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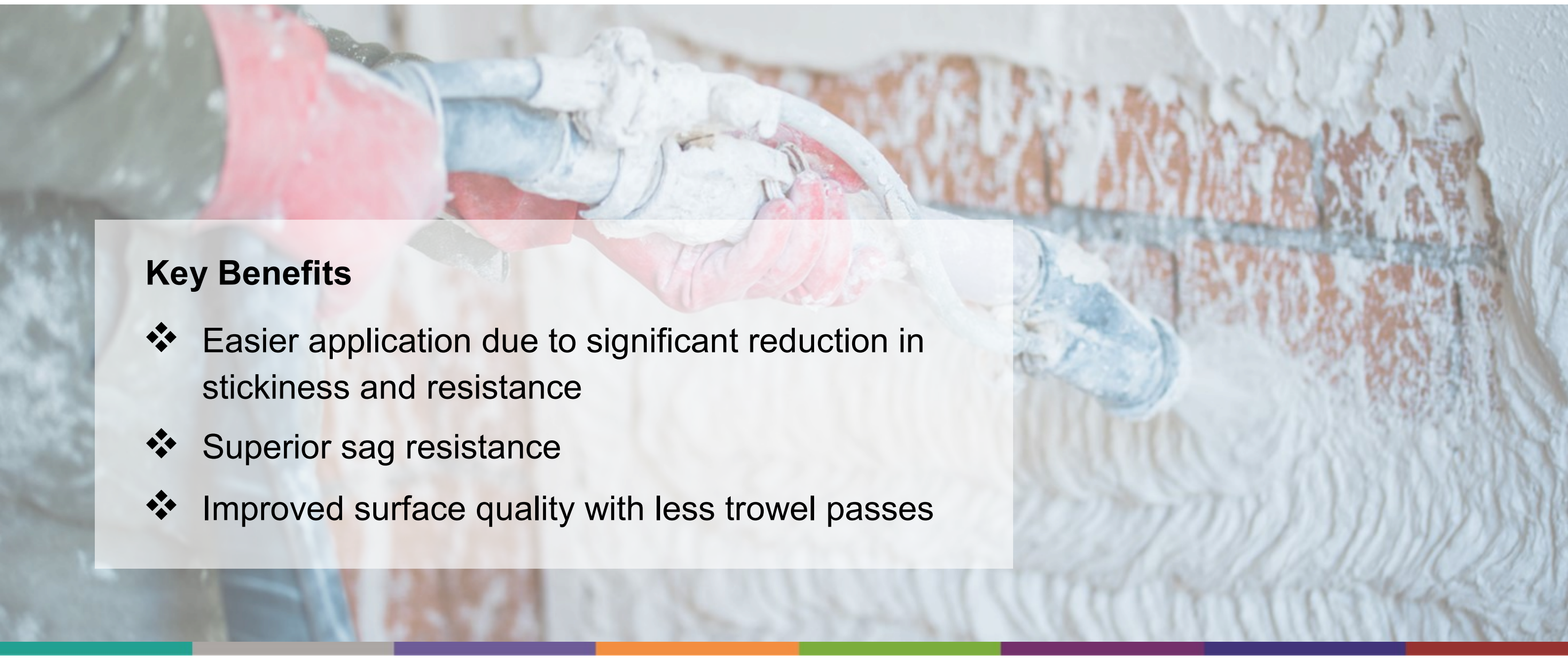
Application Leaflet

BENTONE® OC

Clay based rheology modifier for lime-cement based rendering systems



Key Benefits

- Easier application due to significant reduction in stickiness and resistance
- Superior sag resistance
- Improved surface quality with less trowel passes

Introduction

Lime-cement renderings are widely used as finishing systems for wall applications. These powdered systems are being supplied in bags or containers to the relevant construction site to be mixed with water and applied to the substrate. Beside cement and lime-hydrate, these renders consist of various grades of sand and other extenders, mainly based on calcium carbonate and dolomite. Depending on the composition, renderings can provide fine or coarse, smooth or textured surfaces and are usually overpainted after application. Lime-cement renderings are generally used on exterior walls, however, they can also be applied to feature interior walls.

