



Technical Data Sheet

ACUSOL™ 880 Rheology Modifier **ACUSOL™ 882 Rheology Modifier**

ACUSOL™ 880 Rheology Modifier and ACUSOL™ 882 Rheology Modifier are hydrophobically modified non-ionic polyol (HEURs) thickeners and stabilizers used in detergent formulations for household and industrial applications.

These polymers offer rheological advantages due to their highly associative nature. The non-ionic nature of these polymers confers excellent chemical compatibility with the majority of raw materials used in the above mentioned products.

Features & Benefits

Features	Benefits
Nonionic	No neutralization necessary. Compatible with cationic, anionic, nonionic, amphoteric surfactants and dispersants.
Liquid	Easy to formulate, no deaggregation or dissolving necessary.
Associative nature	Increases efficiency when formulated with appropriate surfactants and particulate containing systems.
Peroxide stability	Provides moderate viscosity and stability to formulations containing up to 25% hydrogen peroxide.
Acid compatibility	Allows formulations in acidic media (acetic, phosphoric, sulfamic, citric, acids, etc.) to be prepared.

Applications

- Fabric softeners
- Acidic household cleaners
- Acidic abrasive cleaners
- Toilet bowl cleaners
- Scale and rust removers
- Detergent sanitizers
- Cationic silicone emulsions
- Peroxide based detergents
- Hydrogen peroxide bleach products
- Acid metal cleaner/brightener
- I & I laundry sours
- Dye levelling aids
- Acid rinse aids

Typical Properties

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

Property	Unit	Result	
		ACUSOL™ 880 Rheology Modifier	ACUSOL™ 882 Rheology Modifier
Appearance		Hazy, viscous liquid	Hazy, viscous liquid
Solids	%	35	17.5
Solvent	%	Propylene glycol - 60 Water - 40	Diethyleneglycol monobutylether - 25 Water - 75
pH		Neutral	Neutral
Brookfield Viscosity	mPa.s/cps	11,000	2,500
Specific Gravity		1.07	1.03

Performance Properties

Associative Nature

HEURs work by association. This means that the hydrophobic parts of the molecule will build association with the other hydrophobes present in the formulation.

This property allows major viscosity increases to be obtained using the synergistic effects when the rheology modifier is blended with, for example, low HLB surfactants, pigments, particles or any other hydrophobic ingredients.

The degree of association and consequently the viscosity of the final formulation will be strongly dependent upon the ingredients used.

Rheological Behavior

The rheology of the HEURs varies with the formulation, the ACUSOL™ 880 Rheology Modifier showing a more Newtonian behavior, particularly at higher shear rates.

ACUSOL™ 882 Rheology Modifier tends to be slightly more pseudoplastic.

An example of the rheological profile of a fully formulated acidic cleaner including surfactant, indicating the importance of formulation effects on rheology, is given below.

In this particular case, both polymers exhibit Newtonian behavior.

Performance Properties (Cont.)

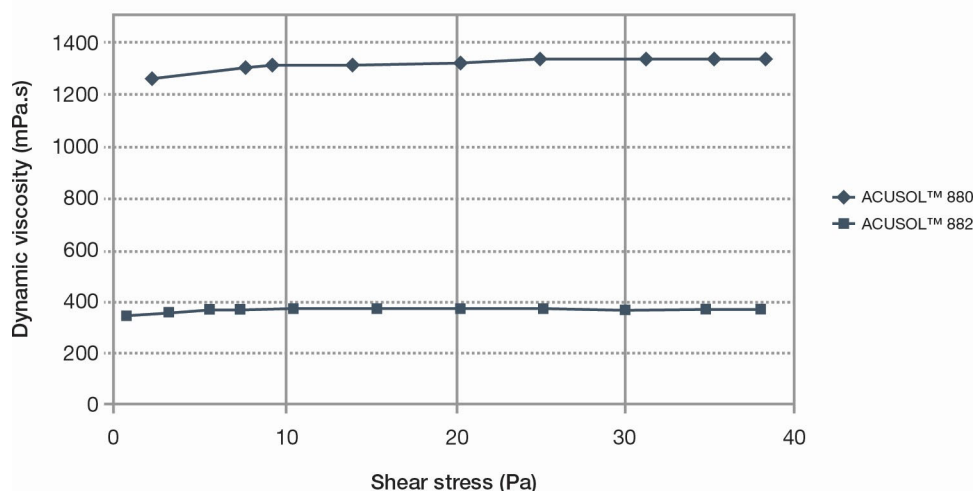


Figure 1: ACUSOL™ 880 Rheology Modifier – ACUSOL™ 882 Rheology Modifier rheology profiles

pH Independent Response

The HEURs maintain an almost constant rheology over a very broad pH range, as exemplified in the graph below. They do not require neutralization.

