



## BENTONITE SWELL INDEX (ASTM D5890)

### Overview:

**Bentofix**® Sodium Bentonite clay is widely known for its high swelling characteristics. A typical sodium bentonite clay has the ability to absorb 4-5 times its own weight in water and can swell 5 - 15 times its dry volume at full-unconfined saturation.

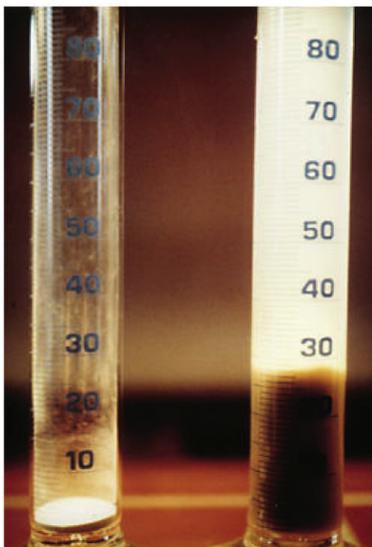
### Test Procedure:

The Swell Index or Free Swell test procedure is used to determine the general swelling characteristics of sodium bentonite clay. For Geosynthetic Clay Liners (GCLs), the Swell Index test has not been demonstrated to have a proportional correlation to hydraulic properties. Although there are correlative limitations, (especially in contaminated environments), a high swell is considered by most to be a good indicator of bentonite quality. Regardless, this test parameter can be used as a simple qualitative indicator of the base clay.

Test method ASTM- D5890 is used to determine the swell index. A 2g sample of dried and finely ground bentonite clay is dispersed into a 100 ml graduated cylinder in 0.1g increments. A minimum of 10 minutes must pass between additions to allow for full hydration and settlement of the clay to the bottom of the cylinder.

These steps are followed until the entire 2g sample has been added to the cylinder. The sample is then covered and protected from disturbances for a period of 16 - 24 hours, at which time the level of the settled and swollen clay is recorded to the nearest 0.5 ml.

Note" when this test method is carried out on granular bentonite and the granules are ground down to perform the test the results of swell index for the granular bentonite carried out in the laboratory may not be representative of the product delivered to site.



## QC Test Frequency:

The ASTM Guideline for GCL Quality Control (ASTM 5889 Standard Practice for Quality Control of Geosynthetic Clay Liners), suggests a frequency of two tests per 50 tons of bentonite delivered to the manufacturing facility and prior to acceptance and production of the finished geosynthetic clay liner. This test frequency has been adopted by the manufacturer of the **Bentofix**® geosynthetic clay liner. As this is a quality assurance test on the base bentonite, not the finished GCL, it is not appropriate to refer to this parameter based on a frequency per square meter.

## Bentofix® Specified Value:

While the sodium bentonite clay utilized in Bentofix® GCLs typically meets a Swell Index in the range of 24 ml – 36 ml, the targeted minimum value is 24 ml /2 g. This minimum value will generally ensure the specified performance of a GCL product is achieved.

## Summary:

Whilst the determination of Swell Index is a very useful tool in characterising the general quality of Bentonite being delivered to a manufacturing facility and prior to production of the geosynthetic clay liner itself, the test itself, is somewhat variable and as such the Swell Index Value should not be a specification value in projects that by itself would cause rejection of any delivered product by an imposed CQA audit process.

Should the Swell Index be lower than the specified value (generally  $\geq 24$  ml/2 g) then under the specification it should clearly allow for a retest of the property, allow for appropriate permeability testing or indeed accept the product should the test frequency and prior site specific test results indicate compliance with statistical acceptance limits imposed for the project (typically an allowance of 2.5% of product delivered- MARV).

Note. Bentonite Swell Index may be artificially increased by introducing a polymer into the bentonite at time of manufacture of the geosynthetic clay liner. This has been proven in the past and has good short term performance when tested using standard test methods for acceptance of bentonite and geosynthetic clay liners.

The use of polymer modification to any bentonite geosynthetic clay liner should be clearly notified to the purchaser and should clearly be noted on all data sheets and technical information relating to the polymer modified product.

The polymers are generally water soluble, have little long term performance substantiation, may have doubtful polymer distribution throughout the bentonite (less than 1% addition by mass of bentonite) and there are no means to verify the addition of polymer, the distribution of the polymer or indeed the application rate of the polymer.

Any acceptance testing of the geosynthetic clay liner must be done prior to the addition of polymer and the bentonite in the unmodified state must meet the requirements of fluid loss as well as all other items of the specification requirements.

Ensure that polymer modification has not been undertaken on the natural bentonite to enhance the properties of the geosynthetic clay liner without full disclosure by the manufacturer with respect to polymer type, safety data sheet, dose rates and long term performance data relating to the contained environment within which the GCL is being placed.

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