To adjust water retention and consistency, typically cellulose ethers are formulated. However, an unwelcome side effect of the use of cellulose ethers is poor trowelability caused by low slip and strong tackiness on the tool. Stickiness can be reduced and workability can be improved by the use of clay based rheological modifiers, such as BENTONE® OC, in the formulation. As a further result, the surface appearance will be improved while requiring less trowel passes.

These kind of renderings are typically applied by machines with the relevant pump/spray equipment. Afterwards it is smoothened by hand by long metal bars where low stickiness and resistance is desireable. Besides the optimized workability, BENTONE® OC often enhances pumpability by the reduction of the pumping pressure. And most importantly, BENTONE® OC significantly improves sag/slump control.

Composition	Untreated natural hectorite clay
Color/Form	Cream to light brown powder
Solids content, [%]	100
Density, [g/cm^3]	2.6
Particle size < 74 μm, [%]	95

Key benefits

- Easier application due to reduced resistance and stickines
- Excellent sag and slump control
- Excellent flow properties for easy pumpability
- Optimised surface appearance due to enhanced slip

Incorporation and levels of use

BENTONE® OC is typically added to the dry mix powder blend. The compound can then be mixed with water on site in accordance with the mortar producer`s instructions.

Typical levels of usage for BENTONE® OC are between 0.1% and 0.5%. However, the ultimate required amount will depend on the system and on the type of cellulose ether that is used.

Test system

Water concentration

225 ml/kg dry powder (in all cases constant)

Sample preparation

- Put the defined amount of water into the bowl of the Hobart mixer.
- Add the dry powder over 15 seconds under stirring.
- Stir for 30 seconds.
- Stop the mixer and wait for 2 minutes.
- Stir for a another 15 seconds.

Note: In all cases the water content was kept constant. The abbreviation CE has been used in the following practical example for cellulose ether.

Compound	Concentration [%]
Portland cement CEM I 42.5 R	14.02
White lime hydrate	10.00
Calcium carbonate	7.90
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
Sodium oleate	0.10
Rheological additive	X
Total	100.00

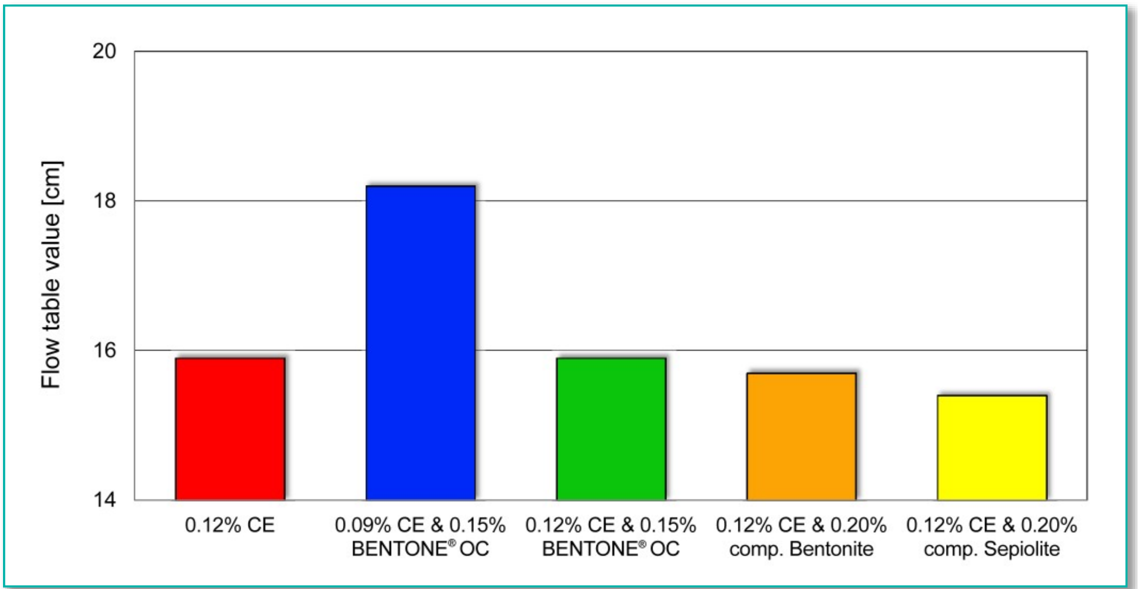
X is variable in accordance with individual concentration.

