



## ACUSOL™ 823 Rheology Modifier

ACUSOL™ 823 Rheology Modifier is a hydrobically modified, alkali soluble acrylic polymer emulsion (HASE). ACUSOL™ 823 Rheology Modifier can be directly incorporated into formulations without necessity for slow preliminary preparation of a separate thickener solution. Viscosity is developed simply by adjusting the pH on the alkaline side with any base. It is supplied as a low viscosity (< 100 mPa.s) emulsion and therefore is easy to handle. ACUSOL™ 823 Rheology Modifier is an anionic associative thickener, containing hydrophobic groups which are capable of forming intramolecular associations and adsorbing onto the surface of dispersed particles, thus offering thickening and stabilization power much greater than other unmodified polymers of similar molecular weight. Thickening of ACUSOL™ 823 Rheology Modifier is especially effective in formulations having a high electrolyte content, such as in "liquid slurries," in hard surface abrasive cleaners and in highly built detergents. It also offers excellent stabilization and maintains the viscosity even in formulations at very high pH. ACUSOL™ 823 Rheology Modifier is the acrylic thickener whose rheology and stabilization efficacy are closer to the cellulose without the usual drawbacks associated with these products.

### Features & Benefits

| Features             | Benefits   |
|----------------------|--|
| Anionic              | Can be thickened instantaneously with any alkali. Compatible with both non-ionic and anionic surfactants, builders and fillers.                  |
| Salt tolerance       | Compatible with high levels of salts and electrolytes commonly present in household and institutional formulations.                              |
| Gel appearance       | Offers crystal clear gels or solutions.  |
| Associative nature   | Association may occur with other formulation components offering enhanced viscosity and stability.   |
| Liquid               | Supplied as low viscosity liquid emulsion, is very easy to handle. No predissolution, declumping or warming required.                            |
| pH tolerance         | No viscosity drop at pH up to 13.  |
| Rheology             | Offers pseudoplastic (shear thinning) rheology, similar to cellulose but maintains higher viscosity for higher shear rates.                      |
| Microbial resistance | As a synthetic polymer, it is inherently resistant to microbes and enzymes that can degrade cellulosic thickeners, leading to loss of viscosity. |

## Features & Benefits (Cont.)

| Features               | Benefits  |
|------------------------|---|
| Emulsion technology    | Water based polymerization. No residual solvents. No residual organic initiators.                             |
| Instant neutralization | Permits continuous manufacturing process through in-line static mixers.process through in-line static mixers. |

## Applications

Due to its excellent properties ACUSOL™ 823 Rheology Modifier is recommended for the following applications:

- Highly built detergent liquids
- Liquid abrasive cleaners
- Highly alkaline oven cleaners and paint strippers
- All-purpose cleaners
- Moderate viscosity liquid detergents
- Automatic dishwashing liquids
- Hard surface cleaners

## Typical Properties

Specification Writers: These values are not intended for use in preparing specifications.

| Property                             | Unit      | Result                            |
|--------------------------------------|-----------|-----------------------------------|
| Appearance                           |           | Opaque, white to off-white liquid |
| Charge                               |           | Anionic                           |
| Solids                               | %         | 30                                |
| pH (as supplied)                     |           | 2.10–3.50                         |
| Viscosity (as supplied) <sup>1</sup> | mPa.s/cps | < 25                              |
| Density (25°C)                       |           | 1.06                              |
| Equivalent weight <sup>2</sup>       |           | 191                               |

1. Viscosity Brookfield (mPa.s), LV, Spindle #1, 60 rpm, 25°C
2. Grams of dry polymer neutralized by 1 eq of NaOH

## Formulation Guidelines

ACUSOL™ 823 Rheology Modifier is an acrylic polymer containing acid carboxyl functional groups supplied at pH of approx 3.5. Because it is produced by emulsion polymerization, ACUSOL™ 823 Rheology Modifier is supplied as dispersed particles in water, and therefore, it is easily handled due to its low viscosity. This emulsion is stable; however, membrane pumps with low shear characteristics are recommended to transfer the emulsion during bulk handling: once diluted any type of pump is suitable. ACUSOL™ 823 Rheology Modifier can be incorporated directly into formulations without concern about dissolving, declumping or warming. The preferred order of addition in detergent formulations using ACUSOL™ 823 Rheology Modifier is the following:

1. Introduce ACUSOL™ 823 Rheology Modifier diluted at least 3 times with formulation water
2. Introduce the non-ionic surfactants (if any) - the lower HLB first
3. Introduce the anionic surfactants (if any) - the lower pH first
4. Introduce builders, fillers, particulates
5. Introduce dyes, then perfume
6. Neutralize with the chosen alkali

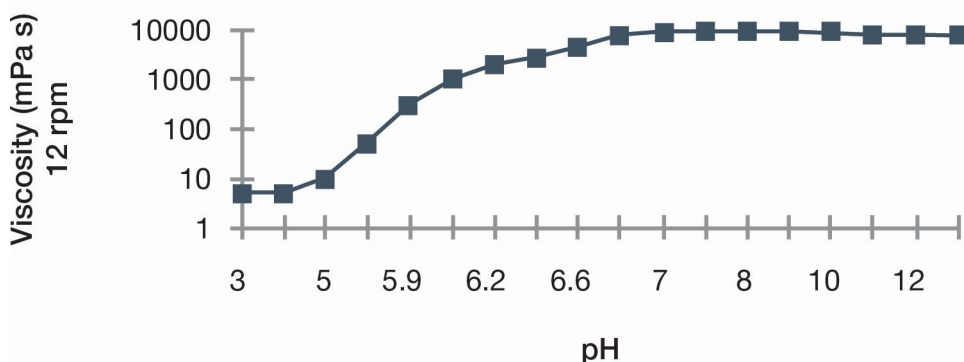
### Note

Although ACUSOL™ 823 Rheology Modifier will normally thicken solutions at pH above 6, its associative effect can be used to thicken lower pH formulations. In this case apply the above mentioned procedure, neutralizing up to pH = 7.5, and wait for complete association to occur, then adjust pH to the desired value preferably using a weak organic acid. A minimum of 5% surfactant is necessary for this feature.

## Performance Properties

### High pH Tolerance

ACUSOL™ 823 Rheology Modifier maintains a flat viscosity/pH curve up to high pH levels.



**Figure 1:** Viscosity/pH response at 2% polymer (active)

### High Salt Tolerance

ACUSOL™ 823 Rheology Modifier is more compatible than most of the other synthetic and natural thickeners with high electrolyte levels.

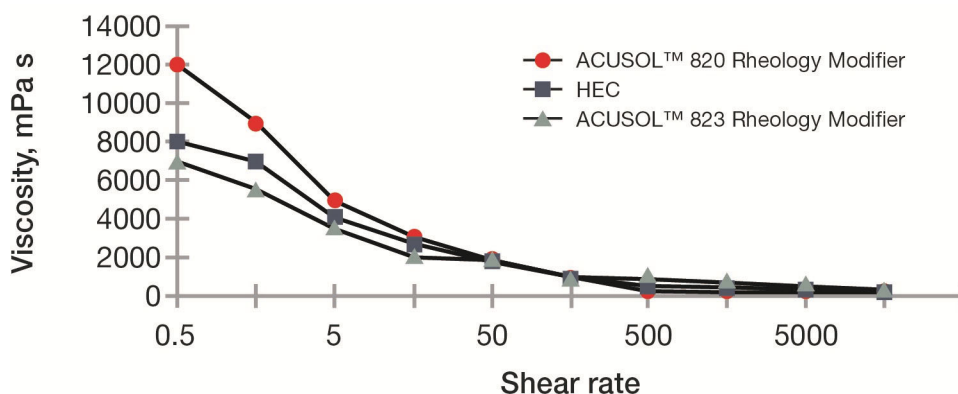
## ACUSOL™ 820 Rheology Modifier and ACUSOL™ 823 Rheology Modifier vs. Salt

|   | ACUSOL™ 820 Rheology Modifier |        |        | ACUSOL™ 823 Rheology Modifier |        |        |
|---|-------------------------------|--------|--------|-------------------------------|--------|--------|
| Polymer, % active                                 | 1.5                           |        |        | 1.5                           |        |        |
| pH  | 8.5                           |        |        | 8.5                           |        |        |
| Electrolyte, % (NH <sub>4</sub> NO <sub>3</sub> ) | 0                             | 2      | 0      | 0                             | 2      | 0      |
| Viscosity (mPa.s/cps, 12 rpm)                     |                               |        |        |                               |        |        |
| Immediate   | 66,000                        | 39,000 | 22,000 | 14,000                        | 14,000 | 14,000 |
| After 12 hours                                    | 69,000                        | 27,000 | 25,000 | 14,000                        | 14,000 | 14,000 |
| After 48 hours                                    | 71,000                        | 19,000 | 27,000 | 13,000                        | 13,000 | 13,000 |

