

ACUSOL™ 880 and ACUSOL 882

Detergent Grade Rheology Modifiers and Stabilizers

Description

ACUSOL 880 and ACUSOL 882 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
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.

Recommended 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

These properties are typical but do not constitute specifications.

	ACUSOL 880	ACUSOL 882
Appearance	Hazy, viscous liquid	Hazy, viscous liquid
Solids %	35	17.5
Solvent	60% propylene glycol 40% water	25% diethyleneglycol monobutylether 75% water
pH	Neutral	Neutral
Brookfield Viscosity	11,000 mPa.s/cps	2,500 mPa.s/cps
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

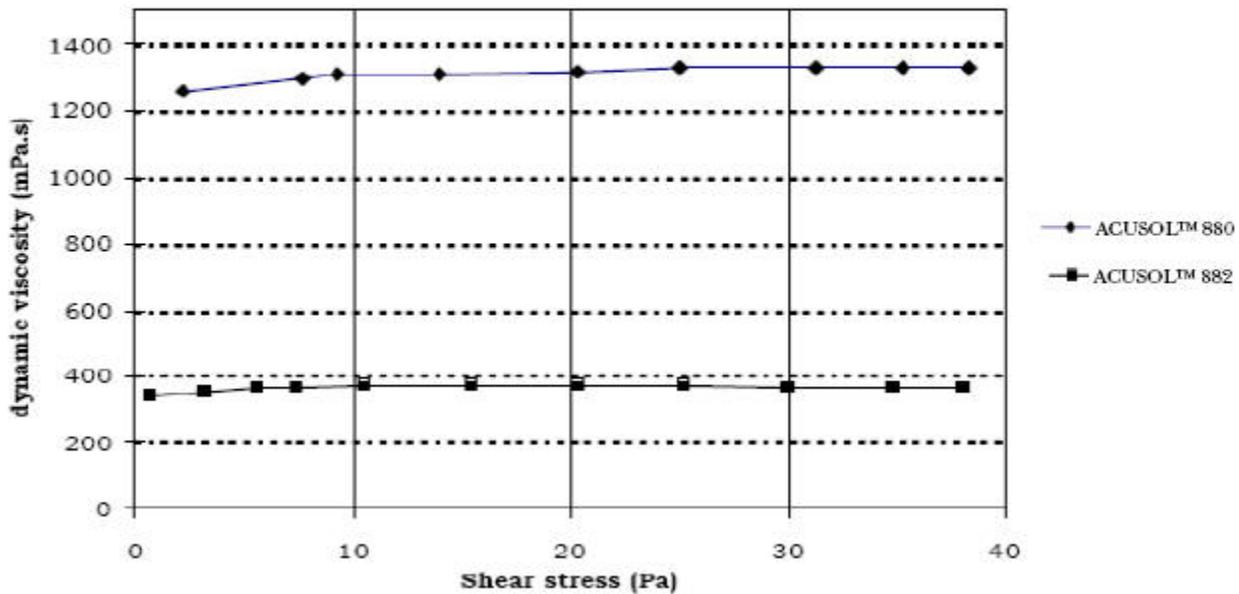
The rheology of the HEURs varies with the formulation, the ACUSOL 880 showing a more Newtonian behavior, particularly at higher shear rates.

ACUSOL 882 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.