Practical examples

In this leaflet, the use of BENTONE® OC in comparison to competitve clay based rheology modifiers, in combination with cellulose ether is illustrated.

Figure 1 : Loading level and spread rate

The figure 1 shows the additive concentrations required to achieve equal flow table values in accordance with DIN 18155, Part 2.

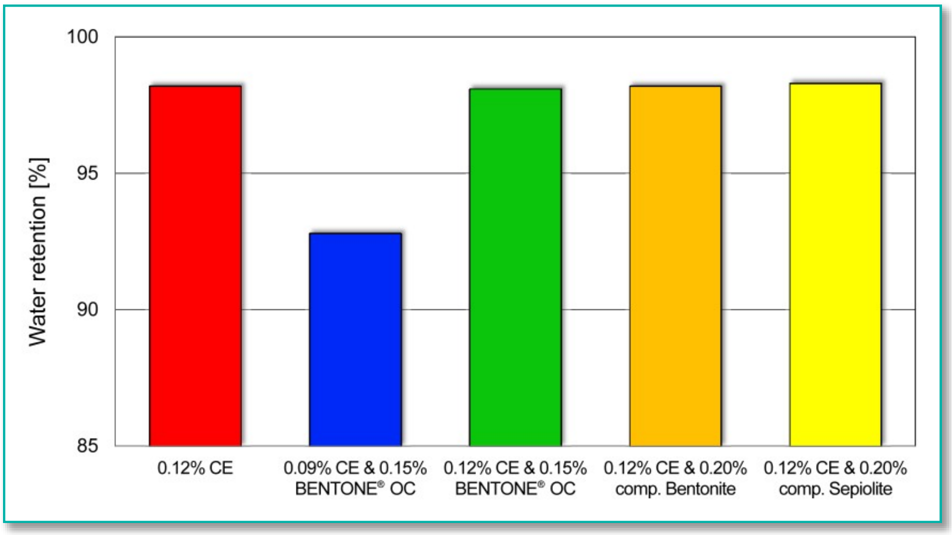


For all clay additives equal spread rates of around 16 cm are observed when formulated with an equal amount of 0.12% of the original cellulose ether content. The sample with lower cellulose ether content demonstrates significantly lower consistency and is therefore not of practical use.

Excellent sag and slump control

Figure 2: Water concentration

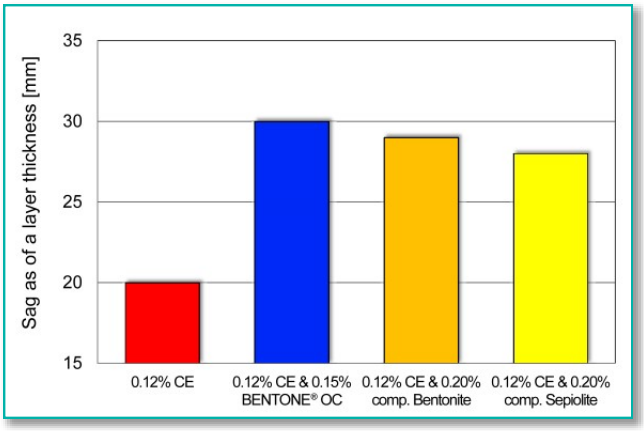
Water retention was tested using the filter plate method, in accordance with DIN 18555, Part 7.

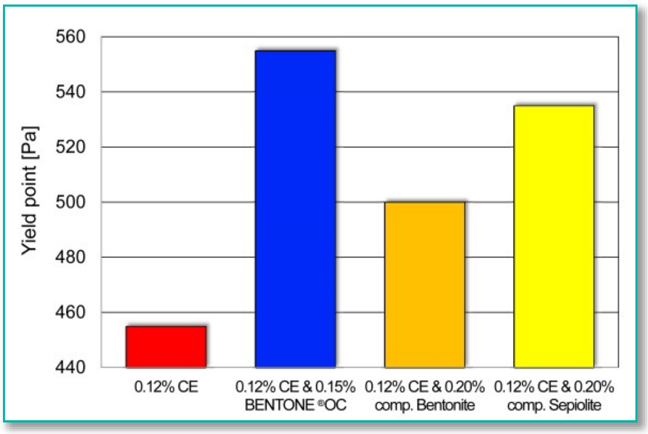


All formulations with the initial concentration of cellulose ether show the required high water retention values. With reduced cellulose ether content, significantly lower water retention values are obtained. This can not be compensated by the addition of BENTONE® OC. Due to these results, the formulation with reduced cellulose ether content can not be considered for further evaluation.

