ACUSOL™ 820 Rheology Modifier/Stabilizer

Description

ACUSOL™ 820 Rheology Modifier/Stabilizer is a Hydrophobically modified Alkali Soluble acrylic polymer Emulsion (HASE) with unusually high aqueous thickening and stabilising efficiency. When neutralized to a pH above 7 by adding alkalis, ACUSOL 820 thickens instantly. The instantaneous effect on viscosity and easy incorporation of ACUSOL 820 into alkaline cleaner formulations offer savings in valuable production time that cannot be matched by carbomer or cellulosic thickeners, requiring predissolution and elimination of lumps.

Applications

Working by association, ACUSOL 820 can also thicken solutions containing high levels of surfactants at low pH. This unique performance is achieved by acidifying a neutralized surfactant-containing formulation with a dilute organic or mineral acid.

Physical Properties

The following are typical properties of ACUSOL™ 820 Rheology Modifier/Stabilizer; **they are not to be considered product specifications.**

Appearance: ..... Off white milky emulson
Polymer type: ..... Associative anionic acrylic
Solids (%): 30
pH (as supplied): 2.7
Density: 1.06
Viscosity (as supplied): .....15 Brookfield mPa·s/cPs
Acid value: .....11.7 (mls. N/10 NaOH per g product)

Features and Benefits

Features	Benefits
Anionic	Can be thickened instantly with any alkali. Compatible with both non-ionic andanionic surfactants, builders and fillers.
Liquid	Supplied as a low viscosity liquid emulsion, it is very easy to handle. No predissolution, elimination of lumps or warming required.
Associative nature	Association may occur with other formulation components giving enhanced viscosity and stability.
Rheology	Gives pseudoplastic (shear thinning) rheology, similar to cellulosics but maintains higher viscosity for higher shear rates.
Emulsion technology	Water-based polymerization. No residual solvents. No residual organic initiators.
Instant neutralization	Permits continuous manufacturing process through in-line static mixers.
Gel appearance	Gives clear gels or solutions.
Microbial resistance	Being a synthetic polymer, ACUSOL™ 820 Rheology Modifier/Stabilizer is inherently resistant to microbes and enzymes that can degrade cellulosic thickeners, leading to loss of viscosity.
Salt tolerance	Compatible with high levels of salts and electrolytes commonly used in household and institutional formulations.

Recommended Applications

ACUSOL™ 820 Rheology Modifier/Stabilizer is highly cost-effective for the following applications:

- Emulsion cleaners
- Glass cleaners
- Hand dishwash liquid detergents
- Hard surface and floor cleaners
- Liquid abrasive cleaners
- Liquid laundry detergents
- Oven cleaners
- Paint strippers
- Waterless cleaners
- White-wall tire cleaners

Formulating Tips

ACUSOL™ 820 Rheology Modifier/Stabilizer is compatible with surfactants, solvents, oils, salts and other ingredients commonly found in detergent and cleaner products. Formulators of detergents and cleaners will have no difficulty in discovering the best way to incorporate ACUSOL 820 into their own specific products.

General Mixing Procedure

Operating flexibility is provided by the physical characteristics of the product (low viscosity liquid before neutralization), and its high thickening efficiency allows varying operating procedures. The following mixing procedure meets most formulating needs:

1. Introduce ACUSOL™ 820 polymer into the formulation water. This should provide at least a threefold dilution of the polymer.
2. Add the nonionic surfactants (if any).
3. Add the anionic surfactants (if any)—low pH first.*
4. Add builders, fillers, particulates.
5. Add dyes, then perfume.
6. Neutralize with the chosen alkali.

* In the case of strongly acidic components, such as sulphonic acids, it is preferable to disperse this component in the system and partially neutralize (e.g.- to pH about 4-5) prior to addition of the polymer.

