



ACUMER™ 4300 Polymer
 Scale Inhibitor and Dispersant for Calcium Carbonate and Calcium Sulfate Control

Description

ACUMER™ 4300 is a high performance scale inhibitor, specifically developed to prevent both calcium carbonate and calcium sulfate salt deposits in water systems. This product, a maleic multipolymer, can also prevent the formation of other scales such as calcium oxalate. ACUMER 4300 can also disperse colloids and fine particles such as clay.

Benefits

Performance

General purpose scale inhibitor/dispersant – effective on a variety of foulants and scale formers (calcium oxalate, calcium carbonate, calcium sulfate and silt).

Excellent calcium carbonate inhibition, performs in high alkalinity/hardness and high total dissolved solids systems.

Excellent calcium sulfate inhibition, performs in high and low pH water systems.

Enhances inhibition properties in blends with high performance dispersant polymers (e.g., OPTIDOSE™ 2000 and OPTIDOSE 3100).

Polymer Characteristics

Can replace phosphonates and maleic acid polymers as scale control agents.

Stable at all pH levels.

General

Manufactured in an ISO 9002 certified manufacturing plant.

The following table lists the typical physical properties of ACUMER™ 4300 Polymer.

Typical Physical Properties

These properties are typical but do not constitute specifications

Property	Value
Appearance	Clear to slightly hazy liquid
Type	Maleic multipolymer
Molecular weight ¹	2000
% total solids	50
% actives	36.5
pH	7
Viscosity, as is, cps ²	400-1200
¹ Mw is measured by aqueous GPC and reported as acid form	
² Brookfield LV, Spindle#2, 12 rpm, 25°C	

Mechanism of Action

Maleic polymers are known to be excellent calcium carbonate inhibitors and crystal modifiers but many exhibit only fair calcium sulfate deposit control. An advanced polymer, ACUMER™ 4300, has been developed to overcome this problem. ACUMER 4300 contains maleic and a unique combination of other functionalities to provide both an advanced calcium carbonate and calcium sulfate inhibition. Preventing calcium sulfate scale is important in water systems treated with sulfuric acid for pH control or if using seawater or briny waters. Also removing sulfur oxide gases in scrubbing systems can result in sulfur containing calcium deposits.

ACUMER 4300 polymer can be used to inhibit scale buildup on surfaces through at least three mechanisms:

- Solubility enhancement or threshold effect, which reduces precipitation of low solubility inorganic salts.
- Crystal modification, which deforms the growing inorganic salt crystals to give small, irregular, readily fractured crystals that do not adhere well to surfaces.
- Dispersing activity, which prevents precipitated crystals or other inorganic particles from agglomerating and depositing on surfaces.

Performance Advantages With ACUMER™ 4300 Polymer Scale Inhibitor

The following tables compare the product efficacy of ACUMER™ 4300 polymer with other scale control agents for inhibiting calcium salts and dispersing solids. The higher the performance value (% inhibition or NTU), the better the scale inhibitor and dispersant. Test conditions represent various salt levels found in cycled cooling water.

Calcium Carbonate Inhibition

Polymers were tested by Dow laboratories for preventing the precipitation of calcium carbonate under highly stressed conditions. The “High Salt” conditions used for these evaluations contain chloride levels typical of seawater or very briny waters. The “High Calcium” conditions contain calcium and carbonate levels typical of highly cycled cooling water. In Table 1, ACUMER 4300 provided excellent performance for inhibiting calcium carbonate under both test conditions. ACUMER 4300, HEDP and polymaleic acid were the best inhibitors in the “High Salt” test while ACUMER 4300 and pAA were the best inhibitors in the “High Calcium” test.

Performance Advantages With ACUMER™ 4300 Polymer Scale Inhibitor (Cont'd)

Table 1
ACUMER™ 4300 – Calcium Carbonate Scale Inhibitor

Additive	MW	% CaCO ₃ Inhibition – High Salt	% CaCO ₃ Inhibition – High Calcium
ACUMER 4300	2000	84	96
HEDP	206	86	90
Polymaleic acid	750	86	82
Polyacrylic acid	2000	10	96
Polyacrylic acid	4500	8	95
AA/sulfonate copolymer	4500	6	85
Competitive polymer VI	6700	10	Not tested
None	-	3	63

CaCO₃ Inhibition (%) (High Salt): 20 ppm polymer solids / 200 ppm Ca⁺² as CaCO₃ / 3500 ppm M-Alkalinity as CaCO₃ / 30,000 ppm NaCl / pH 9 / 38°C / 20 hours.

CaCO₃ Inhibition (%) (High Calcium): 10 ppm polymer solids / 600 ppm Ca⁺² as CaCO₃ / 300 ppm Mg⁺² as CaCO₃ / 600 ppm M-Alkalinity / pH 9/54°C / 20 hours.