Figure 3: Sag/slump control and Figure 4: yield point

Sagging, measured as the maximum applicable layer thickness, was tested by application with a wedge blade. The yield points were evaluated by an Anton-Paar MCR 300 rheometer, using the so called tangent crossover method.



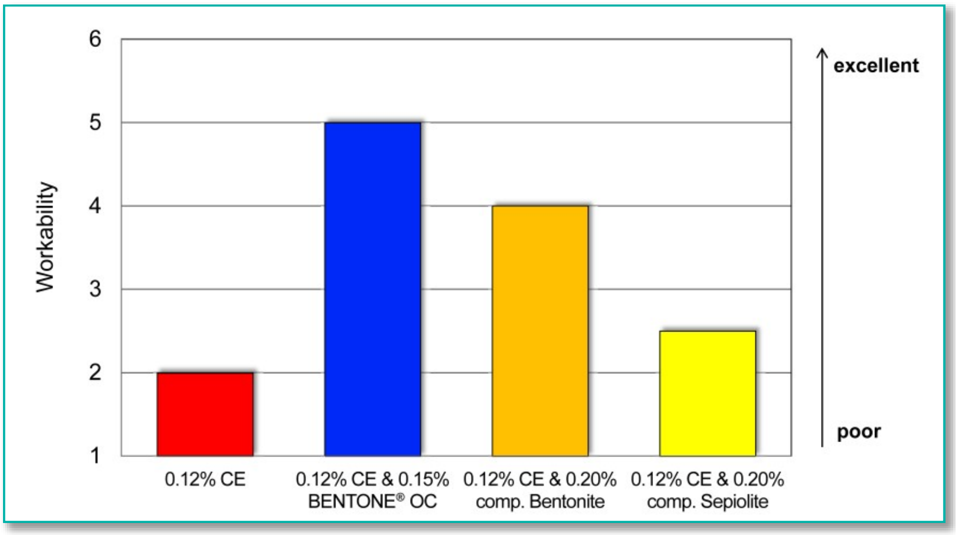


The highest sag stability and yield points are obtained with BENTONE® OC, both compared to competitive clays as well as to the formulation with cellulose ether only. This means thicker stable layers can be applied on the vertical surface without sagging.

Easier application

Figure 5: Ease of application

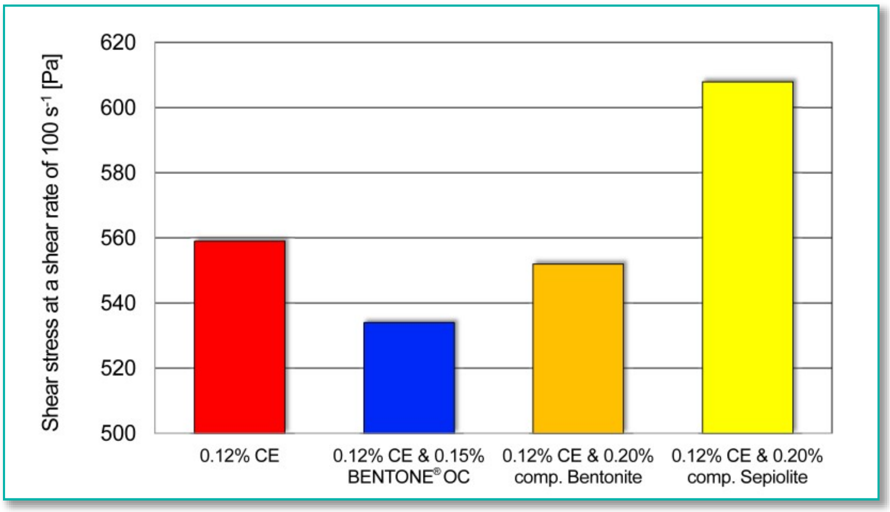
The application behavior was judged qualitatively by judging the behaviour while applying the rendering.