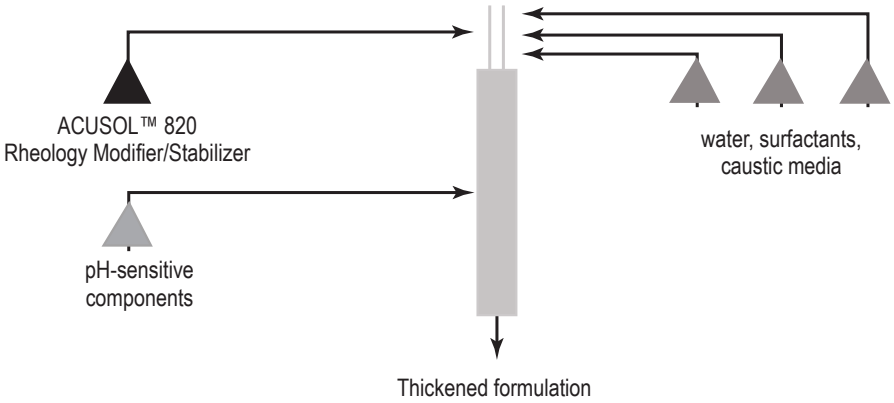
Rapid Mixing Technique

ACUSOL™ 820 polymer undergoes instantaneous thickening when a base is added. An in-line mixing technique using a static mixer along with a simple pump affords a convenient, rapid means of producing thickened solutions and gels. The solutions prepared by this technique are free from air bubbles.

For example, pumping solutions of ACUSOL 820 (4% polymer solids) and sodium hydroxide (0.74%) at equal rates through a static mixer gave 115 kg/hr of a clear foam-free gel (Brookfield viscosity 2 x 10^6 mPa·s at 0.5 rpm) containing 2% ACUSOL 820 solids. A small laboratory pump run at maximum speed gave the same output rate as in pumping deionized water. Although this example used only two feed streams, more feeds could be combined, depending on the type of formulation and the compatibility of the ingredients (see Fig. 1, next page).

Figure 1

Schematic Representation of an In-Line Mixer



Performance Properties

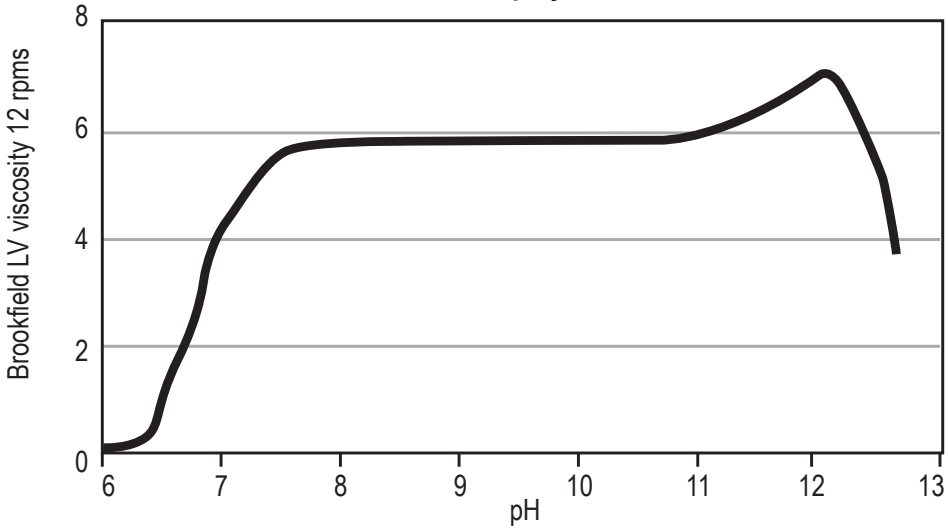
Thickening Efficiency

ACUSOL™ 820 Rheology Modifier/Stabilizer is a low viscosity dispersion that becomes a highly viscous clear solution when neutralized with alkali. Figure 2 shows the pH profile of sodium hydroxide neutralized ACUSOL 820 where a stable viscosity plateau is observed, and viscosity drops at pH values below 7.5 and above 12.5. This pH/viscosity profile may change in the presence of surfactants (see “Associative Nature” under Features and Benefits).

Figure 2

Viscosity / pH Response of ACUSOL™ 820 Rheology Modifier/Stabilizer

at 0.8% active polymer content



Performance Properties

Thickening Efficiency (cont'd)

Figure 3 shows the thickening performance at various Brookfield rotational speeds as a function of the polymer concentration.

