Consistency (concentration) of pulp suspensions

1. Scope

1.1 This method describes the measurement of pulp consistency (concentration) of pulp-water mixtures.
1.2 It is applicable to pulp-water mixtures containing up to 25% of oven-dry pulp.

2. Summary

2.1 For pulp-water mixtures containing less than 1% of pulp, the excess water is removed by filtering and the resulting pulp pad is dried to constant weight.
2.2 For mixtures containing 1 to 25% pulp, the weighed material is diluted to 0.5% consistency or less, and the consistency of the stock is determined by removing the excess water by filtering and drying the pad to constant weight.

3. Significance

This method provides a useful procedure for measuring pulp consistency of various pulp-water mixtures.

4. Definitions

Pulp consistency or, more properly, "concentration" is defined as the weight in grams of oven-dry fiber in 100 grams of pulp-water mixture.

5. Apparatus and materials

5.1 Sampling cup, of about 200 mL capacity, with a height approximately equal to its diameter and with a smooth lip. If the pulp to be sampled is to be taken from a source where it is being well mixed, it is preferable to use a larger sampling cup having a capacity of about 1000 mL.
5.2 Beakers, 600 to 1000 mL and 1500 mL to 2000 mL, tared to the nearest 0.1 g
5.3 Containers, a 10-L bucket and a 40-L container, both tared.
5.4 Mixing device, for the 10- and 40-L containers, preferably a portable electric stirrer.
5.5 Balances: (a) 40-kg capacity, accurate to 50 g; (b) 2-kg capacity, accurate to 0.1 g.
5.6 Büchner funnel, 150-mm diameter, and filtration flask, 1500 to 2000 mL.
5.7 Filter paper, 150-mm diameter, coarse texture, tared by dampening, drying under conditions used in 7.1.1 and weighing. Store tared papers in a sealed box.
5.8 Dryer, or steam cylinder with wire mesh cover, large enough to accommodate the filter papers and controlled within a range of 100-150° C.
5.9  **Dryer oven**, maintained at 105 ± 3° C.
5.10  **Balance**, having a capacity of at least 100 g and accurate to 0.01 g.

**NOTE 1:** Moisture balance consisting of a drying and a weighing device is preferable.

6. **Sampling and test specimens**

6.1  When sampling according to the following procedures, always take the sample at the point of greatest agitation.

6.2  **For mixtures containing less than 1% pulp.** Use the sampling cup to withdraw five consecutive portions of approximately 100 mL each. Each time, deposit the entire contents in the tared 600 to 1000 mL beaker. Carefully dry the outside of the beaker and weigh it and its contents to the nearest 0.1 g. Subtract the tare weight of the beaker to determine the net weight of the specimen.

6.3  **For mixtures containing from 1 to 4% pulp and 4 to 15% pulp.** Withdraw 10 consecutive portions of pulp slurry, filling the cup with approximately 100 g each time and emptying the entire contents into the tared 1500 to 2000 mL beaker. Weigh the beaker and contents to the nearest 0.1 g and determine the weight of the specimen.

6.4  **For mixtures containing from 15 to 25% pulp.** Proceed as in 6.3, except instead of 10, take 5 consecutive portions of the original stock of approximately 100 mL each.

7. **Procedures**

7.1  **For mixtures containing less than 1% pulp**

7.1.1  Place a previously dried, tared filter paper in the Büchner funnel, moisten with water, then apply suction to the flask and filter the specimen slurry from 6.2. If the filtrate is cloudy, refilter through the same pad until clear. Remove the resulting pad and filter paper and heat on the dryer until it ceases to steam. Place the paper and pad on the weighing pan of the moisture balance and make successive readings after additional drying until a constant weight is obtained. Record the weight to the nearest 0.01 g.

7.1.2  The percent consistency $c$ of the specimen is then:

$$c = \left[\frac{w-f}{g}\right] \times 100$$

where

$w$ = weight of the moisture-free pad and filter paper, g

$f$ = weight of the moisture-free filter paper, g

$g$ = net weight of the original specimen in the 600-mL beaker, g.

**NOTE 2:** After removing filter paper and pad from the Büchner funnel, be sure all filters, etc., are wiped clean from the inside surface of the funnel and deposited onto the pad. This can be done with the finger.

**NOTE 3:** Drying can be speeded up if the pad is pressed between blotters in a hydraulic press before drying.

**NOTE 4:** If the pads tend to stick to the steam cylinder dryer, place the pad between dry blotters. The surfaces of the cylinder may be treated with a silicone spray to prevent sticking.

7.2  **For mixtures containing 1 to 4% pulp**

7.2.1  Deposit the specimen from 6.3 into the tared 10-L bucket and dilute to 0.5% consistency or less, using some of the water to rinse all the fibers from the beaker. Weigh the bucket and contents and determine the net weight of the slurry to the nearest 10 g. Insert and adjust the electric stirrer to give complete agitation with the propeller at one side of the vessel.

7.2.2  Maintaining rapid mixture of the slurry, dip quickly with the sampling cup to withdraw a portion as in 6.1 and 6.2. Determine the consistency of the stock as in 7.1.1.

7.2.3  The present consistency $c$ of the original specimen is then:

$$c = p \times \left(\frac{W}{w}\right)$$
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where

\[ p = \text{consistency of the diluted stock, } \% \]
\[ W = \text{net weight of the contents of the bucket, g.} \]
\[ w = \text{weight of the original specimen withdrawn in 6.3, g.} \]

7.3 For mixtures containing 4 to 15% pulp
7.3.1 Deposit the specimen from 6.3 into the tared 40-L container and dilute to less than 0.5% consistency, using some of the water to rinse all the fibers into the beaker. Weigh the container to determine its net contents. Insert and adjust the electric mixer for thorough agitation of the suspension.
7.3.2 Proceed as in 7.2.2 and 7.1.1.
7.4 For mixtures containing 15 to 25% pulp. Take the specimen from 6.4 and proceed as in 7.3.1, 7.3.2, and 7.1.1.

8. Report

8.1 Mixtures under 1% pulp content and 1 to 4% pulp content. Report the percentage consistency of the moisture-free pulp in the original specimen to the nearest 0.01%.
8.2 Mixtures containing 4 to 15% pulp and 15 to 25% pulp. Report the percentage consistency of the moisture-free pulp in the original specimen to the nearest 0.1%.

9. Precision

9.1 Repeatability = 10%
9.2 Reproducibility = not known.
9.3 These values are in accordance with the definition of these terms in TAPPI T 1206 "Precision Statement for Test Methods."

NOTE 5: The accuracy of the reported method depends mainly on the sampling procedure.

10. Additional information

10.2 This method was first published in 1967 as a Suggested Method and became an Official Method in 1975; it was revised in 1981 and 1993.

Your comments and suggestions on this procedure are earnestly requested and should be sent to the TAPPI Technical Divisions Administrator.