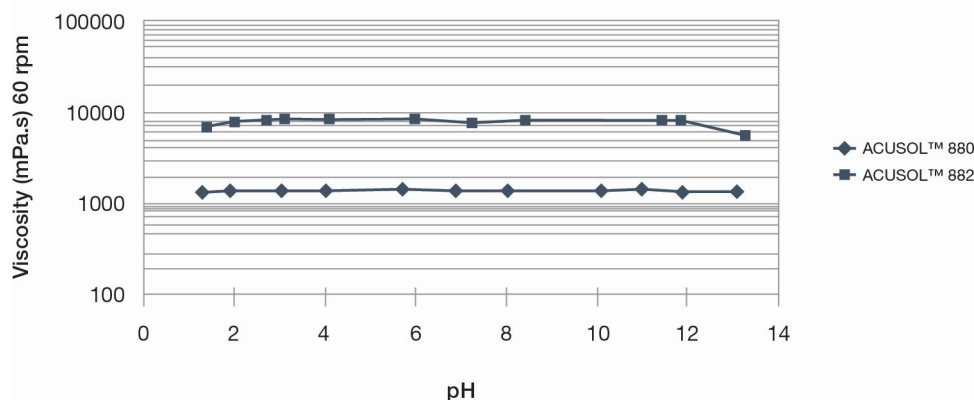


Figure 2: Viscosity vs pH, ACUSOL™ 880 Rheology Modifier and ACUSOL™ 882 Rheology Modifier (2.5% active)

Formulating Tips and Examples

General Guidelines

In the majority of situations, ACUSOL™ 880 Rheology Modifier associates well with low HLB nonionic surfactants, whereas ACUSOL™ 882 Rheology Modifier tends to give better results with cationic surfactants.

In either case, the larger the hydrophobe, or the less water soluble the surfactant, the better the association.

Formulated products containing HEURs can be transparent, translucent or opaque depending on formula composition. ACUSOL™ 882 Rheology Modifier tends to give clearer formulations than ACUSOL™ 880 Rheology Modifier. Clarity can also often be improved by minor formulation modification, and by the choice of appropriate surfactants.

Formulating Tips and Examples (Cont.)

Numerous examples of the use of the HEURs rheology modifiers can be found in the detergent formulary.

The different viscosities which can be obtained with ACUSOL™ 880 Rheology Modifier and alcohol ethoxylates of various chain lengths and degrees of ethoxylation are presented below.

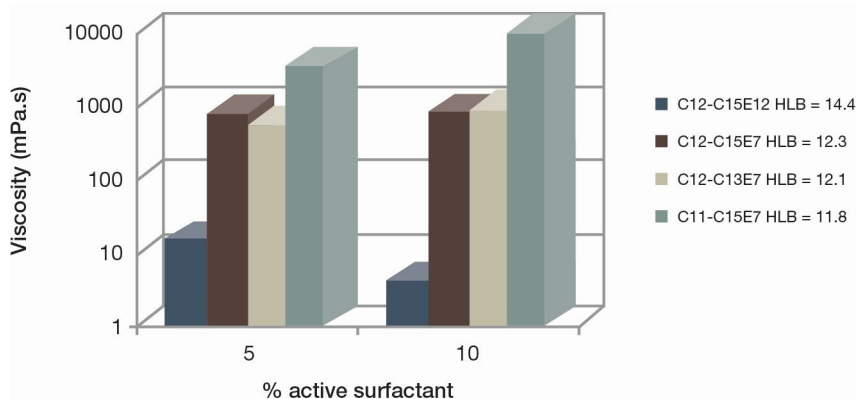


Figure 3: ACUSOL™ 880 Rheology Modifier 1% active in association with alcohol ethoxylates

Acid Compatibility

An example of the low pH compatibility of ACUSOL™ 880 Rheology Modifier and ACUSOL™ 882 Rheology Modifier is given in the following table:

Acid Solutions Thickened with ACUSOL™ 880 Rheology Modifier and ACUSOL™ 882 Rheology Modifier (1% Active)

Acid	Brookfield Viscosity ¹ (rpm)	ACUSOL™ 880 Rheology Modifier (Tendency Hazy)	ACUSOL™ 882 Rheology Modifier (Tendency Clear)
Citric acid 3%	6	2820 mPa.s	1045 mPa.s
Sulfamic acid 10%	3	5700 mPa.s	1860 mPa.s
Phosphoric acid 15%	30	5800 mPa.s	860 mPa.s
Acetic acid 3%	6	730 mPa.s	180 mPa.s

1. LVT, spindle #2 values obtained with the addition of 5% fatty alcohol ethoxylate C14 – C15 7EO.

Peroxide Compatibility

ACUSOL™ 880 Rheology Modifier and ACUSOL™ 882 Rheology Modifier thickeners are compatible with peroxides and do not induce appreciable loss of active oxygen.

