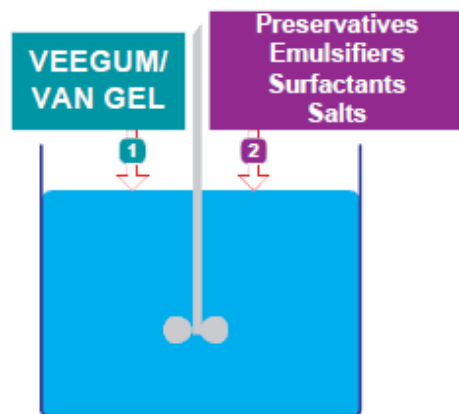


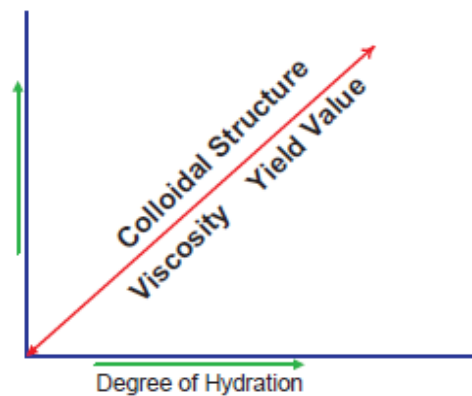
PREPARATION of DISPERSIONS

VEEGUM and VAN GEL products must be properly dispersed in water and hydrated to provide the desired performance properties. The two guides to successful hydration are:

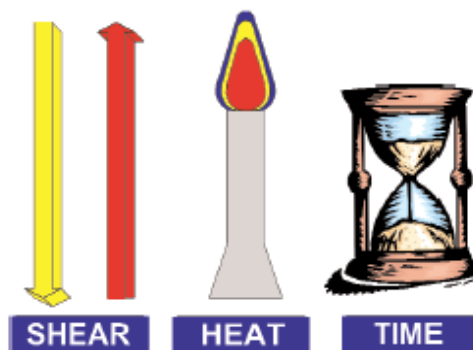
- ✓ THE BEST DISPERSIONS ARE PREPARED IN WATER FREE OF ADDITIVES.
- ✓ MORE ENERGY INPUT GIVES QUICKER HYDRATION.



Any materials present in the water when VEEGUM or VAN GEL clay is added, including preservatives, chelating agents or other minor additives, will interfere with hydration and inhibit the formation of the desired colloidal structure.



Dry smectite particles are actually multiple layers of individual platelets, each separated by a layer of water. The extent to which these particles are delaminated into individual clay platelets is referred to as the degree of hydration. The greater the degree of hydration, the stronger the colloidal structure, and the greater the viscosity and yield value of the dispersion.

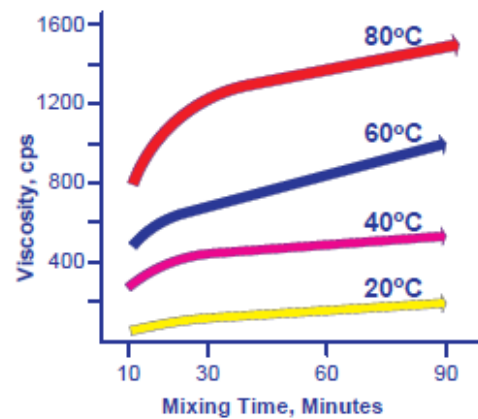
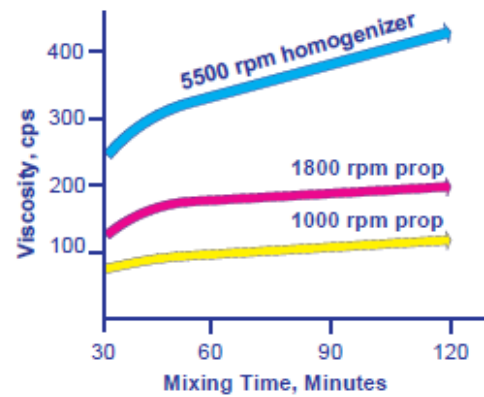


The degree of hydration is directly proportional to the amount of energy used to disperse the product, and therefore increases in proportion to the following factors:

- Shear, or mixing intensity
- Heat input, or water temperature
- Mixing time

The degree of clay hydration is increased by greater mechanical energy from shear and by longer mixing times. Shear is generally more efficient than mixing time in promoting hydration, as demonstrated here by the viscosity of 5% VEEGUM clay dispersions. Yield value is likewise increased in proportion to the degree of hydration.

Heat energy, in the form of heated water, has the greatest effect on degree of hydration, as demonstrated here by 5% VEEGUM clay dispersions mixed at low shear with a 1000 rpm prop mixer. When only low shear mixers are available for hydration, even a modest increase in water temperature can significantly improve clay hydration.



Any modification of mixer intensity (e.g., speed, propeller to vessel ratio) or water temperature will affect the degree of hydration and the hydration time. Whichever mixing conditions are used, it is very important that they be consistently controlled to achieve reproducible results in the laboratory, during scale-up and in production.

