible especially at the Brookfield viscosity results.

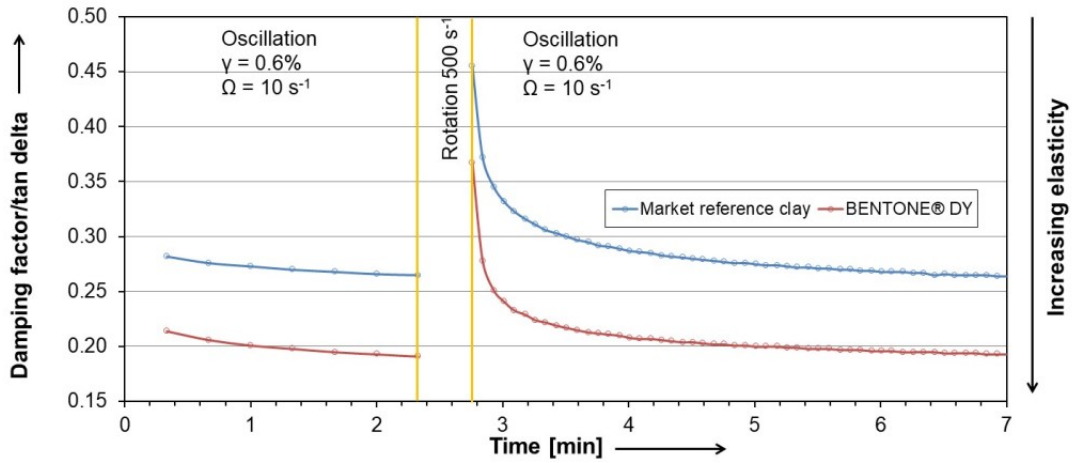
Figure 2 : Flow behavior - paint PVC 77.5% after 24 hours



The rheograms confirm the higher effectiveness of BENTONE® DY.

Both clays performed equally in application tests. Sag, levelling, brush-out and scrub resistance (EN ISO11998) all matched.

Figure 3 : Structure recovery oscillation - paint PVC 77.5%

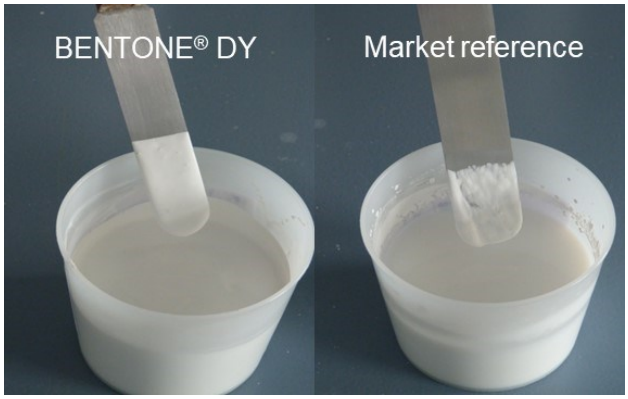


Both paints formulated with the clays showed strongly elastic character. However the BENTONE® DY showed less extreme elastic dominance. This was reflected in its excellent resistance to syneresis on storage, whereas the competitor exhibited typical surface bleeding.

Water diluted latex paint test results

Storage stability results after 8 months at room temperature. Paint diluted with 10% water.

