ELEMENTIS

A global specialty chemicals company

Application Leaflet

BENTONE® WBS

Economic rheology modifier based on beneficiated, high purity smectite for aqueous paint and construction systems

Key Benefits

- Improved storage stability
- Excellent sag and slump resistance
- Optimized workability

Introduction

BENTONE® WBS is a beneficiated, high purity smectite clay. It is easy to process and economical to use. BENTONE® WBS is particularly recommended for low cost latex paints and emulsion-based construction systems to improve storage stability and sag resistance. In mineral based systems it will greatly improve workability and pumpability.

Benefits and Features

BENTONE® WBS provides

- Improved storage stability and prevents settling of pigments and extenders efficiently
- Enhances sag and slump resistance
- Imparts Thixotropy
- Provides low and mid shear viscosity
- Improves workability particularly in mineralic construction applications

Chemical and physical data

Composition	Beneficiated smectite clay
Appearance	Creamy white powder
Active content [%]	100
Particle size [% < 53 µm]	98
Specific gravity [g/cm³]	ca. 2,5

Proposed applications

- Aqueous decorative latex paints and similar systems
- Building materials such as mortars, renderings, skim coats and adhesives based on lime, cement and gypsum

Incorporation

BENTONE® WBS is very easy to process and can be used either as a pre-gel or powder.

A pre-gel can be prepared as follows:

Add BENTONE® WBS gradually, with stirring, to a vessel containing only water.

Mix at highest practical speed for 10 minutes.

In this way, 5 % to 10% pre-gels can be made. Typically a 8% pre-gel is recommended. This can then be dded to the formulation as convenient

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

Latex based paint

In the following case study, the influence of BENTONE® WBS on the performance of a PVC 77.5 latex paint is shown. In both samples 0.35% of a standard Hydroxy Ethyl Cellulose ether has been formulated alongside with the clay. In is visualized that BENTONE® WBS optimizes the performance of waterborne latex-based systems in combination .

Formulating this smectite clay into a standard, cellulose-thickened, high pvc latex paint will improve application performance and storage stability as shown in the following example.

BENTONE® WBS only marginally influences the mid- to high-shear viscosity of the waterborne system (*Result table 1*).

	KU	ICI	Brookfield viscosity [mPas] at			
	[units]	[P]	10 rpm	20 rpm	50 rpm	100 rpm
Blank	80	1.2	5200	3320	1896	1280
0.2% BENTONE® WBS	80	1.1	5320	3260	1744	1100

Result table 1: Paint viscosity

The smectite clay improves brush-out levelling and sag resistance in latex-based systems (*Figure 1*).

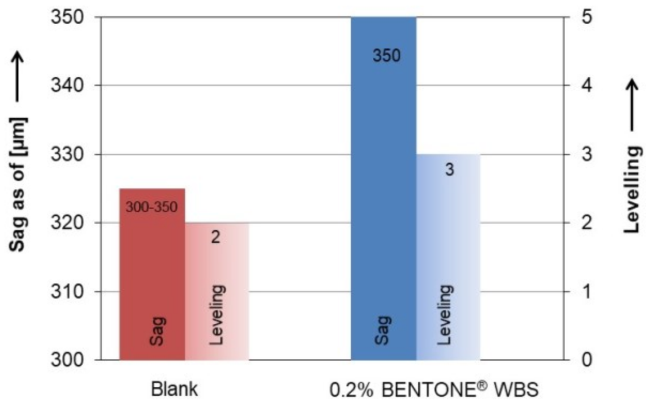

Figure 1: Application properties

The rheogram in *Figure 2* shows that BENTONE® WBS provides strongly shear thinning, thixotropic flow behaviour in latex- based waterborne systems. This allows for excellent workability combined with good storage stability.

