Lubrizol

TECHNICAL DATA SHEET

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Optimizing Performance of Carbopol®* ETD 2020 and Ultrez 10 Polymers with Partial Neutralization of Polymer Dispersions

Unique Dispersions from New Generation Carbopol® Polymers

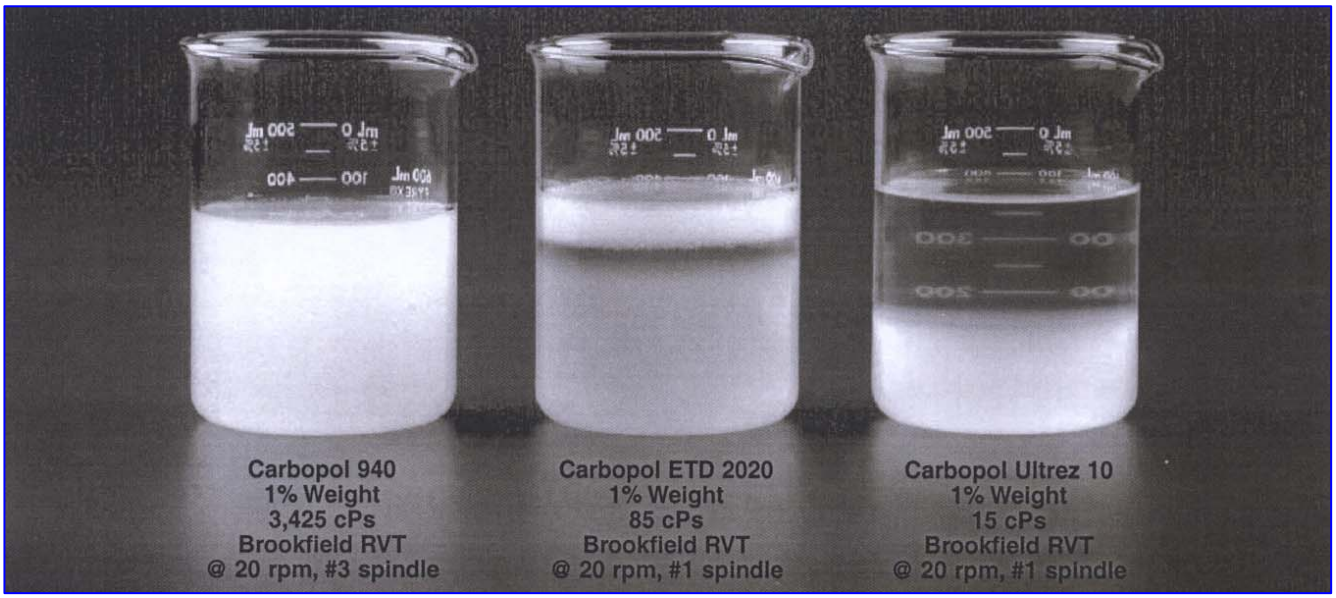
Carbopol® ETD and Ultrez polymers are "easy to disperse" crosslinked polyacrylic acid polymers synthesized in a toxicologically preferred cosolvent system of ethyl acetate and cyclohexane. Although Carbopol® ETD 2020 and Ultrez 10 have properties similar to traditional Carbopol® polymers, they are specifically designed to provide easily made dispersions that are less susceptible to lumping as well as easier to pump and handle in processing due to its low dispersion viscosity before neutralization. This unique dispersion performance is derived from their ability to *wet quickly* and *hydrate slowly*, uncoiling at a relatively slower rate. Dispersions made with Carbopol® Ultrez 10 and ETD 2020 may appear to be non-uniform, containing visible aggregate particles which may settle into a separate phase when not mixed. This is typical of Carbopol® "easy to disperse" polymers.

Creating Uniform Dispersions

In order to achieve a homogeneous dispersion without phase separation, it is recommended to prepare dispersions with a minimum polymer concentration of 2% by weight. This is especially true when preparing a stock dispersion that will not be completely used. This creates a space-filled dispersion that doesn't phase separate.

Another alternative is to partially neutralize the dispersion, achieving enough viscosity and yield value to gain homogeneity and the suspension of aggregate particles in a continuous phase.

Figure 1 Dispersion Appearance Comparison of Three Types of Carbopol® Polymers (unneutralized)



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Dispersions of three different Carbopol® polymer types in Figure 1 illustrate the distinct appearance of dispersions made with these polymers:

- Carbopol® 940 - Homogeneous dispersion
- Carbopol® ETD 2020 - Layered phases
- Carbopol® Ultrez 10 - Softly settled polymer particles

The varying appearances are unique to each Carbopol® polymer type. Formulators and processors working with the various Carbopol® polymers need to keep in mind that it is typical for dispersions with Carbopol® ETD 2020 and Carbopol® Ultrez 10 to form separate layers. These dispersions can be made uniform with gentle mixing.

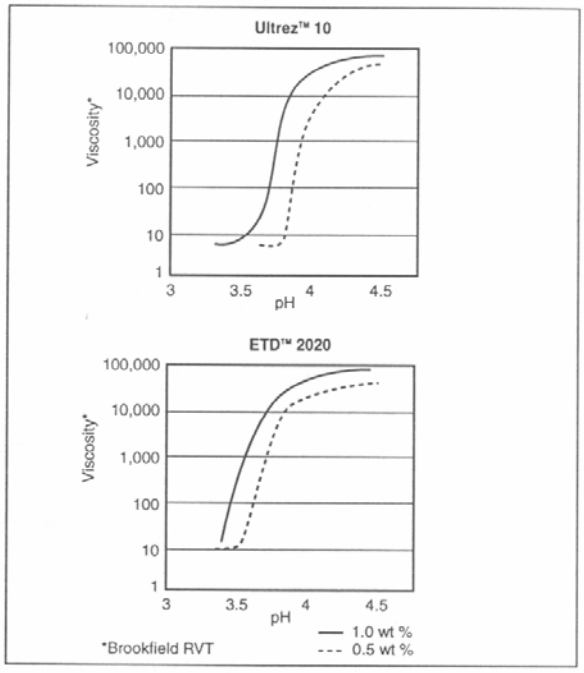
Optimizing Performance in Surfactant Systems

Besides uniform dispersion preparation, this concept is also helpful when formulating Carbopol® ETD polymers in high-active surfactant systems such as shampoos, bath gels, hand soaps and facial and body scrubs. In these systems, high concentrations of surfactants prevent uncoiling of Carbopol® polymer chains if the polymer neutralization is carried out after the addition of surfactants. This results in either low viscosity or yield value of the end product, graininess, insoluble "jelly particles" (or "fish eyes") and insoluble precipitates. This is particularly true when cationics or secondary surfactants, such as amphoterics or alkyl polyglycosides, are present at higher levels. Clarity of the final product can also be adversely affected in such cases.

Normally, for partial neutralization, approximately 10% of total neutralizing agent necessary for the whole batch should be sufficient. Partial neutralization will result in an increase in the pH of the dispersion (approximately 3.8 - 4.0) and viscosity due to the partial uncoiling or swelling of the polymer.

The following graph (Figure 2) represent typical viscosity increases during this procedure.

Figure 2
Typical Viscosity Response of Carbopol® Ultrez 10 and ETD 2020 During Partial Neutralization Procedure
Neutralized with NaOH (18%)



Any conventional neutralizing agent can be used in this method but the use of a weaker neutralizing agent such as a TEA is recommended for better control of the pH.

Figure 3
Dispersion Viscosities of Various Carbopol® Polymers