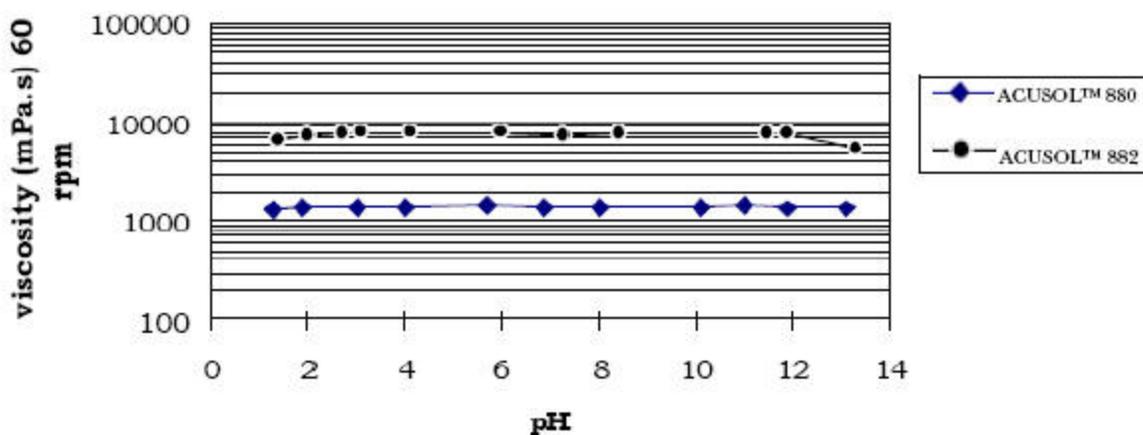
ACUSOL™ 880 - ACUSOL™ 882 rheology profiles



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.

ACUSOL™ 880 - ACUSOL™ 882 (2.5% active)
Viscosity vs Ph



Formulating Tips and Examples

General Guidelines

In the majority of situations, ACUSOL 880 associates well with low HLB nonionic surfactants, whereas ACUSOL 882 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 tends to give clearer formulations than ACUSOL 880. Clarity can also often be improved by minor formulation modification, and by the choice of appropriate surfactants.

Numerous examples of the use of the HEURs rheology modifiers can be found in the detergent formulary. Suggestions for surfactants giving good association are presented below.

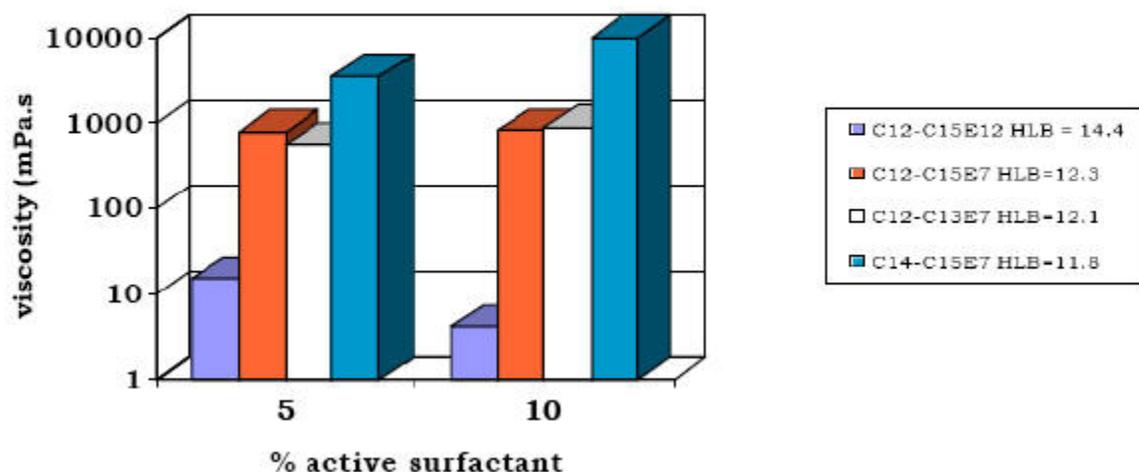
The different viscosities which can be obtained with ACUSOL 880 and alcohol ethoxylates of various chain lengths and degrees of ethoxylation are presented below.

