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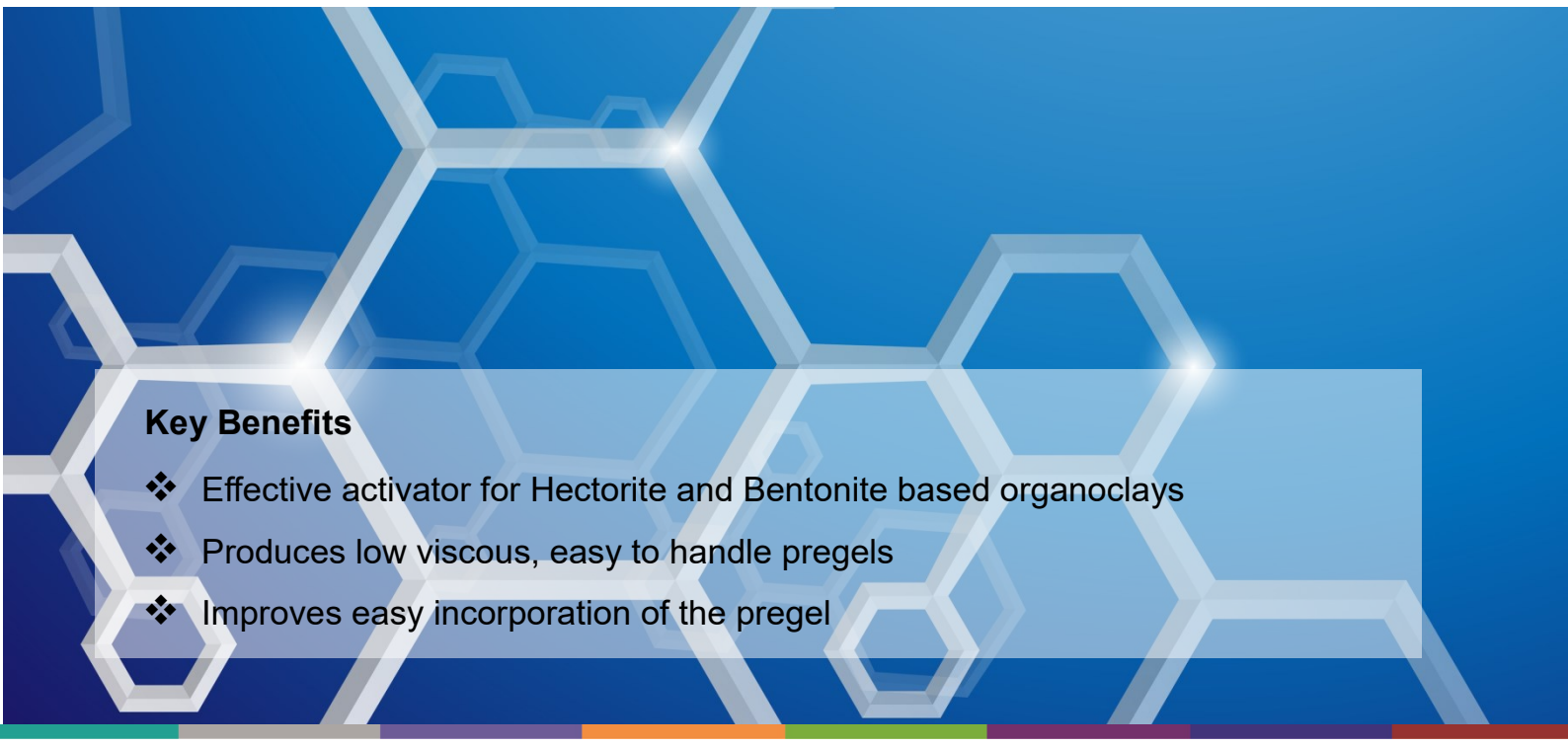
Application Leaflet

DAPRO® FX 2060

Polyamide based polar activator for organoclays with sag and stability improving properties



Key Benefits

- Effective activator for Hectorite and Bentonite based organoclays
- Produces low viscous, easy to handle pregels
- Improves easy incorporation of the pregel