Calcium Sulfate Inhibition

ACUMER 4300 is also an excellent calcium sulfate inhibitor as demonstrated in Table 2. Many conditions were evaluated at different temperatures, pH and polymer levels. ACUMER 4300 provided excellent performance similar to pAA in the longer term tests but was the best performer for inhibiting calcium sulfate in once-thru conditions where induction time is under an hour. ACUMER 4300 excelled for inhibiting calcium sulfate.

Table 2
ACUMER 4300 – Calcium Sulfate Scale Inhibitor

Additive	MW	CaSO ₄ Inhibition: Induction Time (Minutes)	% CaSO ₄ Inhibition (pH 4, 70°C, 5 ppm (Polymer Solids))	% CaSO ₄ Inhibition (pH 4, 50°C, 10 ppm (Polymer Solids))	% CaSO ₄ Inhibition (pH 9, 70°C, 5 ppm (Polymer Solids))
ACUMER 4300	2000	24.0	94	94	98
Polymaleic acid	750	2.0	5	50	98
Polyacrylic acid	2000	12.2	97	94	97
Polyacrylic acid	4500	14.5	98	94	80
HEDP	206	4.5	Not tested	6	Not tested
Acrylic acid/sulfonate copolymer	4500	Not tested	68	94	98
None	-	1.0	0	0	0

CaSO₄ Inhibition (Induction time before precipitation, minutes): 5 ppm polymer solids/ 6800 ppm Ca⁺² as CaCO₃/ 30 g/l Na₂SO₄/pH 8.5/ 25°C.

%CaSO₄ Inhibition: 5 or 10 ppm polymer solids/ 6810 ppm CaSO₄/ pH 4 or 9/ 50 or 70°C/ 18 hours.

Performance Advantages With ACUMER™ 4300 Polymer Scale Inhibitor (Cont'd)

Calcium Oxalate Inhibition, Phosphate Stabilization, and Iron Oxide/Clay Dispersancy

The next table lists results of other water treatment tests. ACUMER™ 4300 is an excellent calcium oxalate inhibitor. (Oxalate scales can form from paper manufacturing and agricultural processes.) Also, ACUMER 4300 provides fair dispersancy for iron oxide and clay, similar to performance of polyacrylic acid. If phosphate scale exists or may form, ACUMER 4300 should be combined with a sulfonated copolymer such as ACUMER 2000.

Table 3
ACUMER 4300 – Performance in Other Water Treatment Tests

Additive	MW	Calcium Oxalate Inhibition %	Phosphate Stabilization %	Iron Oxide Dispersancy NTU	Clay Dispersancy NTU
ACUMER 4300	2000	100	13	114	116
AA/sulfonate copolymer	4500	73	92	330	840
Polymaleic acid	750	93	25	90	120
Polyacrylic acid	2000	83	20	82	180
Polyacrylic acid	4500	97	15	87	210
HEDP	206	Not tested	14	76	63
None	-	20	5	56	50

Calcium Oxalate (CaC₂O₄) Inhibition: 20 ppm polymer solids / 75 ppm calcium oxalate / 18 hours / pH 9 / 40 °C.
 PHOSPHATE STABILIZATION: 10 ppm polymer solids / 6 ppm PO₄⁻³/ 250 ppm Ca as CaCO₃ / 2.5 ppm Fe⁺³/ pH 8.5 / 70°C / 17 hours.
 DISPERSANCY: Fe₂O₃ - 3 ppm polymer solids / 700 ppm Fe₂O₃ / 200 ppm Ca as CaCO₃ / pH 7.5 / Settling time= 4 hours.
 Clay - 5 ppm polymer solids / 1000 ppm Hydrite UF Kaolin clay / 200 ppm Ca⁺² as CaCO₃ / pH 7.5 / Settling time=2 hours.

In addition to excellent performance properties, ACUMER 4300 is non hazardous, chlorine stable, phosphate free, and convenient to handle and meter. In the most difficult cases, ACUMER Polymers can be used in conjunction with acid as the products are stable and effective over a wide pH range. ACUMER 4300 can be formulated with preservatives and other common water treatment chemicals.

Handling Storage

The products are stable for two years if kept in their original containers under normal storage conditions. When the containers are opened the products should be used within one month.

ISO 9002 Certification

All ACUMER™ products are produced in ISO 9002-certified manufacturing facilities.

Handling Precautions	Before using this product, consult the Material Safety Data Sheet (MSDS)/Safety Data Sheet (SDS) for details on product hazards, recommended handling precautions and product storage.
Storage	Store products in tightly closed original containers at temperatures recommended on the product label.
Disposal Considerations	Dispose in accordance with all local, state (provincial) and federal regulations. Empty containers may contain hazardous residues. This material and its container must be disposed in a safe and legal manner.
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