



New high-performing
scale inhibitor and
dispersing agent with low
free monomer levels



Versaflex[®] 310

Nouryon



VERSAFLEX 310 is a new sulfonated copolymer designed to provide formulators in the water treatment industry with excellent calcium phosphate scale inhibition while dispersing iron, zinc and silt. Most importantly, with the unique proprietary manufacturing process of VERSAFLEX 310, formulators can count on the lowest free-monomer-level scale inhibitor in the marketplace and increased performance over that of similar polymer compositions. Nouryon also offers VERSAFLEX 310-37, a lower solids grade ideal for formulations that require 37% solids.

Applications

VERSAFLEX 310 sulfonated copolymer was developed to control phosphate scale in industrial water treatment processes, including:

- Cooling towers
- Boilers up to 150°C
- Mining
- Industrial production where water may contact animal feed

Benefits

VERSAFLEX 310 sulfonated copolymer has been comprehensively evaluated against leading sulfonated polymers as well as against iron dispersant agents. Study results indicate:

1. Low free monomer level
 - More stable formulation
 - Reduced HSE exposure for formulators and their customers
 - Meets FDA CFR 173.310 resulting in peace of mind for formulators when it comes to ensuring safety of steam in contact with food
2. Better scale inhibition of calcium phosphate than 60/40 wt% AA/AMPS copolymers
3. Stabilizes iron at lower active treatment level than 60/40 wt% AA/AMPS copolymers
4. Effective at dispersing clays and other debris that may be present in systems which are open to the atmosphere
5. Effective zinc stabilizer to prevent precipitation
6. Stable over a wide pH range

Performance

1. Free monomer level below 250 ppm for more stable formulations and reduced HSE exposure for formulators and their customers

In typical AA/AMPS copolymers the residual acrylic acid and residual AMPS can be 1000 ppm or higher. For a number of applications such as animal feed, it is required that the sum of the monomers (a total of acrylic acid and AMPS) be less than 500 ppm.

The proprietary process used to produce VERSAFLEX 310 sulfonated copolymer generates materials with less than 250 ppm total monomer and, in most cases, less than 100 ppm total monomer. Residual monomers can be toxic to both humans and animals. This very low level of monomer minimizes the potential health hazards of residual monomers to both the formulators and field personnel.

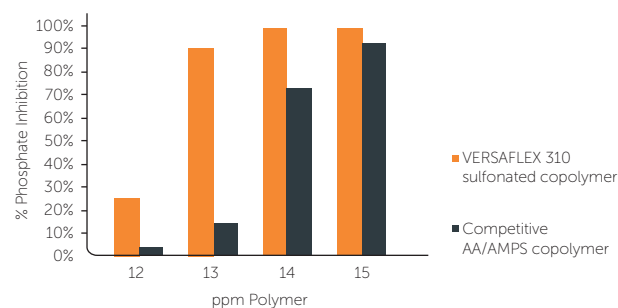
2. Better calcium phosphate scale inhibition than other 60/40 wt% AA/AMPS copolymers

VERSAFLEX 310 sulfonated copolymer and a competitive AA/AMPS copolymer were tested for calcium phosphate scale inhibition using the following conditions:

Typical Calcium phosphate static test conditions

Calcium	200 ppm
Iron	2 ppm
Phosphate	10 ppm
Time	17 hours
Temperature	70°C
pH	8 (buffered with sodium borate)

Figure 1: Calcium phosphate inhibition



Results: Testing conducted (Figure 1) indicate that VERSAFLEX 310 sulfonated copolymer inhibited phosphate scale at a lower active treatment level than a competitive AA/AMPS copolymer having the same level of AMPS. This increase in performance can be attributed to the special, proprietary process used in the manufacture of VERSAFLEX 310 sulfonated copolymer.

VERSAFLEX 310 sulfonated copolymer meets FDA CFR 173.310 resulting in peace of mind for formulators when it comes to ensuring safety of steam in contact with food.

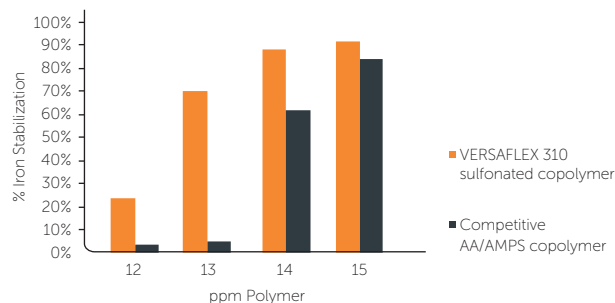
3. Better Iron dispersion than AA/AMPS copolymers

VERSAFLEX 310 sulfonated copolymer and a competitive AA/AMPS copolymer were tested for iron stabilization using the following conditions:

Typical iron stabilization static test conditions

Calcium	200 ppm
Iron	2 ppm
Phosphate	10 ppm
Time	17 hours
Temperature	70°C
pH	8 (buffered with sodium borate)

Figure 2: Iron stabilization



Results: Testing conducted indicates (Figure 2) that VERSAFLEX 310 sulfonated copolymer stabilized iron at a lower active treatment level than a competitive AA/AMPS copolymer with same level of AMPS.

