ELEMENTIS

A global specialty chemicals company

Application Leaflet

NUOSPERSE® FX 504 & NUOSPERSE® FX 605

Polyacrylate based dispersants for aqueous systems

Key Benefits

- High dispersing power
- Excellent viscosity stability
- Low foaming

Introduction

In the manufacture of waterborne systems such as e.g. dispersion paints, adhesives or putties, the pigments and extenders have to be properly dispersed in the aqueous phase. The degree of dispersion of the pigment and extender particles effects the major functions of the paint such as hiding power, color development, shelf-life, gloss etc. The use of an efficient pigment dispersing agent is essential. The deflocculating effect of the pigment dispersing agent results, even during the incorporation of the pigment/ extenders, in a strong reduction of the viscosity of the extender loading. This optimizes the milling efficiency considerably.

To stabilize the pigment/extender dispersion each particle must be protected by some barrier that counteracts the effect of Brownian motion, Van der Waals forces and gravity. Anionic, polymeric pigment dispersants adsorb strongly on the surface of individual particles rendering the surfaces negatively charged. This charge causes electrostatic repulsion around the particle rendering the surfaces negatively charged. This charge provides electrostatic repulsion surrounding the particle. The particles repel each other and hence are kept in the form of a stable dispersion (known as ionic or coulombic stabilization).

NUOSPERSE® FX 504

Composition	Ammonium salt of a polymeric carboxylic acid
Form	Clear liquid
Active concentration [%]	30

NUOSPERSE® FX 605

Composition	Sodium salt of a polymeric carboxylic acid
Form	Clear liquid
Active concentration [%]	45

Other inorganic dispersant technologies e.g. sodium hexametaphosphate, have been used to manufacture dispersion paints. However, these polyphosphates lack in stability (hydrolyses) and result in poor storage stability. This is the reason why synthetic, organic dispersants such as polyacrylates are most widely used.

The following product technologies have been compared to NUOSPERSE® FX 504 and NUOSPERSE® FX 605.

Chemistry	Abbreviation used in below evaluation
Diisobutylene maleic anhydrate, sodium salt	DIBMA
Sodiumhexametaphosphate	SHMP

Dispersant demand test

The method used to determine minimum dosage level of dispersants is known as „dispersant demand test“. When dispersants are added to a pigment and/or extender dispersion in water, the viscosity decreases dramatically. The higher the effectiveness of the dispersant, the stronger the viscosity drop at the lowest dipersant rate. In the dispersant demand test the drop in viscosity is measured as dispersant titrated into the system. The optimum dispersant requirement is at the point of minimum viscosity. Overdose of dispersant can cause flocculation to occur, thereby increasing the viscosity of the dispersion.

Raw material	Concentration [%]	Function
Titanium dioxide	33.3	Pigment
Calcium carbonate	33.3	Extender
Water	33.3	
	100.0	

Test system: Dispersant demand test

The most ideal dispersant provides the lowest viscosity at the lowest dispersant level and displays a minimal viscosity growth as the dispersant level increases (*Figure 1*).

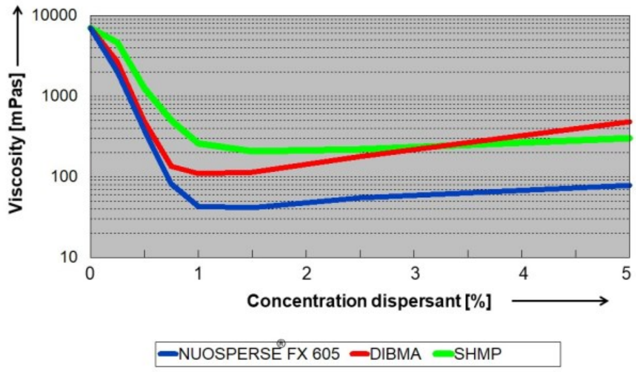


Figure 1: Dispersant demand test

As Figure 1 shows, NUOSPERSE® FX 605 provides the lowest viscosity of the tested dispersant technologies. The minimum viscosity can be observed at a dispersant concentration of approximately 1%.

Viscosity stability

A good indication for proper pigment stabilisation in e.g. a paint formulation is the stability of the systems viscosity. When viscosity increases after time, it is a strong sign that the dispersant is inadequate in compatibility and concentration and flocculation occurs.

In *Figure 2* the development of the viscosity of a styrene acrylic, pvc 85%, paint equipped with various dispersants is shown.

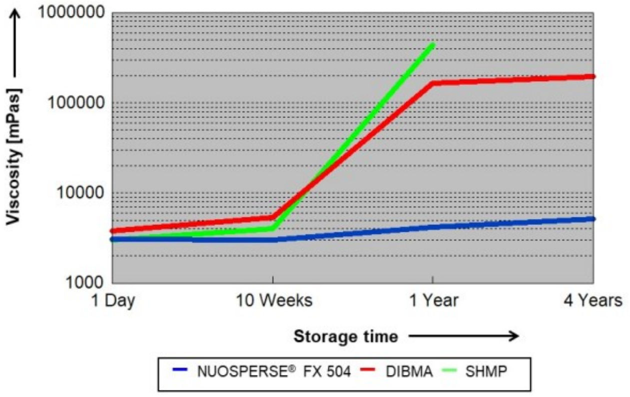


Figure 2: Viscosity stability test

The sample formulated with NUOSPERSE® FX 504 shows optimum viscosity stability over the entire test time range of 4 years. Both other dispersant chemistries are showing significant viscosity rises as of a storage time of 10 weeks.

