EXILVA THE NATURAL PERFORMANCE ENHANCER

TECHNICAL BULLETIN

HIGH SALT COMPATIBILITY LEVEL

EXILVA IN HIGH SALINITY SYSTEMS

Exilva shows high level of compatibility with common mono and multivalent salts. Exilva's good compatibility with different salts allows using Exilva to thicken and stabilize even high electrolyte content systems such as personal care products, oilfield applications and concrete mixes.

HIGH SALINITY SUSPENSIONS AND VISCOSITY

The key to understanding the effect of different salts on the properties of Exilva is to look at the mechanism how Exilva thickens and stabilizes suspensions. Exilva fibrils form a three dimensional network where the fibrils are mainly connected by physical links and entanglements. The network builds throughout the whole suspension, increasing the viscosity and stabilizing other components when they are trapped in the network. In addition to the strong physical links, the fibrils carry a small anionic surface charge which causes repulsion between the fibrils. Adding salt to the suspension screens these charges allowing the fibrils to come closer to each other but it does not affect the physical links.

Figure 1 shows flow viscosities for Exilva suspensions with 10% (w/w) of mono and multivalent salts. Compared to the suspension of Exilva without salt, the salt solutions decrease the flow viscosity of the Exilva suspensions. Typical cations, like calcium, magnesium and sodium, have small effect on the flow viscosity, whereas ammonium ion decreases the viscosity rather much. However, even at high ammonium concentration, the viscosity effect does not disappear. Under a flow, the fiber network breaks into smaller fragments (flocs) which move along the flow. The size and packing of the fibrils in these flocs is influenced by the salt which in turn is reflected in the flow viscosity.

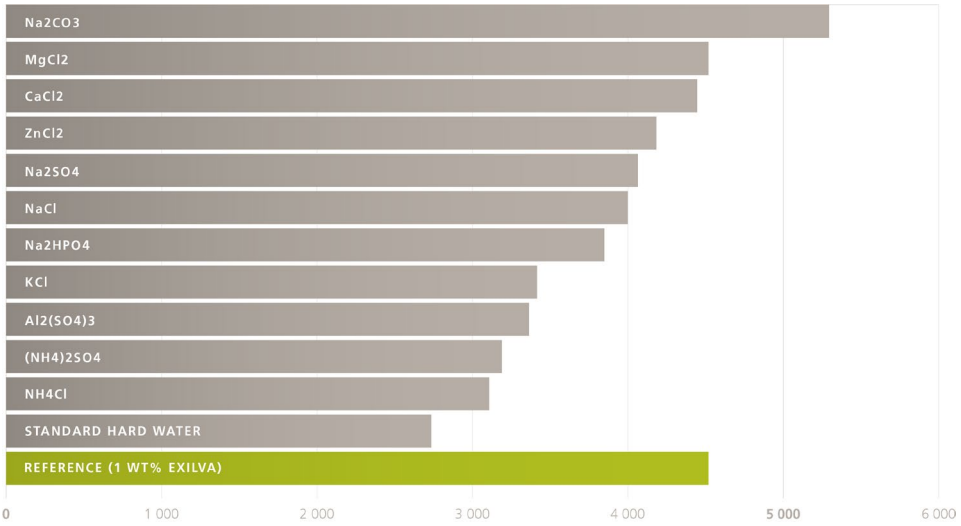

FIGURE 1: Flow viscosity of 1% Exilva suspensions with different salts at 10% concentration. The viscosity is measured by Brookfield viscometer at 10 rpm (given in cP).

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A product by Borregaard

The properties of the suspensions at rest can be studied by measuring the complex viscosity in an oscillation mode. Complex viscosity is closely related to the stability of the suspension: the higher the complex viscosity, the better the stability is. Figure 2 shows the complex viscosities for different Exilva salt solutions. Opposite to the flow viscosity, the complex viscosity of these suspensions increases by addition of a salt. Screening of the surface charge strengthens the network at rest because the fibrils are able to form more contacts with each other, leading to a stronger stabilizing effect than without a salt.

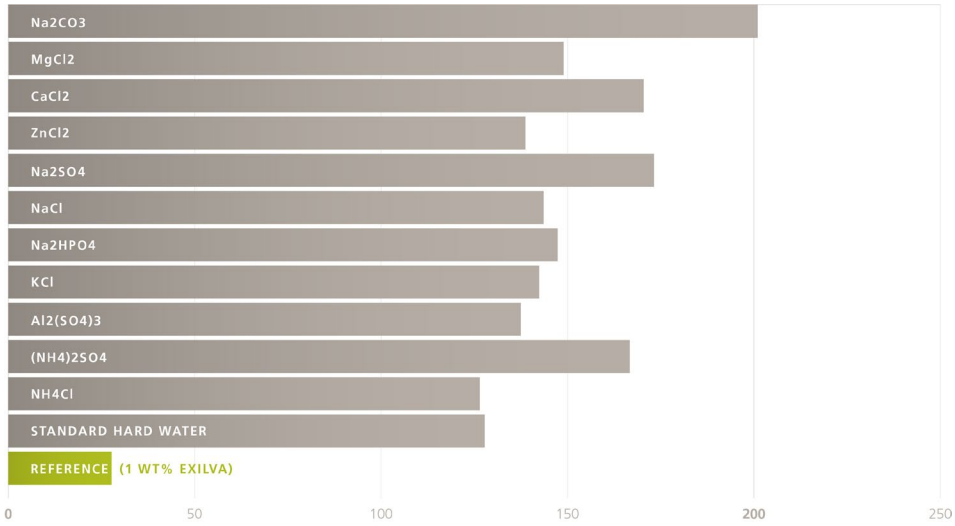

FIGURE 2: Complex viscosity (Pas) 1% Exilva suspensions with 10% salt. Complex viscosity describes the properties of the suspension at rest (without flow).

METHODS

Samples were made by diluting Exilva F 01-V (dry content 10%) with corresponding salt solutions (10 w%), resulting in 1% Exilva solid content (sample size 250 g). Exilva was mixed with Ultra Turrax (10 000 rpm/4 min). Complex viscosity was measured with Anton Paar rheometer using bob and cup measuring geometry. Brookfield viscosity was measured with a V-72 spindle at 10 rpm after 5 min measurement time. The complex viscosity was recorded from the linear viscoelastic region of an amplitude sweep (frequency 1 Hz).

SUMMARY

Exilva tolerates salts very well, enabling its use as a rheology modifier in high salinity formulations. Some changes in the rheology may be observed:

- Flow viscosity may decrease due to the denser fibers tructure
- Complex viscosity increases indicating better stabilization properties
- Exilva's viscosifying and stabilizing effect may change in high salinity solutions and adjustment of the concentration might be necessary