### Performance Properties (Cont.)

#### Pseudoplastic Behavior

ACUSOL™ 823 Rheology Modifier exhibits a pseudoplastic rheological profile similar to cellulose but with higher viscosity at high shear. ACUSOL™ 823 Rheology Modifier is less shear thinning than ACUSOL™ 820 Rheology Modifier.



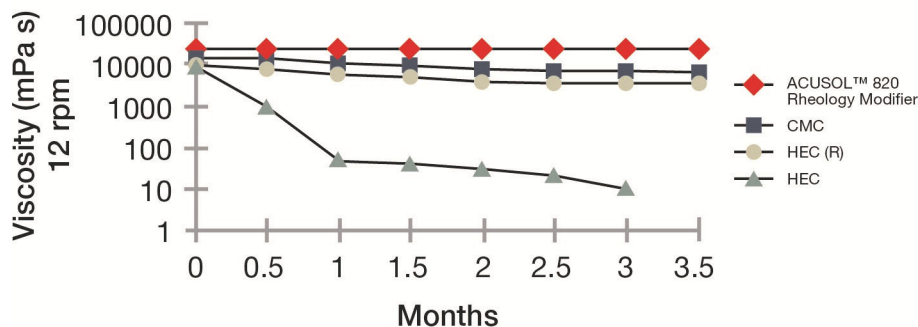
**Figure 2:** Viscosity vs shear rate

#### Microbial Resistance

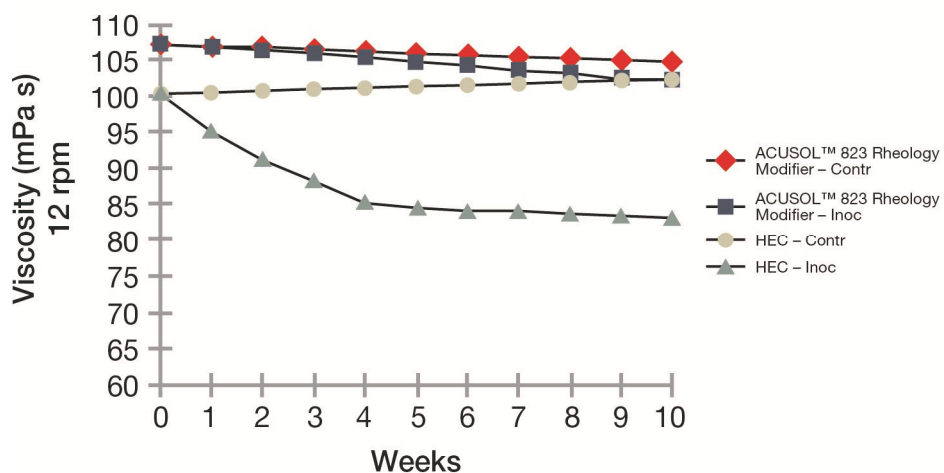
ACUSOL™ 823 Rheology Modifier shows an excellent resistance to bacterial and enzymatic degradation. During a 4 month test even with non-initially inoculated solutions, formulations thickened with ACUSOL™ 823 Rheology Modifier maintained essentially constant viscosity while a non-resistant cellulosic grade became water thin and even the enzyme resisting grades lost more than 2/3 of the initial viscosity.