Figure 4 : Storage stability test

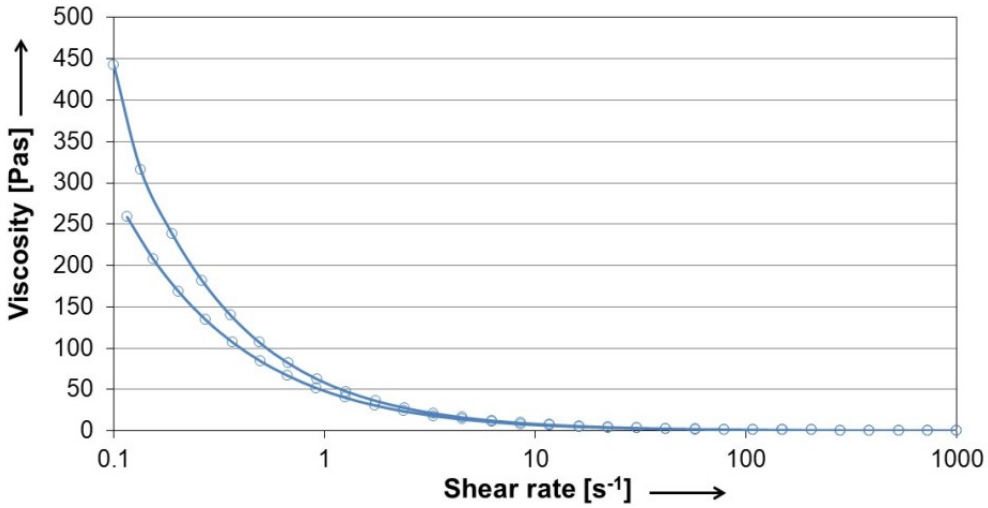


Also the diluted paint made with BENTONE® DY showed no syneresis even after 8 month storage. The market reference product had separated. The syneresis is directly related to the degree of elasticity given by the clay additive.

Excellent flow behavior

Standard flow profile in latex paint

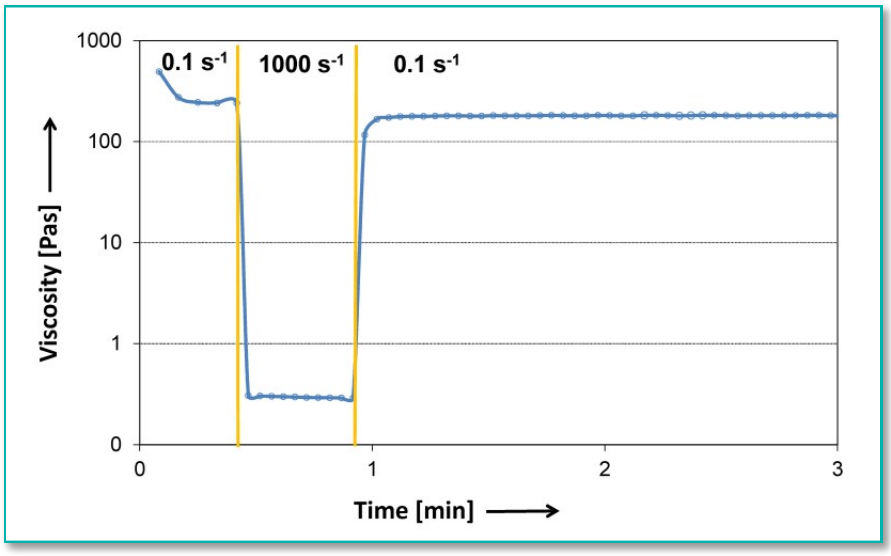
Figure 5: DIY latex paint based on styrene acrylic - PVC 77.5%



BENTONE® DY provides a strongly shear-thinning flow behavior in a coating system as shown in figure 5. This type of flow allows for excellent workability combined with the good storage stability as seen earlier.

