

Enhanced
Performance
Through Applied
Innovation



Personal
Care

ELEMENTIS

A global specialty chemicals company

BENTONE HYDROCLAY™

Incorporation methods





Introduction

BENTONE HYDROCLAY™ products are specialized rheology modifiers for the aqueous phase. In order to reach an optimal performance, proper incorporation is crucial. The following incorporation methods will provide best practices and insights to achieve utmost reproducibility and formulation versatility.

Incorporation as a pure powder

When adding BENTONE HYDROCLAY™ as a pure powder it is essential to ensure thorough mixing. When added as a pure powder, sieving in the product gradually is recommended, using about 5000 rpm with either a Silverson homogenizer, tooth blade mixer or an Ultra Turrax style mixer. 15-20 minutes is the recommended minimum mixing time. All smectite clay products need sufficient mixing times to ensure swelling and full dispersion of the clay can occur. Temperature can also have an effect on the hydration and ultimate viscosity achieved. Figure 1 shows the effect of temperature and mixing time on BENTONE HYDROCLAY™ 1100 in water.

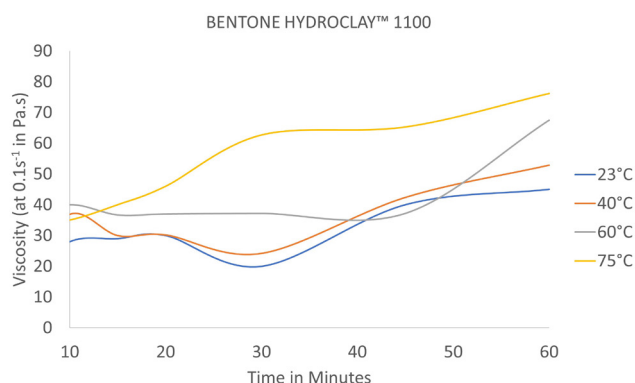


Figure 1. Effect of temperature and mixing time on BENTONE HYDROCLAY™ 1100

Increased mixing times and increased temperature lead to an enhanced performance of the clay. A similar behavior is expected from BENTONE HYDROCLAY™ 550.

Figure 2 shows the effect of temperature and mixing time on BENTONE HYDROCLAY™ 2000. Please note the viscosities on the Y-axis are much larger than for BENTONE HYDROCLAY™ 1100.

Longer mixing times do not seem to affect the viscosity of BENTONE HYDROCLAY™ 2000, but it is still important to mix for 15 minutes, to ensure the clay is dispersed properly. Mixing long term at high temperatures can cause a reduction in the end viscosity of the formulation. Due to the complete dispersion has been carried out, the viscosity is even throughout the product. A similar behavior with BENTONE HYDROCLAY™ 2100 is expected.

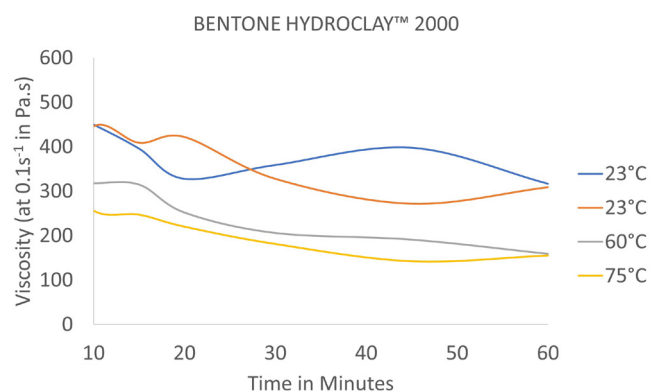


Figure 2. Effect of temperature and mixing time on BENTONE HYDROCLAY™ 2000

Figure 3 shows the effect of temperature and mixing time on BENTONE HYDROCLAY™ 900. The higher temperatures can be very beneficial to quickly achieving a high viscosity and thorough dispersion.

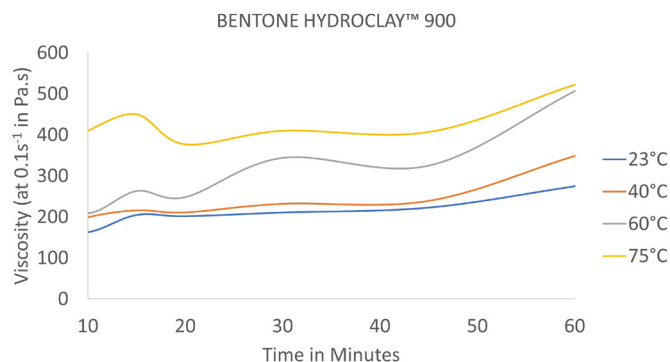


Figure 3. Effect of temperature and mixing time on BENTONE HYDROCLAY™ 900

Incorporation in a glycol premix

Incorporating BENTONE HYDROCLAY™ into a formulation using the glycol premix method, is by far the most popular and easiest choice. Here it is important to choose the right humectant, for example glycerin, butylene glycol or propylene glycol. As glycerin is higher in viscosity than propylene glycol, you may need a higher ratio of BENTONE HYDROCLAY™:glycerin to create a flowable premix than you would BENTONE HYDROCLAY™:Propylene Glycol. Figure 4 shows the appearance of different ratios of BENTONE HYDROCLAY™ to glycerin and propylene glycol, simplifying the choice of premix ratio.