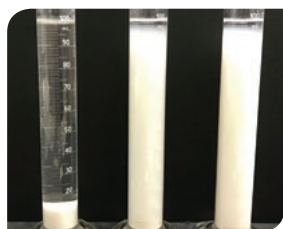
4. Effective dispersing agent

VERSAFLEX 310 sulfonated copolymer is effective at dispersing clays and other debris that may be present in systems which are open to the atmosphere (e.g., cooling towers). A dispersancy test was conducted using the following conditions.

Dispersancy test conditions

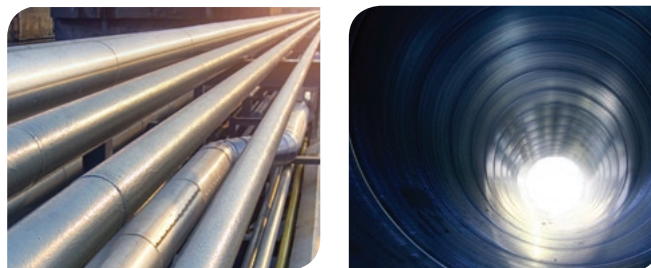
Kaolin clay	2 weight percent
Polymer dosage	2 ppm, 5 ppm
Polymer mix time	5 minutes
Settling time	17 hours
Temperature	21°C

Figure 3. Dispersancy test results



Without polymer VERSAFLEX 310 / 2 ppm VERSAFLEX 310 / 5 ppm

Results: The picture of the test (Figure 3) confirms that VERSAFLEX 310 sulfonated copolymer is an exceptional dispersant. It suspends the clay in this test for an extended period of time as compared to a sample without polymer.



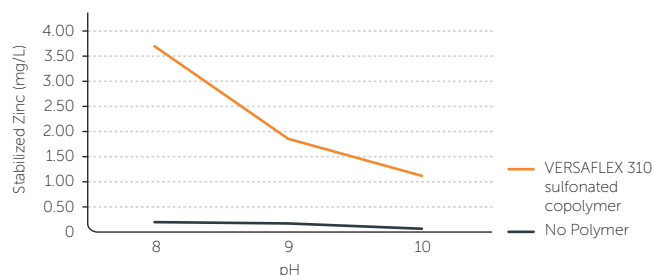
5. Effective zinc stabilizer

When VERSAFLEX 310 sulfonated copolymer is used in formulations containing zinc for corrosion control, it is an effective zinc stabilizer to prevent precipitation.

Typical zinc stabilization static test conditions

Zinc	5 ppm
Calcium	100 ppm
Magnesium	35 ppm
Carbonate	180 ppm
Time	17 hours
Temperature	70°C

Figure 4. Zinc stabilization



6. Stable across a wide range of pH levels

The stability of additives across a wide pH range is important for flexibility in designing water treatment formulations. Stability tests were performed using VERSAFLEX 310 sulfonated copolymer in two high-stress formulations – one simulating a highly acidic environment (pH 1~2), and one simulating an alkaline environment (pH ~13).

Figure 5. pH stability test



pH 2 pH 13

Results: In the picture (Figure 5), each of the formulations tested using VERSAFLEX 310 sulfonated copolymer is transparent, indicating stability of the polymer.

Chemistry

VERSAFLEX 310 sulfonated copolymer is a 60/40 wt% Acrylic Acid/AMPS copolymer that inhibits the formation of calcium phosphate scale while dispersing iron, zinc, and phosphates.

Storage and handling

For complete information on how to handle and store VERSAFLEX 310 sulfonated copolymer, please request a product Safety Data Sheet by contacting your Nouryon sales representative.

Technical property	Typical values
VERSAFLEX 310	
Appearance	Clear, colorless
Chemical form	Liquid
Weight average molecular weight	≥ 9,900
Number average molecular weight	≥ 5,700
Total solids (%)	47 – 49
pH as is (at 25°C)	2.5 – 3.5

VERSAFLEX 310-37	
Appearance	Clear, colorless
Chemical form	Liquid
Weight average molecular weight	≥ 9,900
Number average molecular weight	≥ 5,700
Total solids (%)	36 – 38
pH as is (at 25°C)	4.6 – 5.6

Contact us directly for detailed product information and sample requests.

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