Figure 4 compares its efficiency with that of a cellulosic and a carbomer thickener, demonstrating its pH tolerance. Besides sodium hydroxide, other bases, such as ammonia, soda ash (Na_2CO_3) and TEA, can be used as neutralizing agents.

Figure 3

Viscosity of ACUSOL™ 820 Rheology Modifier/Stabilizer Solutions as a function of polymer concentration

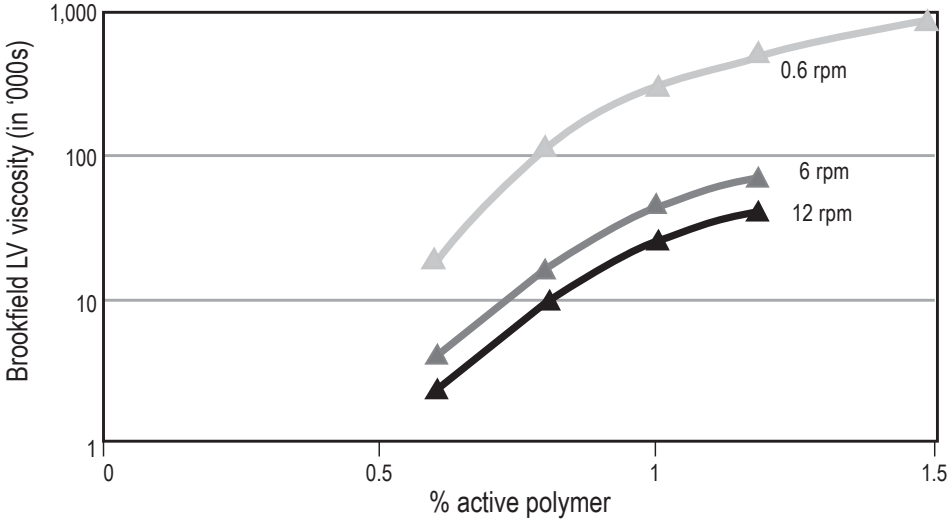
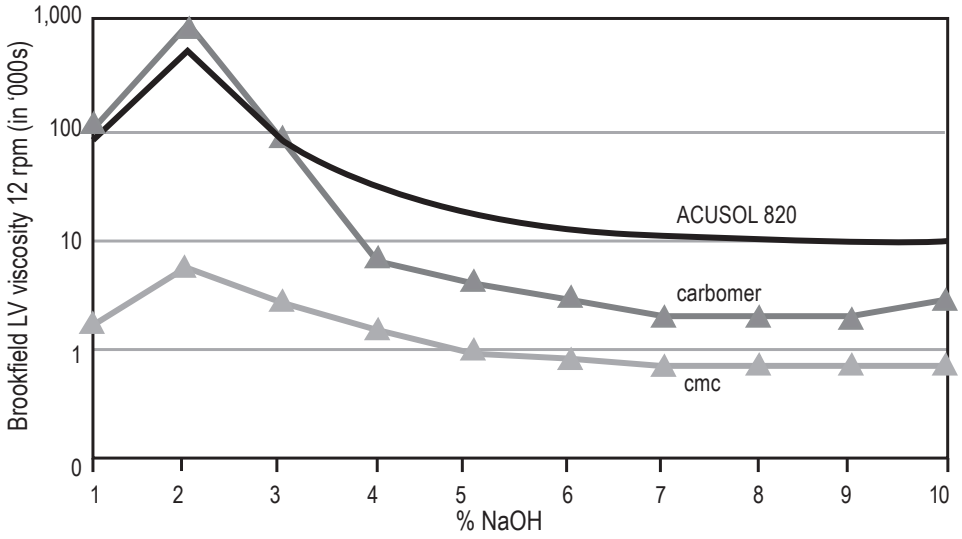


Figure 4

Effect of Alkali Concentration on Viscosity (1.25% ACUSOL™ 820 Rheology Modifier/Stabilizer Al)