Thixotropy for improved levelling

Figure 6: DIY latex paint based on styrene acrylic - PVC 77.5%

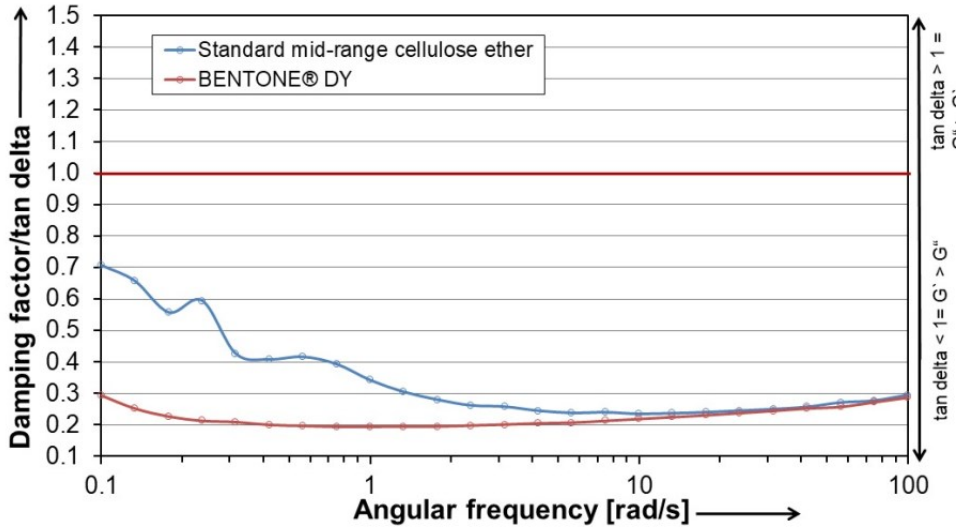


BENTONE® DY will also provide a desirable delay in structural recovery after shear forces are removed (post application) as shown in figure 6. This recovery results in excellent sag resistance but still allows some levelling.

The viscosity was first measured at a low shear of 0.1 s^{-1} (i.e. prior to application). Then the sample was subjected to high shear of 1000 s^{-1} simulating the application process. Reducing the shear forces again to 0.1 s^{-1} simulated the post-application conditions and the recovery of the coating`s viscosity and structure.

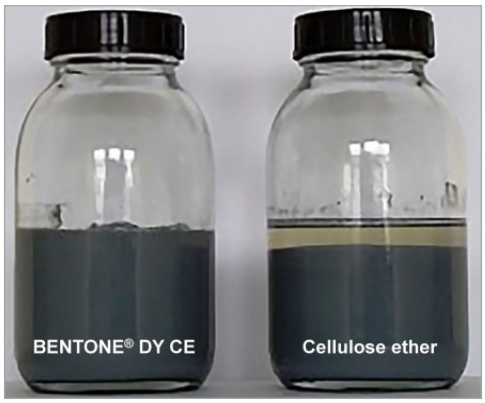
Excellent viscoelastic character

Figure 7: DIY latex paint PVC 77.5% based on styrene acrylic - PVC 77.5%



BENTONE® DY improves storage stability and prevents hard settling or sedimentation in highly filled coating systems. The excellent storage stability achieved in comparison to a typical midrange cellulose is seen in the viscoelastic behavior measured by a frequency-sweep test.