## Performance Properties (Cont.)

### Microbial Resistance (Cont.)



**Figure 3:** Microbial resistance vs. cellulosics (unpreserved)



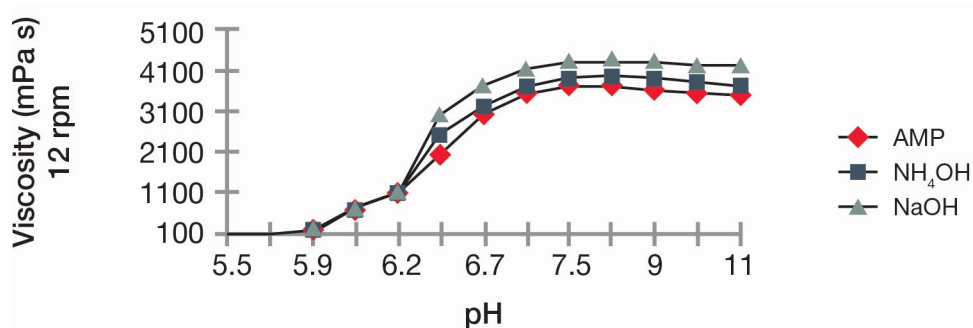
**Figure 4:** Microbial effect on inoculated samples – microbial effect on viscosity

### Versatile Neutralization

ACUSOL™ 823 Rheology Modifier can be neutralized with any alkali: thickening occurs instantaneously, offering water clear solutions. It has been observed that some very sophisticated formulations, thickened with acrylic or natural rheology modifiers that were turbid, become crystal clear when using ACUSOL™ 823 Rheology Modifier.

## Performance Properties (Cont.)

### Versatile Neutralization (Cont.)



**Figure 5:** Viscosity/pH response with different alkali

## Handling Precautions

PRODUCT SAFETY INFORMATION REQUIRED FOR SAFE USE IS NOT INCLUDED IN THIS DOCUMENT. BEFORE HANDLING, READ PRODUCT AND SAFETY DATA SHEETS AND CONTAINER LABELS FOR SAFE USE, PHYSICAL AND HEALTH HAZARD INFORMATION. THE SAFETY DATA SHEET IS AVAILABLE ON THE DOW WEBSITE AT [DOW.COM](http://DOW.COM), OR FROM YOUR DOW SALES APPLICATION ENGINEER, OR DISTRIBUTOR, OR BY CALLING DOW CUSTOMER SERVICE.

## Usable Life and Storage

Keep from freezing. This emulsion product as supplied will irreversibly coagulate upon freezing. Store product in tightly closed original container at temperatures recommended on the product label.

## Limitations

This product is neither tested nor represented as suitable for medical or pharmaceutical uses.

## Health and Environmental Information

To support customers in their product safety needs, Dow has an extensive Product Stewardship organization and a team of product safety and regulatory compliance specialists available in each area.

For further information, please see our website, [dow.com](http://dow.com) or consult your local Dow representative.

## 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. Contact your Dow Technical Representative for more information.

## Product Stewardship

Dow has a fundamental concern for all who make, distribute, and use its products, and for the environment in which we live. This concern is the basis for our product stewardship philosophy by which we assess the safety, health, and environmental information on our products and then take appropriate steps to protect employee and public health and our environment. The success of our product stewardship program rests with each and every individual involved with Dow products - from the initial concept and research, to manufacture, use, sale, disposal, and recycle of each product.

## Customer Notice

Dow strongly encourages its customers to review both their manufacturing processes and their applications of Dow products from the standpoint of human health and environmental quality to ensure that Dow products are not used in ways for which they are not intended or tested. Dow personnel are available to answer your questions and to provide reasonable technical support. Dow product literature, including safety data sheets, should be consulted prior to use of Dow products. Current safety data sheets are available from Dow.

The graphic representations are presented here for illustrative purposes only and should not be construed as product specifications.

dow.com

**NOTICE:** No freedom from infringement of any patent owned by Dow or others is to be inferred. Because use conditions and applicable laws may differ from one location to another and may change with time, Customer is responsible for determining whether products and the information in this document are appropriate for Customer's use and for ensuring that Customer's workplace and disposal practices are in compliance with applicable laws and other government enactments. The product shown in this literature may not be available for sale and/or available in all geographies where Dow is represented. The claims made may not have been approved for use in all countries. Dow assumes no obligation or liability for the information in this document. References to "Dow" or the "Company" mean the Dow legal entity selling the products to Customer unless otherwise expressly noted. NO WARRANTIES ARE GIVEN; ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ARE EXPRESSLY EXCLUDED.