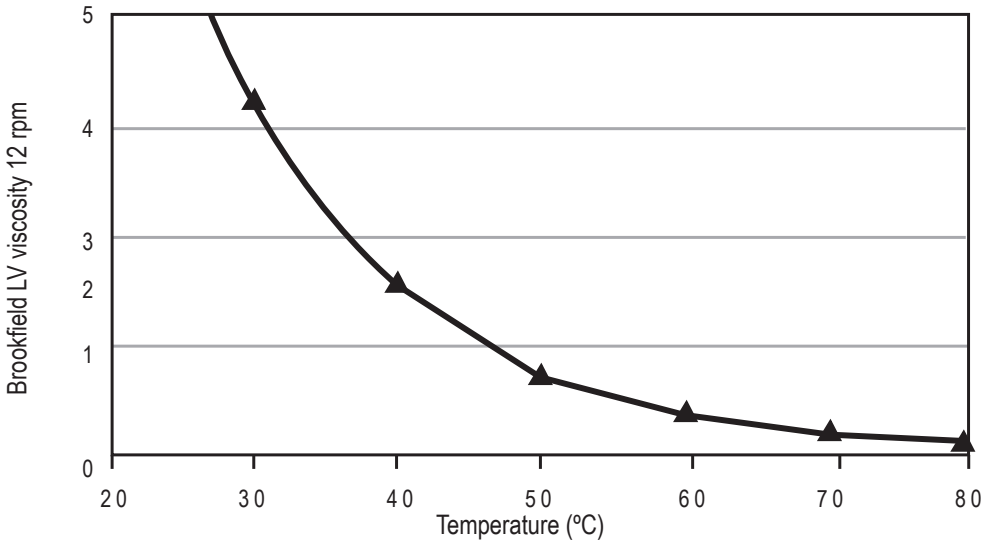
Performance Properties (cont'd)

Effect of Temperature on Viscosity

As with most formulations, products thickened with ACUSOL™ 820 Rheology Modifier/Stabilizer will generally show a drop in viscosity with increasing temperature (Figure 5).
This effect, which is common to most thickeners, is reversible with a decrease in temperature.

Figure 5

Effect of Temperature on the Viscosity of an ACUSOL™ 820 Rheology Modifier/Stabilizer thickened surfactant formulation

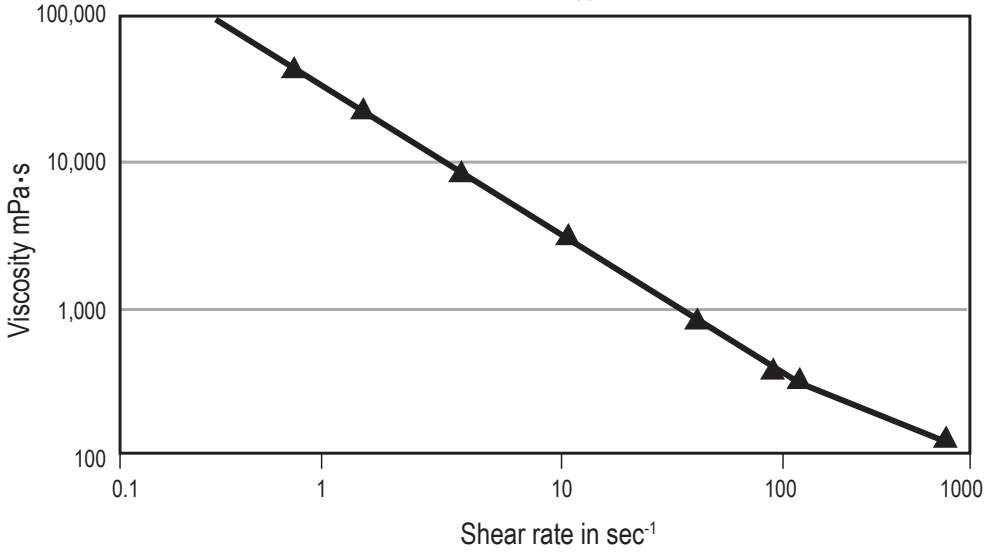


Effect of Shear Rate on Viscosity

The rheology of ACUSOL™ 820 polymer is extremely pseudoplastic (shear thinning). Under good mixing conditions, ACUSOL 820 thickens instantly upon adding a base and thereby allows rapid preparation of solutions and products. Viscosity profiles are very similar, irrespective of the base employed. No pre-wetting, high-shear mixing, and long soak times, often required for other thickeners, are needed to dissolve the un-neutralized polymer. The aqueous neutralized solutions are clear, and show short rheology as well as being shear thinning. Consequently, the solutions are very viscous at low shear rates, as shown in Figure 6.