Figure 8 : Syneresis test

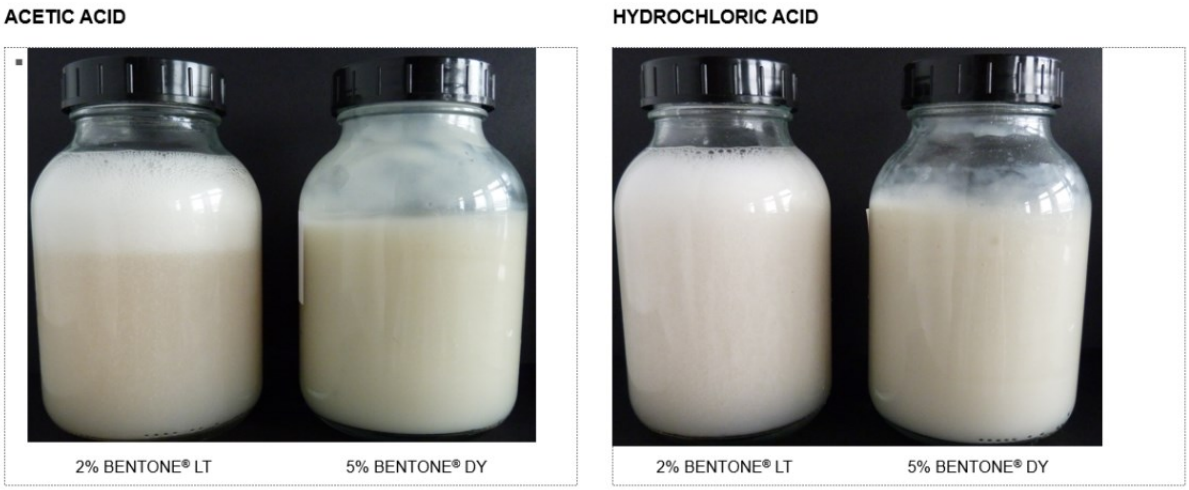


The low, tan delta (ratio of loss modulus G´´ to storage modulus G´) of a latex paint with BENTONE® DY confirms the excellent suspension characteristics. This indicates better storage stability preventing settling as seen in figure 8. However, as described earlier, the elasticity is not so high as to cause syneresis.

Extremely pH stable

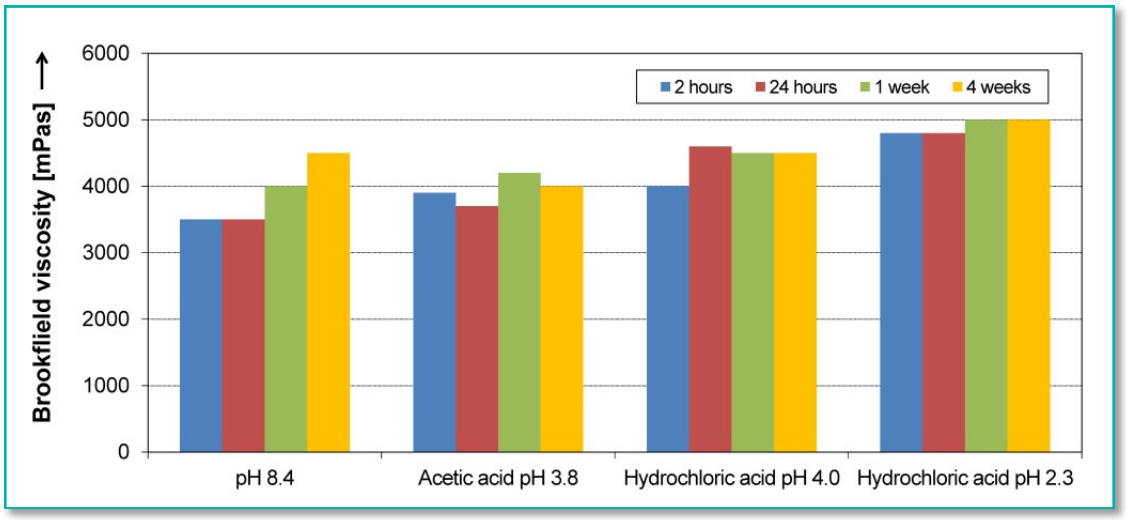
BENTONE® DY is a perfect rheological additive also to stabilise systems with low pH.

Figure 9 : pH 4 medium



The incorporation of BENTONE® DY is in general easier and generates much less foam than a traditional pH stable clay based additive like BENTONE® LT. This behavior was observed at low pH, independent whether mineral or organic acid was used.

Figure 10 : 5% BENTONE® DY - Brookfield viscosity spindle No.6 / 50 rpm



The storage properties of the BENTONE® DY gels evaluated over 4 weeks showed excellent performance in both types of acid (mineral and organic).
No significant difference in efficiency was found between pH 8.4 and pH 2.3.

Conclusion

BENTONE® DY gives excellent syneresis control and should be recommended in particular for standard- to low -cost latex paints where storage stability is of concern. However it is also suitable for many other systems including waterborne epoxies and silicate facade paints. Its resistance to low and high pH makes it a very versatile multipurpose rheological additive.

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