Surfactants With High Association for ACUSOL 880/882

Surfactant Type	Example (commercial name)	Supplier
Ester quat	Stepantex VL90	Stepan
Dialkyl dimethyl quats	Quartamin D86P Carsoquat 868-E Carsoquat 868-P Adogen 470 Adogen 432	Kao
Q.A.C. Miscellaneous	Marlazin 7265	Hüls
Nonionic ethoxylates	Lutensol AO7 Neodol 45-7 Neodol 25-7 Neodol 25-3 Triton X-100 Imbentin POA-060 Imbentin POA-080	BASF Shell Shell Shell Dow Kolb Kolb/Scherex Chemical Company

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

**ACUSOL™ 880 1% active
in association with alcohol ethoxylates**



Acid Compatibility

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

Acid Solutions Thickened With ACUSOL 880 and ACUSOL 882 (1% Active)

Acid	Brookfield Viscosity (rpm)	ACUSOL 880 (Tendency hazy)	ACUSOL 882 (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

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

Peroxide Compatibility

ACUSOL 880 and 882 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 and ACUSOL 882 (0.7% Active)

	ACUSOL 880	ACUSOL 882
Brookfield Viscosity at 30 rpm*	500 mPa.s	300 mPa.s

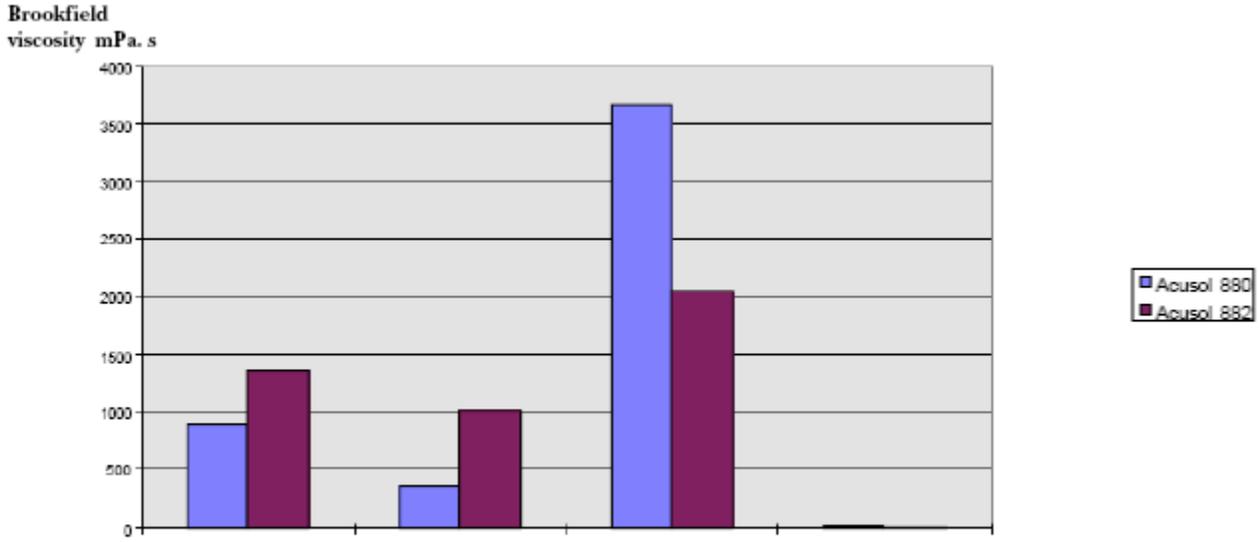
*Values obtained with the addition of 5% fatty alcohol ethoxylate C14-C15 7EO, after 4 weeks storage.

Cationic Compatibility

Due to their non ionic nature, both ACUSOL 880 and ACUSOL 882 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.

