T 701 pm-01
PROVISIONAL METHOD – 2001

CAUTION:
This Test Method may include safety precautions which are believed to be appropriate at the time of publication of the method. The intent of these is to alert the user of the method to safety issues related to such use. The user is responsible for determining that the safety precautions are complete and are appropriate to their use of the method, and for ensuring that suitable safety practices have not changed since publication of the method. This method may require the use, disposal, or both, of chemicals which may present serious health hazards to humans. Procedures for the handling of such substances are set forth on Material Safety Data Sheets which must be developed by all manufacturers and importers of potentially hazardous chemicals and maintained by all distributors of potentially hazardous chemicals. Prior to the use of this method, the user must determine whether any of the chemicals to be used or disposed of are potentially hazardous and, if so, must follow strictly the procedures specified by both the manufacturer, as well as local, state, and federal authorities for safe use and disposal of these chemicals.

Gravimetric method for measuring dewatering of coating colors (Åbo-Akademi-type method)

1. Scope

This method describes a procedure to characterize water retention properties of coating colors under static conditions. The procedure involves determination of the amount of continuous phase removed, through a membrane filter, from the coating into the base paper within a pre-selected time period and under a selected hydrostatic pressure.

2. Significance

2.1 Water retention properties of coating colors are important for the coating process because they impact the rheology of the coating after it contacts the porous paper web hence, a portion of the continuous water phase leaves the coating layer and enters the base sheet. Consequently, the loading of the metering device and coating process defects depend on water retention. Dewatering of the coating color under pressure can be evaluated in the laboratory with this method. The method is based on principle of the pressure filtration; it measures the amount of continuous phase dewatered. It is a static method that can be used to investigate the influence of coating color components, composition and solids content on dewatering.

2.2 Additionally the effect of contact time, base paper or pressure on dewatering of coating colors can be studied with the apparatus. These special tests are not included in this procedure, although the same principles from this method are applicable.

3. Apparatus

3.1 The gravimetric water retention meter[1] has changed over the years from the original apparatus described by Sandås and Salminen (*1, 2*). Improvements have been made to make the device easier to use and to increase the reproducibility of the results. Among others, improvements include replacement of the manual pressure system with pneumatic air and utilization of a timer for accurate time determination. The switches have been replaced with pushbuttons. The components and setup of the present instrument in its present form are shown in Figure 1.

[1] Names of suppliers of testing equipment and materials for this method may be found on the Test Equipment Suppliers list in the bound set of TAPPI Test Methods, or may be obtained from the TAPPI Quality and Standards Department.

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3.2 The instrument installation requirements are listed here.

3.2.1 An air supply free of oil, water and other contaminants should be capable of supplying the maximum pressure of the apparatus (1000 to 1500 kPa).

3.2.2 A balance with a 0.0001 g accuracy.

3.2.3 Electricity of 110-240 V AC.

3.2.4 A timer which displays seconds.

3.3 The instrument consists of parts described as follows.

3.3.1 A sample test cell made in aluminum or stainless steel. The area of the test cell is 6.7 x 10^{-4} m^2 and volume about 33 ml (Older test cells have different geometry).

3.3.2 A plug, easy and fast to use. The air inlet at the top is directed against the threaded plastic part to avoid blowing a hole in the coating color and to guarantee even air distribution into the sample test cell.

3.3.3 A regulator of the air supply to regulate the working pressure for the test. It is a high precision regulator with a locking knob in order to avoid changes in the pressure during the test.

3.3.4 A pressure measuring device, with the accuracy to measure the regulated pneumatic air within the specifications.

3.3.5 An instrument timer for accurate measurement of the test time. The timer is a multifunctional system with possibilities to alter the contact time when complimentary tests are performed.