Figure 6

Viscosity vs Shear Rate
for an 0.8% aqueous solution of the sodium salt of ACUSOL™ 820 Rheology Modifier/Stabilizer

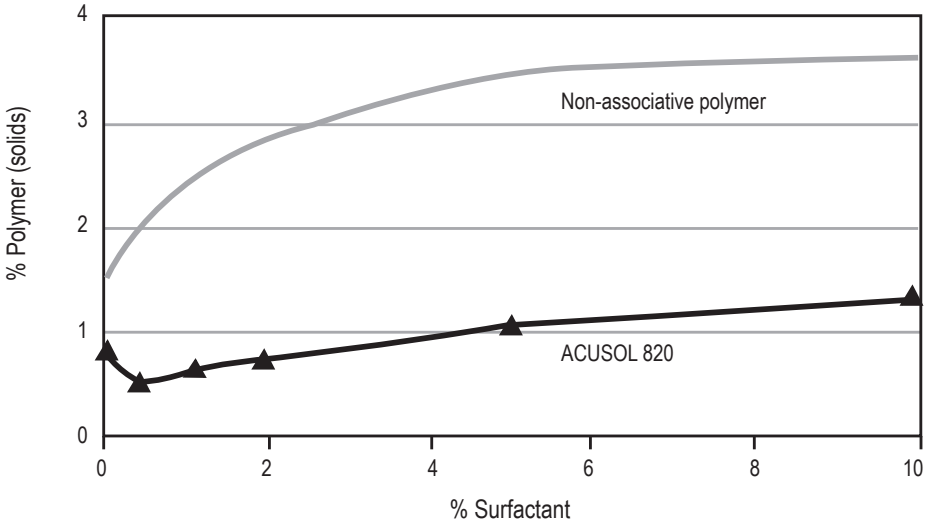


Associative Nature

ACUSOL™ 820 Rheology Modifier/Stabilizer has long hydrophobic chains that can associate with other hydrophobes present in the formulation (e.g. surfactants, particles etc.). This feature can enhance thickening in the case of low pH formulations, where polymer swelling is limited. The synergistic effect depends on the surfactant concentration: maximum viscosity can be obtained at an optimum concentration. With sodium lauryl sulphate (SLS), for example, the maximum occurs when the ratio of the surfactant to ACUSOL 820 solids level reaches 40% (i.e. a ratio of 0.4:1). Figure 7 illustrates the synergistic effect of ACUSOL 820 in the presence of SLS. In this graph, the polymer concentration required to obtain a given viscosity over a range of surfactant concentrations is shown. For ACUSOL 820, the polymer performance remains good through a wide range of surfactant concentrations, whereas steadily increasing levels of a non-associative polymer are required to maintain a given viscosity.

Figure 7

Relative Efficiency of ACUSOL™ 820 Rheology Modifier/Stabilizer
compared with a non-associative polymer