Overview

Hectorite and Bentonite based BENTONE® organoclays typically require a specific activation in order to obtain optimum functionality and effectivity. In this process requires the firstly the exposure of the organic modified clay to the relevant solvent to allow the platelet staple to dwell. Further high shear is needed in order to delaminate these preswollen agglomerate into the individual clay platelets. Especially the conventional organoclays require additional chemical, or polar, activation to support the swelling and delamination process and to engage the individualized platelets to create the edge to edge bridging mechanism to obtain the needed gel structure. The described mechanism is visualized in the below shown *Figure 1.*

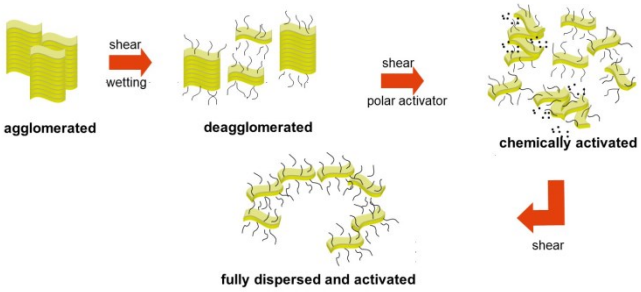


Figure 1: Activation organoclay

For further more detailed information on the activation of organoclays in general, please refer to the technical datasheet "BENTONE® organoclays - Dispersion and activation).

Chemical/polar activation

As already mentioned, polar activators are having a functional role in the activation process of organoclays. Suitable chemical activators can be found in *table 1*.

Chemical/polar activator	Concentration related to BENTONE® clay [%]
Ethanol/water (95/5)	50
Propylene carbonate	33
Acetone/water (95/5)	60
DAPRO® FX 2060	30
DAPRO® BEZ 75	30

Table 1: Polar/chemical activators

As it can be seen, polar activators typically consist of small molecule size but highly polar molecules, e.g. alcohols, blended with small amounts of water. In case the proposed system necessarily needs to be free of water, propylene carbonate is a suitable alternative.

The chemical activators are essentially responsible for two functions. The first is to carry available water into the morphological structure of the organoclay to make it available for hydrogen bonding at the platelet edges.

Most activators (e.g. low molecular weight alcohols) are reducing the surface tension of water which allows better distribution of the hydrophilic water into the hydrophobic organoclay matrix. Additionally activators are solvating and swelling the organic component in order to keep the platelet farther apart from each other. The second function is given by the water migrated between the hydroxyls on adjacent platelet edges, completing and strengthening the hydrogen which results at the end in optimum rheological structure.

It is also very important to keep the correct concentration of polar activator related to the organoclay portion in order achieve optimum effectivity as mentioned in *Table 1*. Too little activator will result in only partial delamination; excessive amounts will weaken the hydrogen bonding in non-polar systems.

DAPRO® FX 2060 is a surfactant based product and is suitable to especially create low viscous, better pumpable, pregels. Another activator option for low viscous but aromatic free pregels is DAPRO® BEZ 75.

DAPRO® FX 2060

Active content [%]	50
Appearance	Clear liquid
Density at 20°C [g/ml]	app. 0.93
Viscosity at 25°C [mPas] DIN 53015)	max. 500
Solubility	Soluble in organic solvents

Table 2: Product description DAPRO® FX 2060

As already describe, activation of organoclay through a pregel step is an effective way to optimize the production effectiveness. The test results in *Figure 2* show that the use of Ethanol/water based activators guides to the highest level of activation, however, also provide the highest pregel viscosity. The alternative use of DAPRO® FX 2060 guides to lower viscous and better pumpable but stable pregels.

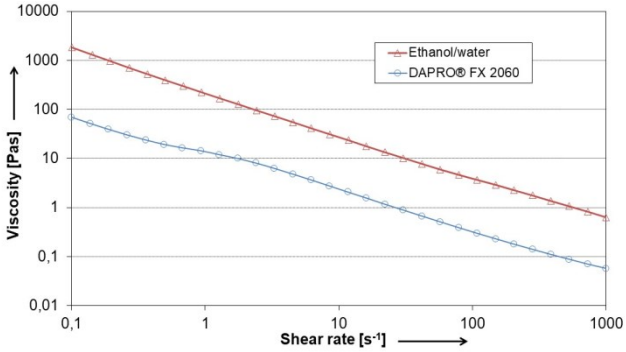


Figure 1: BENTONE® 38 pregel viscosity

The shown BENTONE® 38 pregel prepared at a concentration of 10% in Xylene shows the described differences over the entire range of tested shear rates.