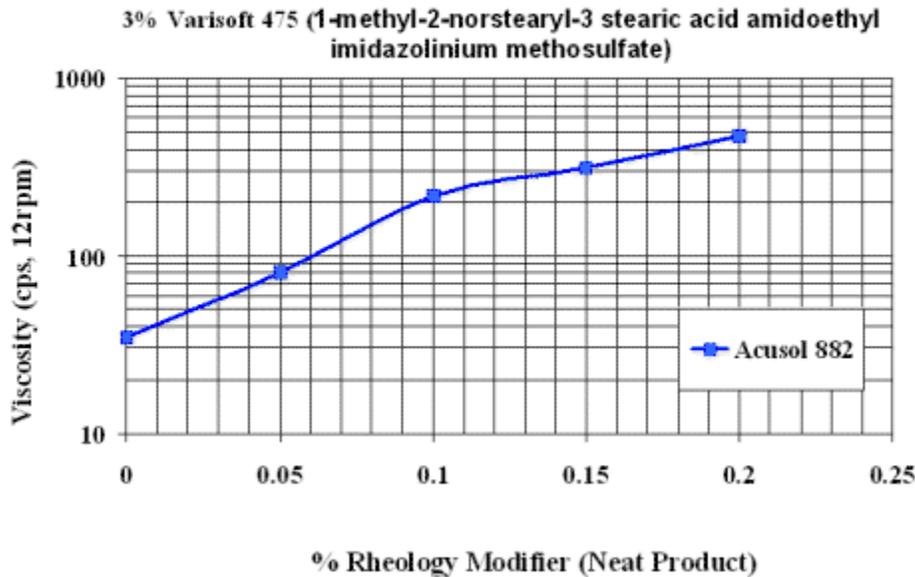
**ACUSOL™ 880 and ACUSOL™ 882 (1% active) in 3% active
INTERACTION WITH CATIONIC SURFACTANTS**



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

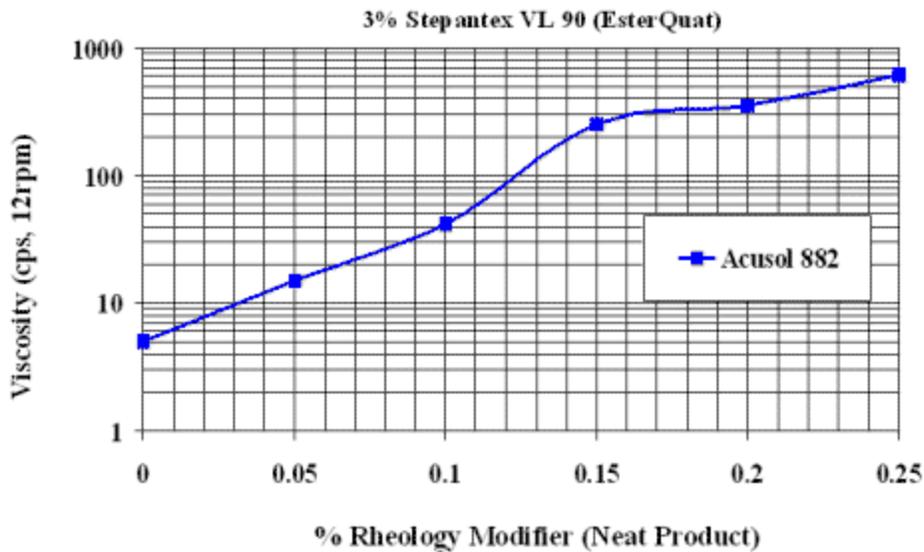
The following three graphs represent efficient, stable thickening of a common cationic surfactant used in rinse-added fabric softeners.