Figure 4. Different ratios of Glycerin and Propylene Glycol with BENTONE HYDROCLAY™

Figure 4 shows that a 1:2 ratio of BENTONE HYDROCLAY™ 1100 and propylene glycol can yield a flowable premix, whereas a 1:3 ratio of BENTONE HYDROCLAY™ 550 is needed. However, generally a 1:3 ratio is recommended. Once the premix is prepared, it is important to use it directly, as leaving it to stand can cause it to harden and become unpourable and hinder

full dispersion. The premix can be added to the water phase, preferably before any other ingredients have been added, using a propeller stirrer and mixing at 500 rpm for 15 minutes. Figure 5 shows that this method has little effect on the viscosity performance.

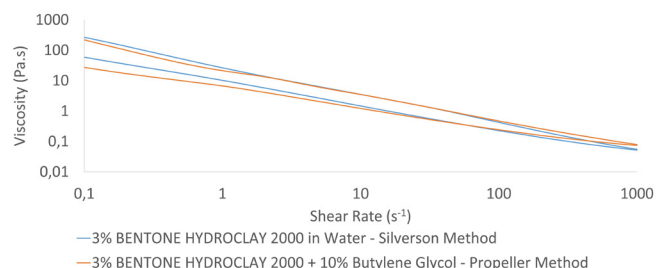


Figure 5. Flowcurve comparison of adding 3% BENTONE HYDROCLAY™ 2000 with a Silverson homogenizer and in Butylene Glycol with a Propeller stirrer

Although BENTONE HYDROCLAY™ does not thicken oil and will not stay suspended in oil, it is possible to use the oil phase as a dispersant for the BENTONE HYDROCLAY™ when making an emulsion. As the water and oil phase of an emulsion generally need to be homogenized for 15 minutes, this method can remove one processing step in manufacture. Once both the water and oil phase have been heated to the appropriate temperature it is possible to add the BENTONE HYDROCLAY™ to the oil phase and stir to ensure the oil phase is homogenous. The oil phase must be stirred while adding it to the water phase and homogenize for 15 minutes as needed. During this homogenization phase, the BENTONE HYDROCLAY™ will move into the water phase of the emulsion and thicken the water phase.

Figure 6 shows the profiles of an emulsion that has been made adding the BENTONE HYDROCLAY™ as a powder using a Silverson homogenizer, as a glycol premix at 75°C using a Silverson homogenizer, in the oil phase, and also as a glycol premix with a propeller mixer after the emulsion has cooled down. All methods gave a similar profile, so are viable methods of incorporation.

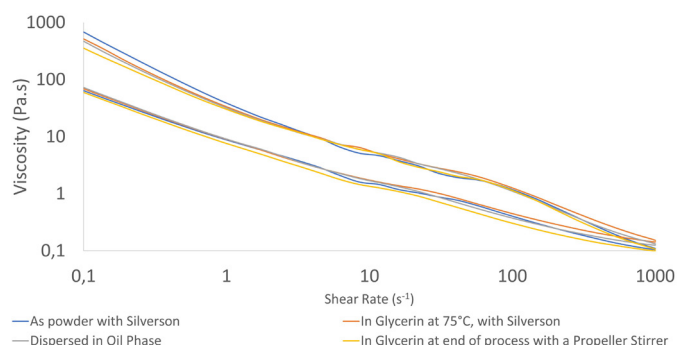


Figure 6. Flowcurve comparison of different incorporation methods of BENTONE HYDROCLAY™ in an emulsion

Conclusion

BENTONE HYDROCLAY™ products can be versatile ingredients for water phase thickening that can be incorporated using various methods depending on your formulation and equipment restrictions.

For more details
please contact:

North America

Elementis
469 Old Trenton Road
East Windsor
NJ 08512, USA
Tel: +1 609 443 2500

Europe

Elementis UK Ltd
c/o Elementis GmbH
Stolberger Strasse 370
50933 Cologne, Germany
Tel: +49 221 2923 2000

Asia

Deuchem (Shanghai)
Chemical Co., Ltd.
99, Liyang Road
Songjiang Industrial Zone
Shanghai, China 201613
Tel: +86 21 5774 0348

elementis.com

NOTE:

The information herein is currently believed to be accurate. We do not guarantee its accuracy. Purchasers shall not rely on statements herein when purchasing any products. Purchasers should make their own investigations to determine if such products are suitable for a particular use. The products discussed are sold without warranty, express or implied, including a warranty of merchantability and fitness for use. Purchasers will be subject to a separate agreement which will not incorporate this document.

© Copyright 2021, Elementis Specialties, Inc. All rights reserved. Copying and/or downloading of this document or information therein for republication is not allowed unless prior written agreement is obtained from Elementis Specialties, Inc.

® Registered trademark of Elementis SRL, Inc.
August 2021