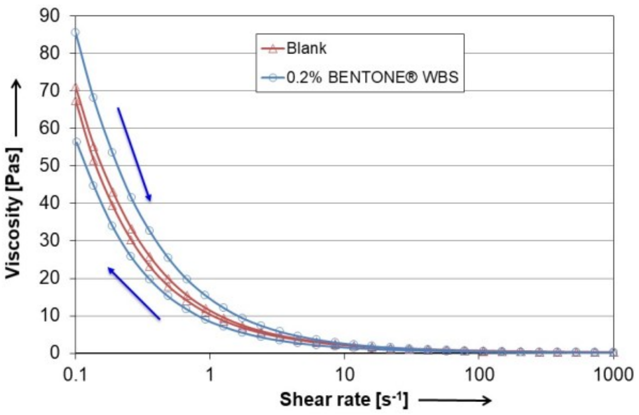

Figure 2: Flow curves

Also the viscoselastic characteristics of the system has been strongly influenced by the utilization of clays.

In *Figure 3*, the data generated in a frequency sweep are shown. In this test, the angular frequency has constantly been in creased at a fixe strain (deformation) rate.

All data running at a damping factor/tan delta of below 1, the elastic characteristics are dominant. The lower the damping factor the stronger the elastic character and e.g. improved anti-settling properties can be expected.

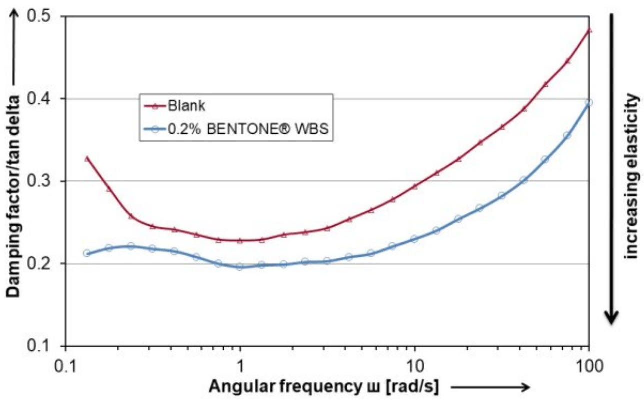

Figure 2: Viscoelasticity

The lower damping factor (tan delta) of a latex paint with BENTONE® WBS can indicates increased elasticity compared to the blank sample containing only HEC. This can indicate better storage stability and confirm the excellent suspension characteristics.

Mineral based rendering

In addition to the application in paints, it is also highly recommend to use BENTONE® WBS in mineralic, cementitious system. BENTONE® WBS typically has a positive influence on the sag stability. Also the workability and the pumpability are being optimized.

In both shown cases, the renderings contain 0.12% of a standard mid.size methyl cellulose.

As it can be seen in *Result table 2*, the BENTONE® WBS noticeably improves the application behaviour of a mineral-based system. Formulating the smectite clay into a lime-cement rendering with cellulose ether will improve sag resistance and workability as shown in the following example. Sag resistance significantly improves with the addition of the smectite clay.

BENTONE® WBS does not affect either flow-table value (consistency/viscosity) or water retention of a mineral based system.

	Flow table value [cm]	Water retention [%]	Sag Resistance [mm]	Workability
Blank	16.6	98.5	13	high resistance; very sticky
0.2% BENTONE® WBS	16.5	98.7	21	easy to apply; slightly sticky

Result table 2: Mineralic rendering performance

BENTONE® WBS gives better workability and pumpability. This also goes in line with the rheological data measured (*Figure 4*). At a shear rate of 100 s^{-1} the shear stress data were extracted in order to achieve information on the condition in the moment of application. The lower the shear strees, typically good trowelability and pumpability can be expected