**Effect of Rheology Modifier Concentration
on Fabric Softener Viscosity**



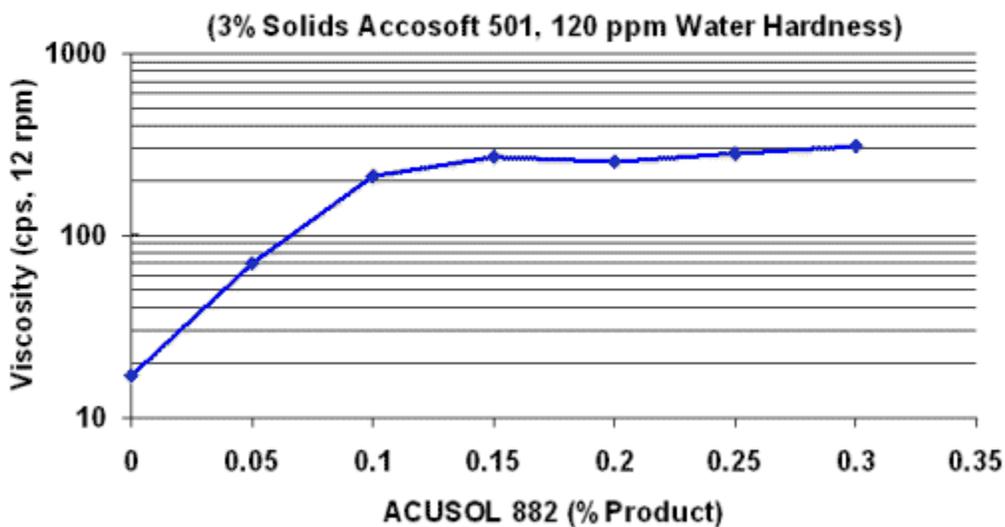
Varisoft is a trademark of Witco Chemical.

Effect of Rheology Modifier Concentration on Fabric Softener Viscosity



Stepantex is a trademark of Stepan Chemical.

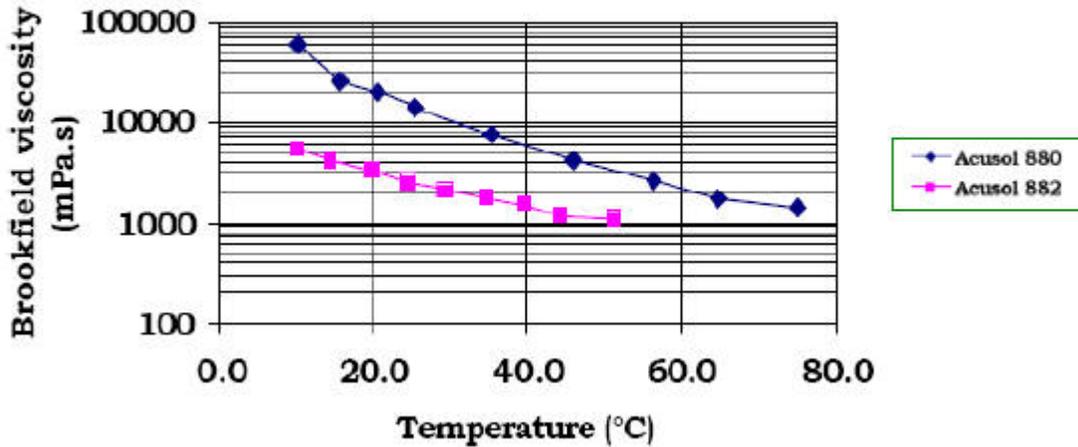
Effect of ACUSOL 882 on Fabric Softener Viscosity



Handling Guidelines

ACUSOL 880 and ACUSOL 882 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.

