

The information and data contained in this document were prepared by a technical committee of the Association. The committee and the Association assume no liability or responsibility in connection with the use of such information or data, including but not limited to any liability under patent, copyright, or trade secret laws. The user is responsible for determining that this document is the most recent edition published.

Accelerated test for viscosity stability of clay slurries

1. Scope

1.1 This method describes a procedure for predicting the relative storage life of aqueous kaolin clay dispersions by measuring viscosity increase during storage at an elevated temperature.

1.2 Viscosity is measured by a low-shear rotating spindle apparatus as described in Appendix A of TAPPI T 648 “Viscosity of Coating Clay Slurry.”

1.3 This procedure does not describe methods for determining dispersant requirements of clays, nor does it describe dry clay slurring procedures. It describes only the testing procedures for a given clay slurry.

1.4 This procedure does not describe a method for determining the viscosity stability of other pigment slurries or for coating colors; however, this method may be useful for such systems.

2. Summary

A sample of clay-water slurry is stored at 60°C (140°F), and low-shear viscosity is measured as a function of storage time. From the increase of viscosity with time, the storage life of the slurry is estimated.

3. Significance

3.1 Slurries of kaolin clay pigments in water are commonly-used raw materials for paper manufacture. To obtain the high-solids slurries (67-70%) needed for economical shipment, yet maintain the low viscosity needed for easy handling, chemical deflocculants (commonly called dispersants) are added. These chemical deflocculants in general tend to decompose with time so that they lose their effectiveness in maintaining the low initial viscosity of the clay slurry. Unless a low viscosity can be maintained for a reasonable length of time, the slurry will thicken or “gel” so that it cannot be pumped by the normal slurry-handling equipment.

3.2 Clay slurries at high solids exhibit non-newtonian flow behavior; i.e., their viscosity is a function of the shear rate applied. A given clay slurry may exhibit shear-thinning behavior at low-shear rates (thixotropy) yet show shear-thickening at high-shear rates (dilatancy). For a complete description of the flow behavior of a slurry, both low- and high-shear viscosities should be determined. The selection of a low-shear viscosity measurement for the present test is somewhat arbitrary, and it must be realized that it does not give a complete rheological description of the system. It has been found, however, that the low-shear viscosity measurement described in this test does correlate reasonably well with actual field observations as to the behavior of a slurry on pumping and mixing. If the low-shear viscosity of a slurry is high, it cannot readily be pumped even though its high-shear viscosity may be low.

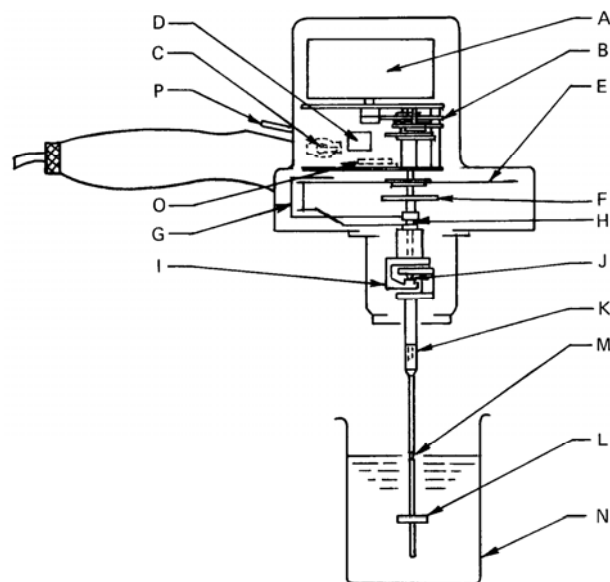


Fig. 1. Rotating spindle viscometer. A = synchronous motor used to power the viscometer; B = speed transmission driven by the motor; C = on-off switch for the motor; D = speed control knob; E = instrument dial driven by the output shaft of the speed transmission; F = beryllium copper spring, one end of which is attached directly to the viscometer dial; G = pointer; H = pivot shaft, upon which is mounted the collet, holding both the pointer G and spring; I = jewel support arm connected directly to the dial and to the gear transmission to the motor; J = pivot point mounted on pivot shaft; K = 3-56 left hand thread on the lower point of the pivot shaft; L = spindle; M = immersion mark on shaft of each spindle; N = container for the specimen; O = bubble level; P = clutch lever. More detail can be found in the Appendix of TAPPI T 648 "Viscosity of Coating Clay Slurry."

4. Apparatus

4.1 *Viscometer*, rotating spindle viscometer with a full-scale spring torque of $0.7187 \times 10^3 \text{ N}\cdot\text{m}$ operating at 20 rpm with an appropriate spindle for mid-scale readings. A typical unit is shown in Fig. 1 and described in Appendix A of T 648. The newer digital versions may be used as well.

4.2 *Drying oven*, laboratory drying oven capable of being maintained at $105 \pm 3^\circ\text{C}$.

4.3 *Oven or water bath*, for storing slurry at $60 \pm 1^\circ\text{C}$.

4.4 *Containers*, glass containers of approximately 500-mL capacity with tightly fitting lids. (Ordinary 1-pint jars used for home canning are satisfactory.)

5. Calibration

Calibrate the instrument with the standard-viscosity oil, using the sample spindle, volume, temperature, and container employed for the sample. Draw a calibration curve for the instrument based on at least two standard oils having higher and lower viscosities than the sample being measured. If the measured viscosity of the standard oil with an established factor differs by less than 2% from that given for the standard oil, the viscosity of the specimen may be found by applying a proportionate correction factor. If the difference is more than 2%, correct the instrument before use.

6. Sampling

The sampling procedure or makeup procedure for the slurry is outside the scope of this method. It is assumed that the slurry sample is available for testing at an appropriate solids content. (The mixing procedure outlined in T 648 may be used for dry clays if desired.)