To obtain optimum viscosity and stability over time, an appropriate surfactant should be used.

7% Hydrogen Peroxide Solutions Thickened with ACUSOL™ 880 Rheology Modifier and ACUSOL™ 882 Rheology Modifier (0.7% Active)

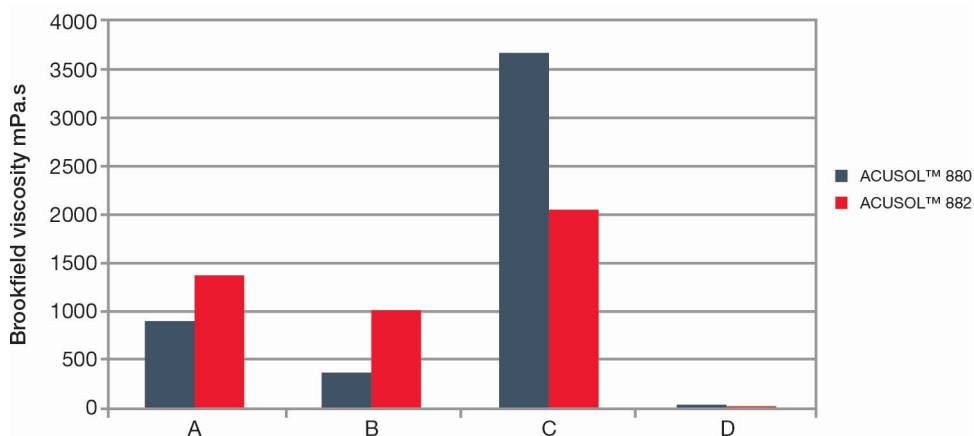
	ACUSOL™ 880 Rheology Modifier	ACUSOL™ 882 Rheology Modifier
Brookfield Viscosity at 30 rpm ¹	500 mPa.s	300 mPa.s

1. Values obtained with the addition of 5% fatty alcohol ethoxylate C14 –C15 7EO, after 4 weeks storage

Formulating Tips and Examples (Cont.)

Cationic Compatibility

Due to their nonionic nature, both ACUSOL™ 880 Rheology Modifier and ACUSOL™ 882 Rheology Modifier are compatible with various types of cationic surfactants. The association depends once again on the type of surfactant present in the formulation. Examples of viscosities obtained are given below.



A: mix. of oleyl imidazoline acetate, fatty alkyl ammonium chloride in isopropanol
 B: dicoco dimethyl benzyl ammonium chloride
 C: dialkyl dimethyl ammonium chloride
 D: alkyl trimethyl ammonium chloride

Figure 4: ACUSOL™ 880 Rheology Modifier and ACUSOL™ 882 Rheology Modifier (1% active) in 3% active interaction with cationic surfactants

Formulating Tips and Examples (Cont.)

The following three graphs represent efficient, stable thickening of a common cationic surfactant used in rinse added fabric softeners.