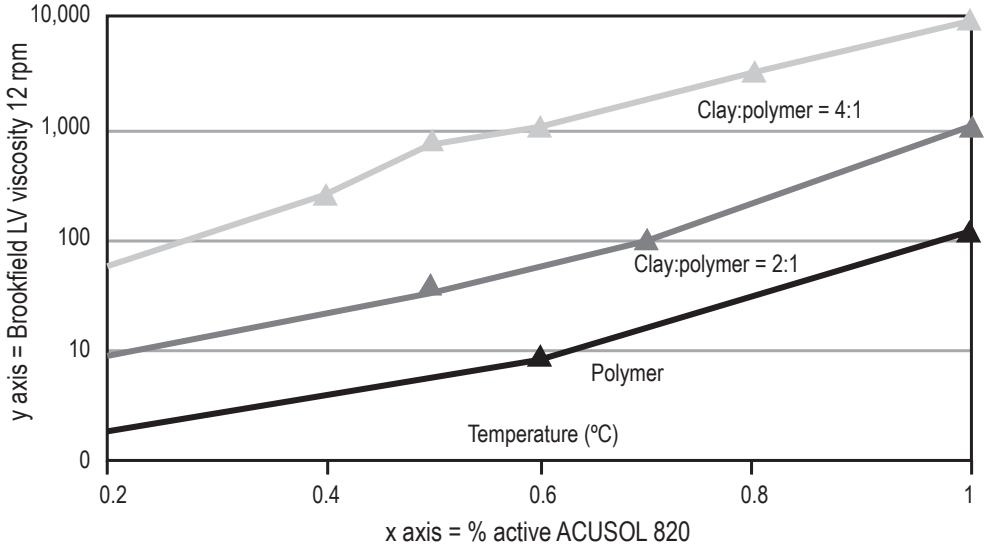


Mixture with Bentonite Clays

The addition of low cost bentonite clays appreciably increases the thickening efficiency of ACUSOL™ 820 Rheology Modifier/Stabilizer. Freestanding gels can be obtained by combining appropriate levels of neutralized thickener with bentonite clays (Figure 8).

Figure 8

Synergistic Effect of Bentonite
on ACUSOL™ 820 Rheology Modifier/Stabilizer



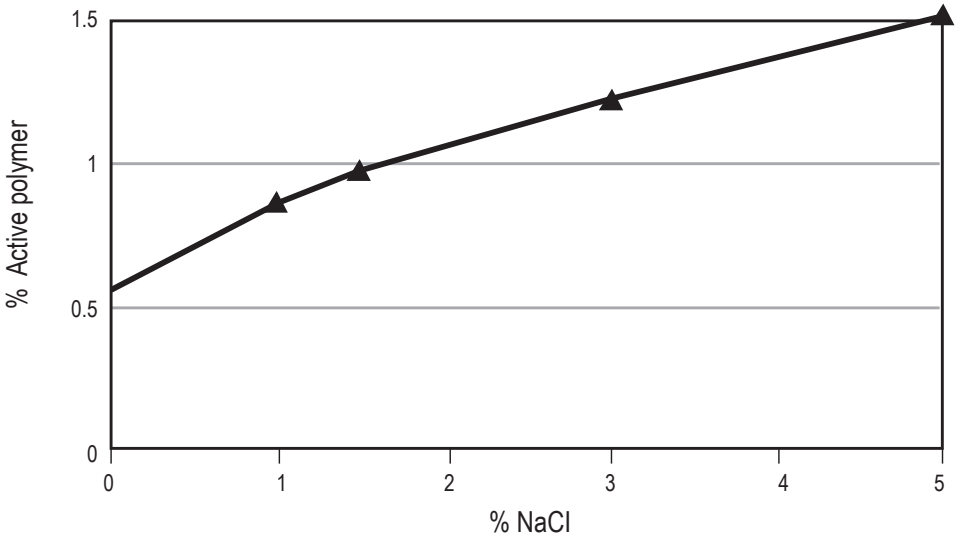
Performance Properties (cont'd)

Compatibility with Inorganics

ACUSOL™ 820 Rheology Modifier/Stabilizer can be used even in the presence of relatively high levels of inorganic salts, such as sodium chloride. Efficacy is reduced, but the polymer remains capable of thickening concentrations of salt even at a level of several percent. This is illustrated in Figure 9.

Figure 9

Performance of ACUSOL™ 820 Rheology Modifier/Stabilizer in the presence of salt



Preparation of Emulsions and Dispersions

Neutralized ACUSOL™ 820 Rheology Modifier/Stabilizer can also be used to make oil-in-water emulsions of organic liquids, such as mineral oil, methylene chloride or kerosene, and to suspend fillers and pigments, such as calcium carbonate, silicate clays and titanium dioxide in water. ACUSOL 820 may be useful in thickening aqueous waste materials and absorbing spills of hazardous wastes as well as in removing water from water-immiscible oils and hydrocarbon solvents.

Handling Precautions

Before using this product, consult the Safety Data Sheet (SDS) for details on product hazards, recommended handling precautions and product storage.

Avoid high-shear pumps when handling this product.

Storage Recommendation

Store product in tightly closed original container at temperatures recommended on the product label.

Keep from freezing. This emulsion product as supplied will irreversibly coagulate upon freezing.

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.

It is the user's responsibility to verify that treatment and disposal procedures comply with local, state (provincial) and federal regulations.

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