3.3.6 A bottom plate with a rubber blanket for packing the test cell.

3.3.7 A mechanical-pneumatical device to raise and lower the backing table when locking /unlocking the test cell.

3.3.8 A push-button for controlling the backing table.

3.3.9 A push-button for activating the instrument timer. The pressure will be switched on simultaneously.

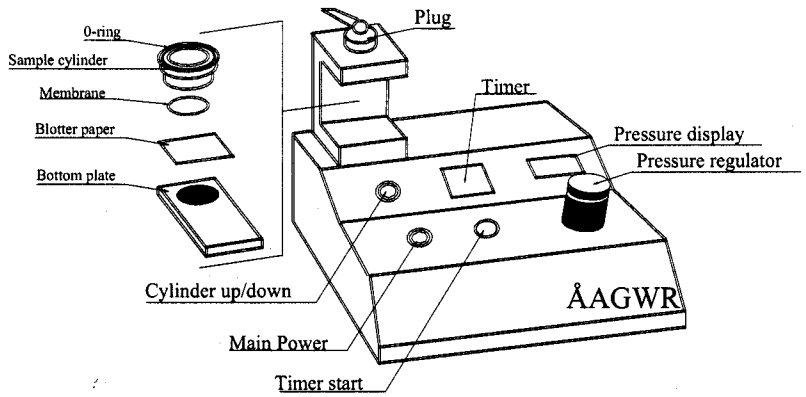

Figure 1. The gravimetric water retention meter

4. Materials

4.1 A membrane filter, a non-hygroscopic polycarbonate filter with 5 µm mean pore size. The filter has track etched cylindrical pores and the pore density is 4 x 10^5 pores per square centimeter.

4.2 An absorbing base paper sheet, ash-free base papers such as chromatography paper, with basis weight 413 g/m^2.

4.3 A syringe, a single use model of volume 10-20 mL.

5. Procedure

5.1 Cut the absorbing base paper into squares or circles big enough to cover the outer cell diameter. This will ensure that the water drained from the coating color goes into the base paper and not on to the rubber blanket.

5.2 Weigh the absorbing base paper on an analytical scale.

NOTE 1. The base paper thickness should be sufficient so that after completing the dewatering test the side in direct contact with the rubber mat is dry. The number of base paper sheets can be increased if this becomes a problem.

5.3 Place the base paper, the wire side upward, on the rubber blanket on the bottom plate.

NOTE 2. The wire marking can be seen more easily in bright light.

5.4 Place the membrane filter with the glossy side upward on the base paper and rubber blanket.

5.5 Place the sample test cell on the membrane filter with the narrower end next to the membrane.

5.6 Place the test system onto the backing table and tighten with device dependent type of mechanism (A switch or a pushbutton).

5.7 Inject 10 mL of the coating color with the syringe into the test cell and start the timer. Close the test cell with the plug.

5.8 After 15 s, pressurize the system to the 50 kPa pressure.

5.9 Upon completion of 90 s pressurized time (total 1 min 45 s contact time), remove the pressure and the test cell plug.

5.10 After 15 s (total contact time 2 min), detach the base paper from the filter membrane and bottom plate.

NOTE 3. A slight shift from the horizontal plane makes it easier to release the stack above the base paper so that the base paper will not be contaminated by the coating color in the cell.

5.11 Reweigh the base paper immediately.

5.12 Determine the amount of water drained from the coating color into the paper sample as the difference between the two weighings.

6. Calculations

Calculate the test results into grams per unit area, using Equations 1 and 2,

$$\text{Difference (g)} = W_{wet} - W_{dry} \quad (1)$$

$$\text{Transferred liquid (g/m}^2\text{)} = (W_{wet} - W_{dry}) / \text{Cell area} \quad (2)$$

where

W_{wet} = weight of the base paper after the test
W_{dry} = weight of the dry base paper
Cell Area = in [m^2] unit

7. Report

Report the result of transferred liquid per square meter (g/m^2) as an average of three test determinations.

8. Precision

8.1 For the maximum expected difference between two test results, each of which is the average of three test determinations:

Repeatability (within a laboratory) = 3 % or 3.0 g/m^2
Reproducibility (between laboratories) = 10 % or 10.0 g/m^2

in accordance with the definitions of these terms in TAPPI T 1200 "Interlaboratory Evaluation of Test Methods to Determine TAPPI Repeatability and Reproducibility."

8.2 These results are based on a round-robin of 10 laboratories on 2 coating colors involving 5 determinations per material tested. The 10 laboratories represent all different commercial models of the apparatus.

9. Safety precautions

If a gas cylinder is used, ensure that it is securely clamped to an immovable object.

10. Keywords

Coating color, Drainage, Filtration, Water retention, Water removal, Static tests.

11. Additional information

Effective date of issue: September 5, 2001.

Literature cited

1. Sandås S. M.Sc.Thesis "Measuring the water retention of coating colours" (in Swedish), Åbo Akademi University, Åbo, Finland, 1988.
2. Sandås, S.E., Salminen, P.J., and Eklund, D.E., "Measuring the water retention of coating colours", Tappi Journal, vol 72, no 12, p 207, 1989.

Your comments and suggestions on this procedure are earnestly requested and should be sent to the TAPPI Director of Quality and Standards. ■