The use of BENTONE® OC results in the best application properties and the least stickiness on the tool. Both competitive clays provide less good performance, even when used in higher concentrations compared to BENTONE® OC.

Figure 6 : Shear stress at high shear forces

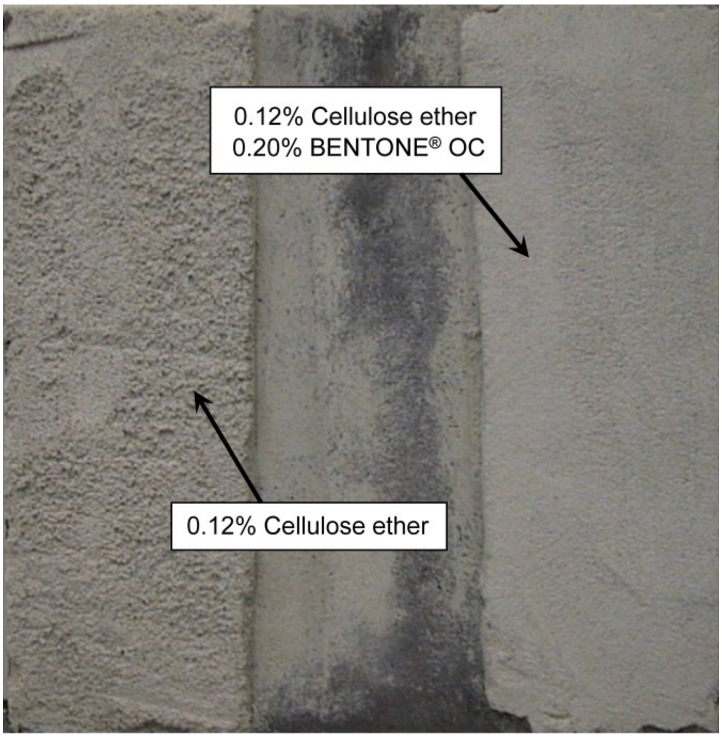
The shear stress necessary to initiate a shear rate of 100 s^{-1} is used as an equivalent for the energy required for pumping and troweling. The lower the bar the better the result.



The formulation with BENTONE® OC requires the lowest amount of energy to initiate flow at a shear rate of 100 s^{-1}. The competitive Bentonite grade shows also better results in comparison to the formulation with cellulose ether only. The competitive Sepiolite, shows even poorer results than the formulation with cellulose ether only.

Surface appearance

The use of BENTONE® OC results in much better, smoother surface quality applied by less amount of trowel passes.



Conclusion

BENTONE® OC added to a commercial lime-cement rendering formulation improves the workability and the surface quality. Further, BENTONE® OC reduces the stickiness on the tool, which providing improved application properties. Compared to competitive Bentonite and Sepiolite, BENTONE® OC gives reduced stickiness and shear stress at high-shear forces (equivalent for pumping or troweling energy) as well as improved sag resistance more effectively. The use of Sepiolite even results in an increase of the shear stress at high-shear rates compared to the formulation with pure cellulose ether. However, clay products cannot simply replace cellulose ethers because of the too low water retention properties.

Appendix

Test methods

- The flow table value was measured with the Haegermann flow table desk (DIN 18555, Part 2).
- To test the sag resistance 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.
- Yield point was determined with a Anton-Paar MCR 3000 rheometer, measuring geometry BM 15 (ball measuring system; ball diameter 15 mm), at a temperature of 23 °C.
- Water retention was tested with the filter plate method in accordance with DIN 18555, Part 7.
- Workability or application properties were evaluated by applying the rendering with a smooth trowel on a vertical wall. The stickiness on the tool and the force required during the application were subjectively assessed.
- Shear stress at high-shear forces was determined with a Anton-Paar MCR 3000 rheometer, measuring geometry CC 37 plaster (spindle/beaker system; serrated surface), at a temperature of 23 °C.

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