Because of its unique nature, VEEGUM *Ultra* clay is an exception. It is relatively unaffected by changes in hydration parameters. Adequate hydration of this product will be achieved in most cases in no more than 15 minutes. Increasing mixing intensity, mixing time or water temperature will not significantly affect its degree of hydration.

The following table provides guidelines for the minimum amounts of time suggested for the hydration of VEEGUM and VAN GEL clays. They are based on laboratory scale preparations: 1 kg batches using distilled, deionized water at specification concentrations under practical formulating conditions. Actual hydration times in the laboratory or in production will depend on the particular combination of batch size, mixer shear, and water temperature used.

In the laboratory or during production, the key to consistent performance of VEEGUM and VAN GEL products is consistent conditions of hydration. Changes in hydration time, mixer shear, vessel size or water temperature will change results.

Minimum Suggested Hydration Times	Normal Hydrating Grades	Quick Hydrating Grades	Ultra Hydrating Grade
	VEEGUM VEEGUM F VEEGUM K VEEGUM HV VEEGUM Pure VEEGUM PRO VEEGUM T VAN GEL B VAN GEL C	VEEGUM HS VEEGUM D VEEGUM Plus VAN GEL O VAN GEL ES	VEEGUM <i>Ultra</i>
Propeller Mixer:			
800 rpm, 25°C water	120 Minutes	30 Minutes	15 Minutes
800 rpm, 75°C water	45 Minutes	20 Minutes	10 Minutes
Homogenizer:			
3000 rpm, 25°C water	30 Minutes	20 Minutes	10 Minutes
3000 rpm, 75°C water	15 Minutes	10 Minutes	10 Minutes

SYNERGY with ORGANIC GUMS and POLYMERS

VEEGUM and VAN GEL products are often used synergistically with organic thickeners. The viscosity or stability of formulations containing these mixtures will be greater than that of the same formulation made with either component. These combinations allow the formulator to fine-tune viscosity, yield value, and flow properties beyond what is possible with either the clay or organic thickener alone.

For example, VAN GEL B clay and xanthan gum combinations are widely used to stabilize flowable, concentrated (up to 70% solids) agricultural pesticide suspensions. VEEGUM clay is frequently used with nonionic cellulosic thickeners to provide a balance of suspension stability and smooth flow properties in dandruff shampoos. VEEGUM clay and carboxymethylcellulose are often combined in liquid makeups.

Other advantages of combining VEEGUM or VAN GEL clay with an organic thickener are:

- The combination may be more economical than the use of either component alone.
- VEEGUM and VAN GEL clays can impart yield value to systems thickened with high efficiency organic polymers or gums.
- Because the colloidal structure of VEEGUM and VAN GEL clays is not sensitive to heat, it can compensate for the loss of viscosity at elevated temperatures common to many organic thickeners.
- VEEGUM and VAN GEL clays can reduce the tacky, gummy or stringy nature of organic thickener solutions.

The table below provides suggested weight-to-weight ratios of VEEGUM and VAN GEL products that will produce beneficial synergistic effects, and indicates the appropriate procedure to introduce the two ingredients into the formulation:

Suggested Starting Ratios*		
Organic Thickener	Weight to Weight Ratio Range of VEEGUM or VAN GEL to Organic Thickener	Recommended Mixing Procedure
<u>Polyacrylates</u>		
Polyacrylates	5:1 to 1:1	A
Carbomers	10:1 to 1:1	A,B
<u>Cellulosics</u>		
Sodium Carboxymethylcellulose	10:1 to 1:1	C
Hydroxyethyl Cellulose	1:1	A,D
Hydroxypropyl Cellulose	1:1	A,D
Hydroxypropylmethylcellulose	1:1	A,D
Methylcellulose	1:1	A,D
<u>Natural Gums</u>		
Xanthan Gum	10:1 to 1:1	C
Sodium Carrageenan	10:1 to 1:1	C
Sodium Alginate	2:1 to 1:1	C
Hydroxypropyl Guar	1:1	A
Gum Arabic (Acacia)	4:1 to 2:1	C
Gum Tragacanth	9:1 to 2:1	C

* For initial evaluations. Ratios are based on rheological studies in water alone. Preferable or optimum ratios may be different in formulated products.

RECOMMENDED MIXING PROCEDURES

A. Divide the available water and prepare the VEEGUM or VAN GEL clay dispersion and the organic thickener solution separately. Slowly add the thickener solution to the VEEGUM or VAN GEL clay dispersion with good agitation. Mix until uniform before adding other formula ingredients.

B. Add the acid pH VEEGUM *Ultra* clay and carbomer simultaneously or as a dry blend to the available water. Hydrate thoroughly before adding other formula ingredients. The carbomer can be neutralized at any convenient point after hydration.

C. Add the VEEGUM or VAN GEL clay and organic thickener simultaneously or as a dry blend to the available water. Hydrate thoroughly before adding other formula ingredients.

D. For nonionic cellulosics that are insoluble in hot water: hydrate the VEEGUM or VAN GEL clay in hot water. Add the gum to the hot clay dispersion with good agitation. Cool the dispersion with continued agitation until the gum is completely dissolved.