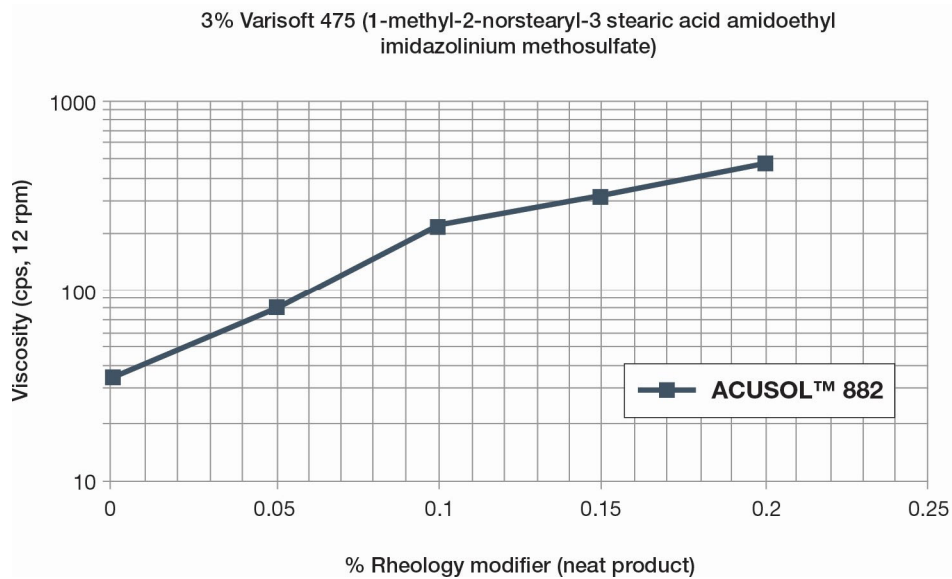


Figure 5: Effect of ACUSOL™ 882 Rheology Modifier concentration on fabric softener viscosity

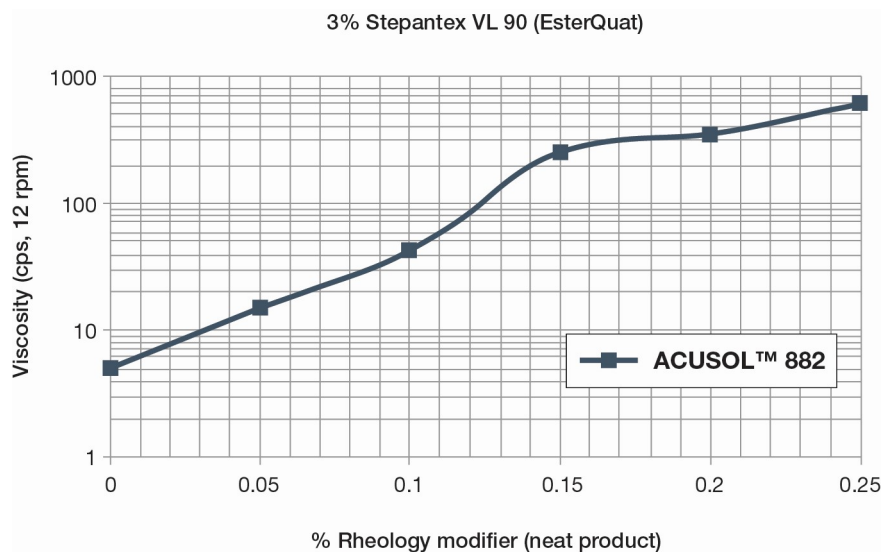


Figure 6: Effect of ACUSOL™ 882 Rheology Modifier concentration on fabric softener viscosity

Formulating Tips and Examples (Cont.)

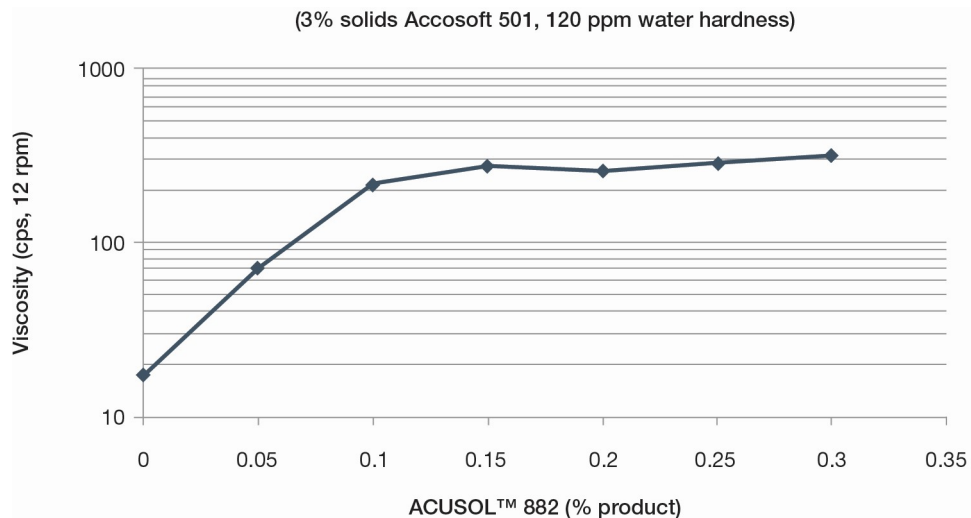


Figure 7: Effect of ACUSOL™ 882 Rheology Modifier on fabric softener viscosity

Handling Guidelines

ACUSOL™ 880 Rheology Modifier and ACUSOL™ 882 Rheology Modifier are supplied as viscous liquids. To facilitate handling and dispersion, the products can be heated up to 75°C, their viscosity values decreasing with increasing temperatures as shown in the graph below.

