

ELEMENTIS

Application Leaflet

DAPRO[®] FX 2060

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

Unique chemistry, sustainable solutions

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**.

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

FIGURE 1: Activation organoclay

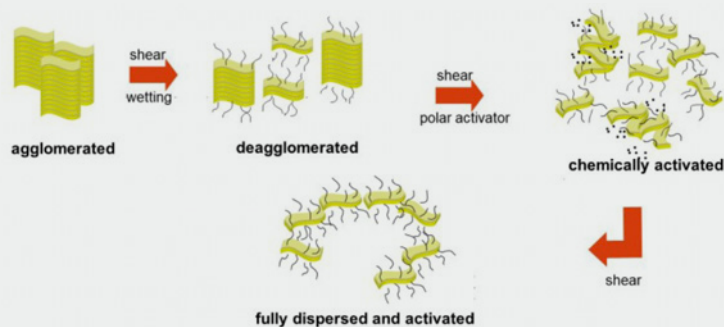


TABLE 1: Polar/chemical activators

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

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**.

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.

FIGURE 2: BENTONE® 38 pregel viscosity

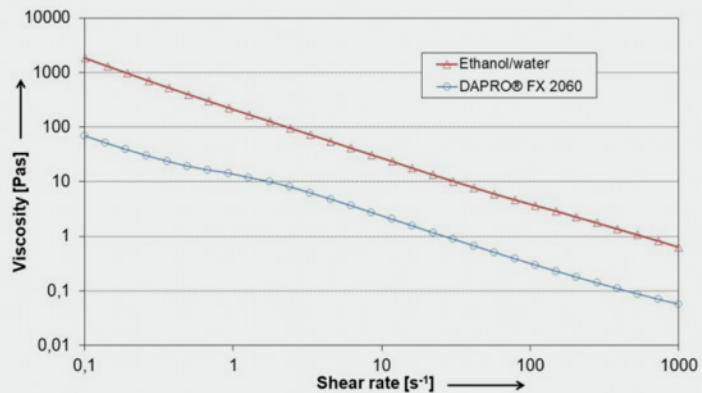
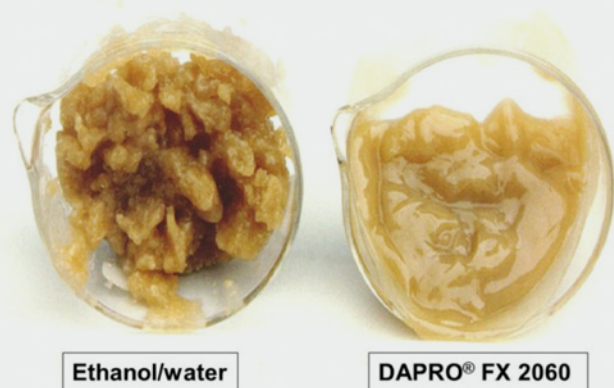


FIGURE 3: BENTONE® 38 Pregel appearance



DAPRO® FX 2060

TABLE 2: Product description 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

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.

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**.

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FIGURE 4: BENTONE® 34 drying behavior

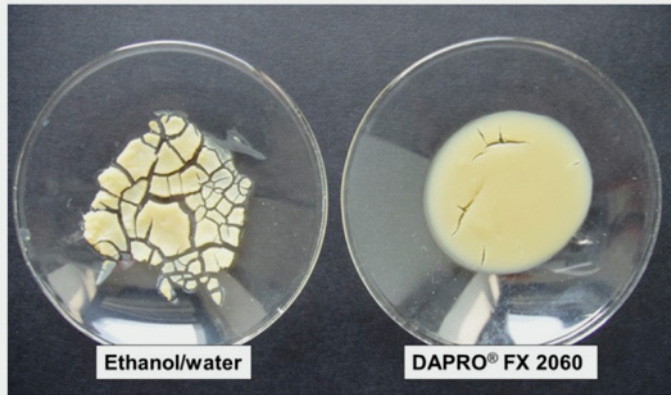
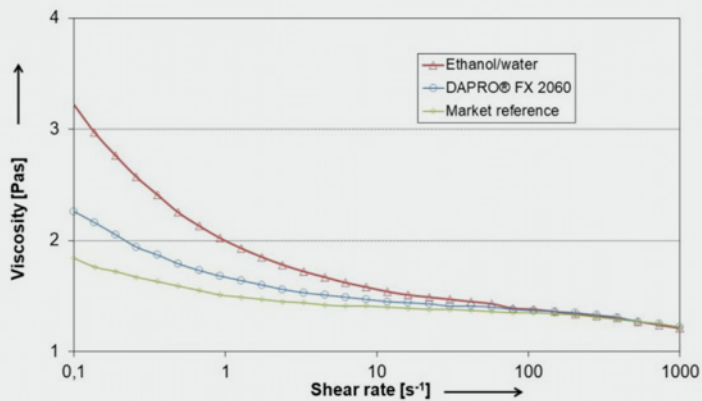


FIGURE 5: Long-oil alkyd paint rheology

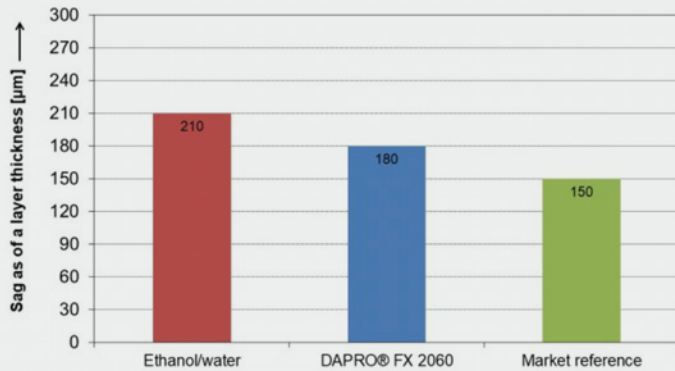


Also important the drying-out behavior during handling and. **FIGURE 4** visualizes the positive impact of DAPRO® FX 2060 on drying of a 10% pregel of BENTONE® 34 in Xylene.

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 6: Long-oil alkyd paint viscosity sag stability



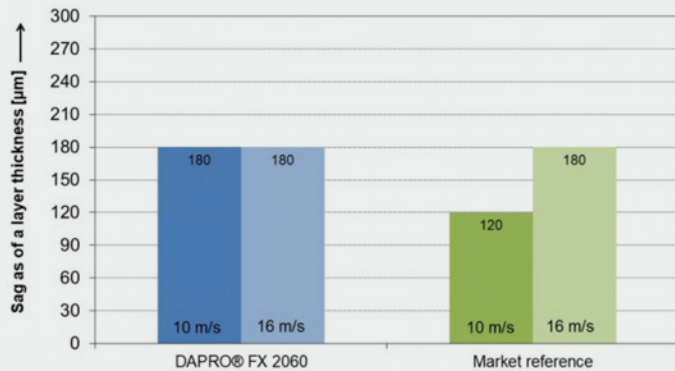
Comparing the sagging stability of these alkyd paint is showing a similar picture as visualized in **FIGURE 6**.

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.

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.

FIGURE 7: Sag stability depending on incorporation



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

TABLE 3: Formulation pregels

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

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

Appendix

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

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:

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