ACUSOL™ 880 - ACUSOL™ 882
Viscosity vs Temperature



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

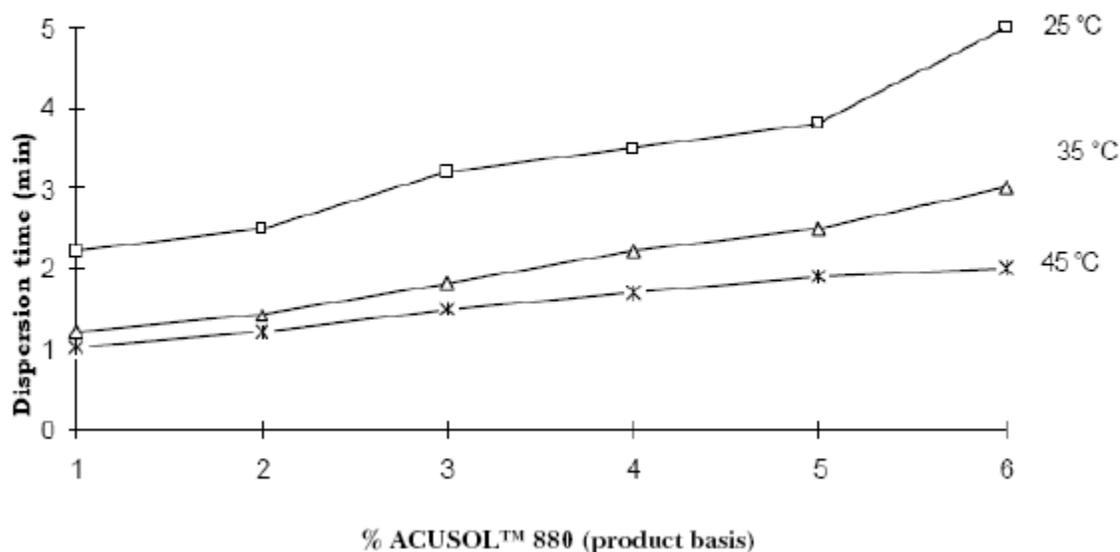
1. Introduce most of the formulation water into the reactor
2. Add the HEURs under agitation and stir for approximately 5 minutes
3. Add the most hydrophilic (high HLB) surfactant
4. Stir at least 5 minutes
5. Add the other components
6. Add the most hydrophobic component
7. Complete with the remainder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

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 can be dispersed within a few minutes.

A graph showing the dispersion time of ACUSOL 880 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.

ACUSOL™ 880
Dispersion Time vs Concentrations
at Various Temperatures



ACUSOL 880 AND ACUSOL 882 Toxicology Profiles

Overall Evaluation

ACUSOL 880 is considered non-toxic by single oral, and dermal exposure, non-irritating to the skin and eyes, non-sensitizing, non-mutagenic in the Ames assay, and non-toxic to aquatic organisms.

ACUSOL 882 is considered non-toxic by single oral, dermal, and inhalation exposure, non-irritating to the skin and moderately irritating to the eyes, non-sensitizing, non-mutagenic in the Ames assay, and non-toxic to aquatic organisms.

Test/Species	Results	
	ACUSOL 880	ACUSOL 882
Toxicity, Acute		
Oral LD ₅₀ - rat, male	>5 g/kg - non-toxic	>5 g/kg - non-toxic
Dermal LD ₅₀ - rabbit, male	>5 g/kg - non-toxic	>5 g/kg - non-toxic
Inhalation LC ₅₀ - 6 hr – rat		non-toxic at saturated vapor concentration
Toxicity, Sensitization		
Sensitization, guinea pig	non-sensitizer	non-sensitizer
Toxicity, Genetic		
Ames Test	non-mutagenic with and without metabolic activity	non-mutagenic with and without metabolic activity
Toxicity, Environmental		
Algae EC ₅₀ - 72 hr	229 mg/l - non-toxic	229 mg/l - non-toxic
Daphnia magna LC ₅₀ - 48 hr	992 mg/l - non-toxic	992 mg/l - non-toxic
Rainbow Trout LC ₅₀ - 96 hr	750 mg/l - non-toxic	750 mg/l - non-toxic

Material Safety Data Sheets

Rohm and Haas Company maintains Material Safety Data Sheets (MSDS) on all of its products. These contain important information that you may need to protect your employees and customers against any known health or safety hazards associated with our products. We recommend you obtain copies of the MSDS for your products from your local Rohm and Haas technical representative or the Rohm and Haas Company. In addition, we recommend you obtain copies of MSDS from your suppliers of other raw material used with our products for appropriate health and safety precautions before using them.

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