These differences are also visible when comparing the appearance of the pregel in *Figure 3*.

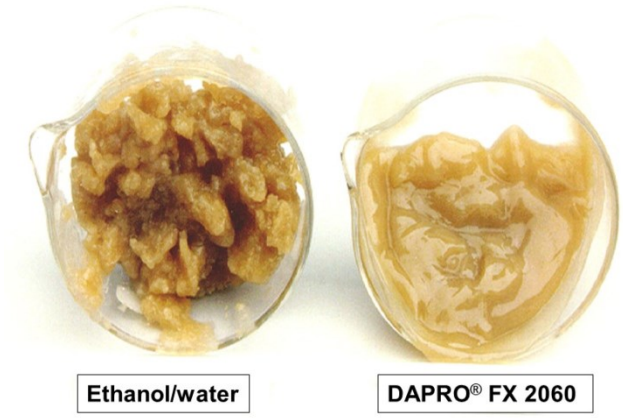


Figure 3: BENTONE® 38 Pregel appearance

As already describe, activation of organoclay through a pregel step is an effective way to optimize the production effectiveness. The test results in figure 2 show that the use of Ethanol/water based activators guides to the highest level of activation, however, also provide the highest pregel viscosity. The alternative use of DAPRO® FX 2060 guides to lower viscous and better pumpable but stable pregels.

Also important the drying-out behavior during handling and. *Figure 4* visualizes the positive impact of DAPRO® FX 2060 on drying of a 10% pregel of BENTONE® 34 in Xylene.

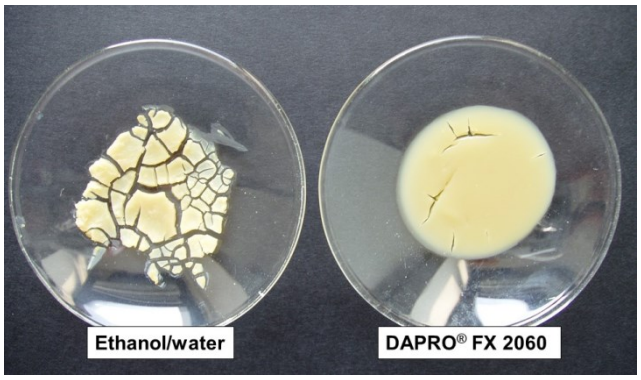


Figure 4: BENTONE® 34 drying behaviour

Pregels manufactured with Ethanol/water blends as polar activator are subject to drying and caking due to the evaporation of the volatile Ethanol. DAPRO® FX 2060 is less volatile and is therefore reducing the drying. This characteristic enhances the ease of handling and storage of the pregels.

In Figure 5 it can be seen that after incorporation of the pregels into a long-oil alkyd paints the pregel with DAPRO® FX 2060 as a polar activator gives slightly lower viscosities than with the Ethanol/water activation. However, the provided rheological behavior is unaffected. On the other hand, the pint viscosity is noticeably than with a market reference activator.

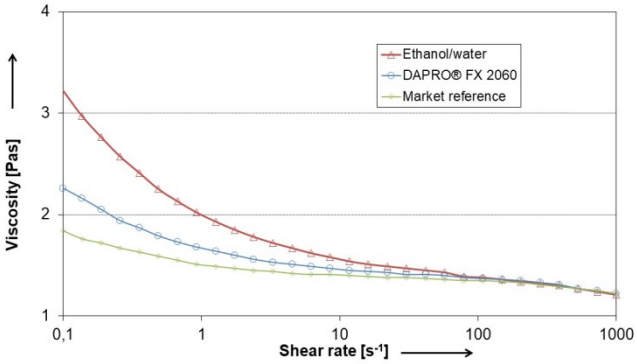


Figure 5: Long-oil alkyd paint rheology

Comparing the sagging stability of these alkyd paint is showing a similar picture as visualized in *Figure 6*.