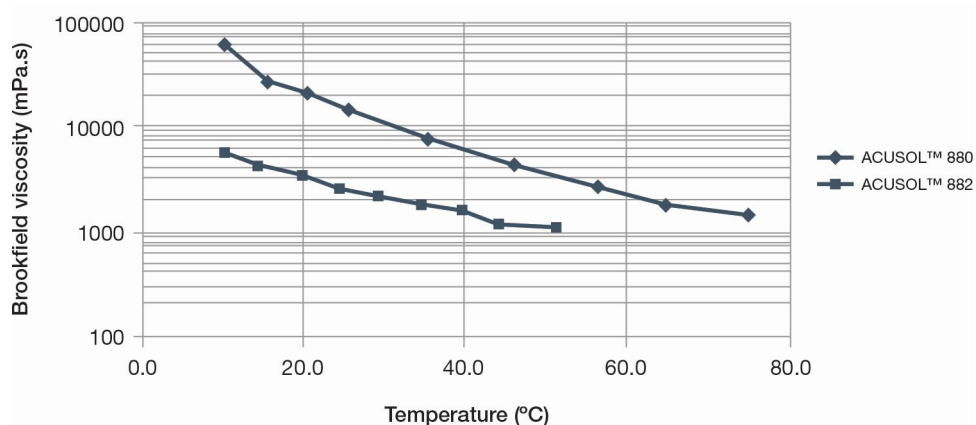


Figure 8: Viscosity vs temperature, ACUSOL™ 880 Rheology Modifier – ACUSOL™ 882 Rheology Modifier

To facilitate the use of the HEURs, the following procedure is recommended:

1. Introduce most of the formulation water into the reactor
2. Add the HEURs under agitation and stir for approximately 5 minutes
3. Add the most hydrophilic (high HLB) surfactant
4. Stir at least 5 minutes
5. Add the other components
6. Add the most hydrophobic component
7. Complete with the remainder of the water

Formulating Tips and Examples (Cont.)

Note: If the formulation does not contain high HLB surfactants which help dispersion, then we recommend that either the formulation water be heated to about 40°C prior to the addition of the thickener, or that a degree of association be developed between the rheology modifier and an appropriate ingredient by adding a lower HLB component immediately after the thickener.

In this manner, the ACUSOL™ rheology modifiers can be dispersed within a few minutes. A graph showing the dispersion time of ACUSOL™ 880 Rheology Modifier for various concentrations and temperatures is presented below. This work was done with a three-blade propeller 1000 rpm and a blade/vessel ratio 1/8.

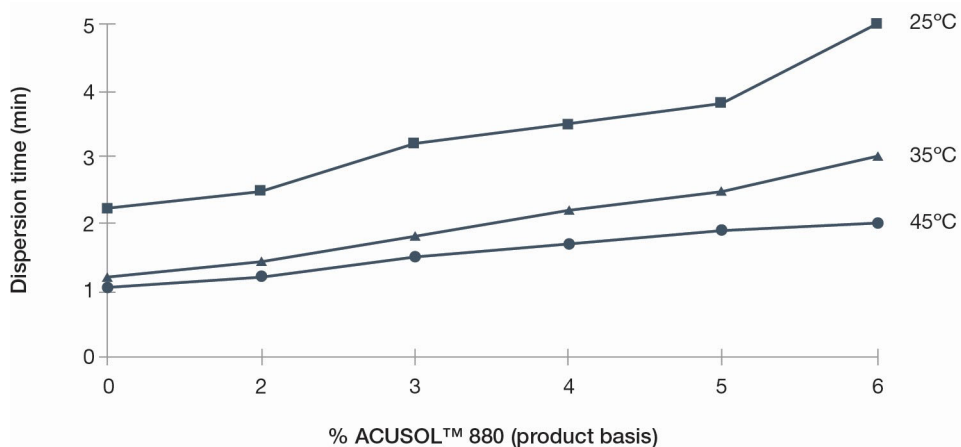


Figure 9: ACUSOL™ 880 Rheology Modifier dispersion time vs. concentrations at various temperatures

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, OR FROM YOUR DOW SALES APPLICATION ENGINEER, OR DISTRIBUTOR, OR BY CALLING DOW CUSTOMER SERVICE.

Usable Life and Storage

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 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.