Freeze/Thaw stability

In order to improve freeze-thaw stability, non-ionic wetting and dispersing agent such as NUOSPERSE® FN 265 are beneficial to be added see below *Figure 3*.

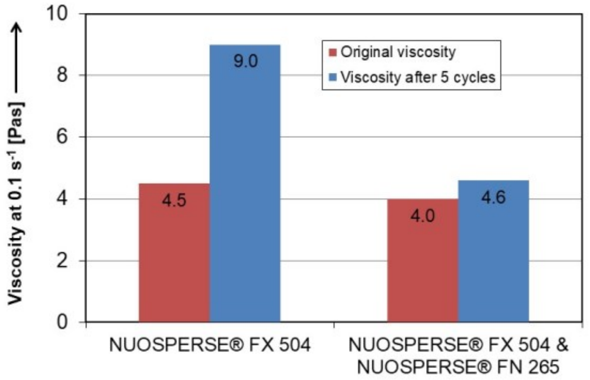


Figure 3: Freeze/Thaw stability

It can also be seen that the original viscosity of the paint is slightly lower using a non-ionic wetting agent. The explanation for this is the excellent pigment wetting properties and the stabilising effect of a non-ionic wetting agent such as NUOSPERSE® FN 265 on the polymeric binder particles (no coalescence).

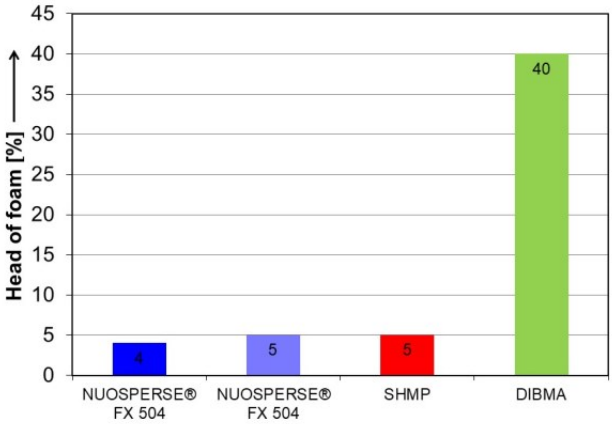
Foaming

Pigment dispersants are taking influence on the foaming properties of a paint. This has typically been tested of pigment or a filler in water. The concentration used in the test shown in *Figure 4* is the following:

Raw material	Concentration [%]	Function
Titanium dioxide	10.3	Pigment
Dispersant	1.0	
Water	89.0	
	100.0	

Test system: Foaming test

The increase in volume is measured after 5 minutes high speed dispersing of the TiO_2 dispersion .



In can be seen that both NUOSPERSE grades and the SHMP based dispersant have only a limited influence on the foaming characteristics of the system. The dispersant based in the DIBMA chemistry caused a 10 times stronger foaming.

Appendix

Test paint, pvc 80%

Raw material	Concentration [%]
Styrene-acrylic emulsion	7.5
Dispersant	0.3
Biocide	0.3
Defoamer	0.2
Pigment, TiO_2	5.0
Extender blend	46.5
FINNTALC® IT Extra (functional filler)	8.0
DAPRO® FX 511 (coalescent)	1.0
Caustic soda, w (NaOH) = 0.1	0.1
RHEOLATE® 185 (rheology modifier)	0.6
Water	30.5
	100.0

- For the freeze/thaw stability tests additional 0.2% of NUOSPERSE® FN 265 have been formulated.

Test methods:

Rheology data

Determined using the Anton-Paar MCR 301 rheometer, equipped with PP 50 measuring geometry at a gap width of 1 mm, at a temperature of 23°C. KU viscosity.

Foaming performance

To test the defoamers performance in the three different formulations the following procedure was conducted: first, 100 ml paint was put into a 250 ml glass jar. This dispersion was stirred for 5 minutes at 5,000 rpm using a 3 cm toothed Cowles blade. After this process step, the height of head of foam was measured.

Freeze/Thaw stability

Measured with the Brookfield RVT viscometer, equipped with Spindle 5, at 10 rpm and a temperature of 23°C.

North America
Elementis
469 Old Trenton Road
East Windsor,
NJ 08512, USA
Tel:+1 609 443 2500
Fax:+1 609 443 2422

Europe
Elementis UK Ltd.
c/o Elementis GmbH
Stolberger Strasse 370
50933 Cologne, Germany
Tel:+49 221 2923 2066
Fax:+49 221 2923 2011

Asia
Deuchem (Shanghai) Chemical Co., Ltd.
99, Lianyang Road
Songjiang Industrial Zone
Shanghai, China 201613
Tel:+86 21 5774 0348
Fax:+86 21 5774 3563