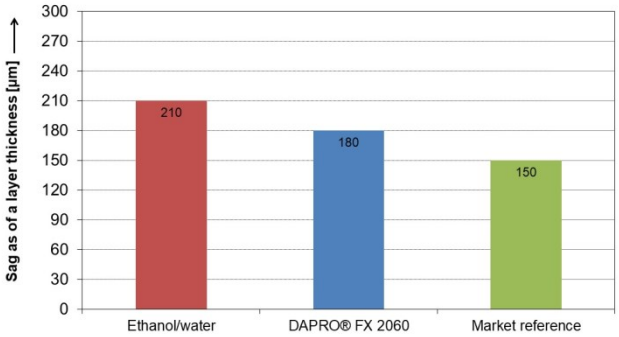


Figure 6: Long-oil alkyd paint viscosity sag stability

The test results show that ethanol/water blends provide the highest level of sagging stability when incorporated at a tip speed of 10 m/s by tooth bladed dissolver into the paint millbase. However, the use of pregels made with DAPRO® FX 2060 provide improved sag control than the market reference.

However, the incorporation method of the pregel into the final system plays a role. In many cases, different shear applied results in different performance. In *Figure 7*, the influence on the sag stability is shown.

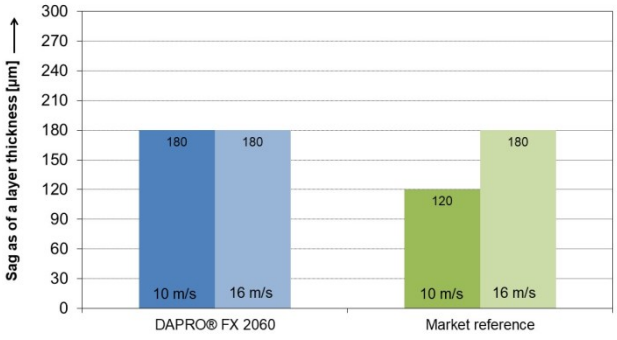


Figure 7: Sag stability depending on incorporation

As already shown in *Figure 6*, the pregel manufactured with DAPRO® FX 2060 is providing its full performance already from a lower dispersing speed at incorporation. A pregel made using the competitive market reference, requires significantly higher shear during the incorporation the final system in order to achieve identical performance.

Conclusion

The results have shown that DAPRO FX 2060 acts an effective polar activator for Bentonite and Hectorite based organoclay in the formulation of non-aqueous coatings. The following benefits of the product can be concluded:

- Effective chemical activation of organoclays
- Produces low viscous, easy manageable pregels
- Inhibits drying of the pregel
- Reduced activation time
- Reduction of incorporation energy requirements of the pregels
- Increased sag resistance
- Improved anti-settling stability

Appendix

Table 3: Formulation pregels

Raw material	Concentration [%]
Xylene	90
BENTONE® 34 or BENTONE® 38	10
Polar activator	3
Total	100

The organoclay portion was added under stirring to the solvent. Afterwards is was dispersed using a tooth bladed/cowles dissolver at 16 m/s for 20 minutes before the polar activator was added. Than it was continuously dispersed for further 5 minutes at 12 m/s.

Table 4: Formulation alkyd test paint

Raw material	Concentration [%]
Alkyd resin	63.5
Titanium dioxide	24.5
Sikkative	1
Anti-skinning agent	1
Organoclay pregel	10
Total	100

The organoclay pregels were added after the millbase processing under the conditions mentioned in the text..

Test methods

Rheology measurements

Measured with Anton Paar MCR 301 using measuring geometry PP 50 at a gap width of 1 mm at 23°C.

Brookfield viscosity

Viscosity data measured with Brookfield RVT, spindle 5/6, at a measuring temperature of 23°C.

Sag control

Sag tested using test blade 30 -300µm

NOTE: The information herein is currently believed to be accurate. We do not guarantee its accuracy. Purchasers shall not rely on statements herein when purchasing any products. Purchasers should make their own investigations to determine if such products are suitable for a particular use. The products discussed are sold without warranty, express or implied, including a warranty of merchantability and fitness for use. Purchasers will be subject to a separate agreement which will not incorporate this document.

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