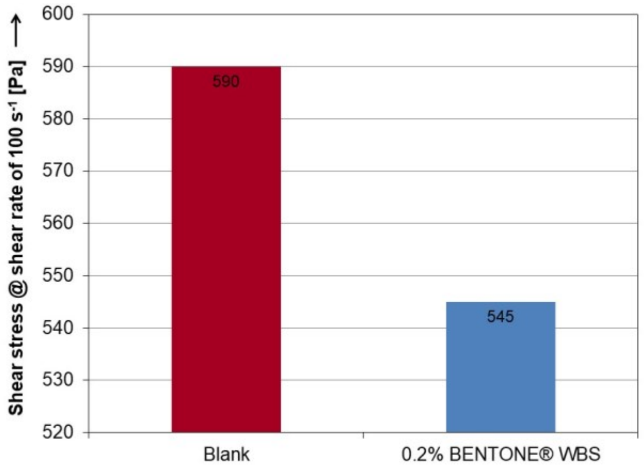

Figure 2: Shear stress at elevated shear rate

It can be seen that the use of BENTONE® WBS results in noticeably lower shear stress at a shear rate of 100 s^{-1}.These data are going strongly in line with the practical findings in *Result table 2*.

Conclusion

Latex paint

BENTONE® WBS provides significantly higher low shear viscosity alongside with increased elasticty in combination to a stand-alone formulated HEC. Additionally, a noticeable increase of the Thixotropic flow character could be determined.

These differences have also benn confirmed by optimized sag control and levelling.

Conclusion

Lime-cement rendering

BENTONE® WBS added to a lime-cement rendering formulation improves the workability significantly. BENTONE® WBS provides improved application properties feelable as a reduced stickiness on the tool.

However, BENTONE® WBS cannot simply replace cellulose ethers. Too low viscosity and water retention would be the result. As a consequence, it has to be formulated on top of the original cellulose ether amount.

Appendix

Test formulation

Latex paint, PVC 77.5%

Raw material	Concentration [%]
Water	32.0 - X
NUOSPERSE® FX 504	0.2
Biocide	0.1
DAPRO® DF 17	0.4
Titanium dioxide	7.5
Calcium carbonate extenders	42.0
MICROTALC® IT Extra	4.5
DAPRO® FX 511	1.1
Styrene-acrylic latex emulsion	12.0
Caustic soda; w(NaOH) = 0.1	0.2
Rheology modifier	X
Total	100.0

Lime-cement rendering

Raw material	Concentration [%]
Portland cement 42-5	14.02
White lime hydrate	10.00
Calcium carbonate extender	8.05 - X
Quartz sand 0.1-0.5 mm	22.22
Quartz sand 0.3-0.9 mm	22.47
Quartz sand 0.7-1.2 mm	23.02
Na-Oleate	0.10
Rheology modifier	X
Standard mid-size methyl cellulose	0.12
	100.00

Test methods

High-shear/ICI viscosity

Indicates the viscosity at high shear rates of 10000 s^{-1} measured by a cone/plate equipped ICI viscometer.

KU viscosity

Represents the mid-shear or appearing in-can viscosity is represented.

Brookfield viscosity

Measured by the Brookfield DV riscometer, equipped with spindle 5, at a temperature of 23°C.

Sag control

Sag was tested using a test blade with applicable ayer thicknesses of 100 - 500 μm. The displayed values indicate the maximum applicable layer thickness without runners.

Levelling

Leveling was determined using test blade 419 (range from 0 - poor to 5-excellent).

Rheology data

Determined using the Anton-Paar MCR 301 rheometer, equipped with the below mentioned measuring geometry at a temperature of 23°C.

Latex paint: PP 50, 1 mm gap width

Rendering: CC 37 plaster (spindle/beaker)

In case of the oscillatory, frequency sweep data a fixed strain rate of 0.1% was pre-adjusted.

Flow table value

Measured with the Haegermann flow table desk (DIN 18555, Part 2).

Water retention

Tsted with the filter plate method in accordance with DIN 18555, Part 7.

Workability

The rendering was applied with a smooth trowel on a vertical wall. Stickiness on the tool and the force required during the application were subjectively assessed.

Slump stability

The renderings were applied with a wedge shaped blade (0 - 3 cm height) on gypsum plasterboards and stored vertically until cured. The maximum film thickness without sagging was recorded.

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