UM 554
ISSUED PRIOR TO 1991
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Polystyrene in paper products

Scope

These procedures are applicable to paper modified with polystyrene. Two alternative methods can be used: ultraviolet and gravimetric.

These can be used for products covering a wide range of polystyrene content. The UV method is more sensitive than the gravimetric method and can be use for determining very low polystyrene loadings as low as 0.1%. The practical lower limit of the gravimetric method is approximately 1% polystyrene content.

Safety precautions

Run all procedures using chloroform under a fume hood approved for the use of this chemical and note the chemical caution statement above.

Significance

The purpose of the addition of polystyrene is for improved optical properties such as whiteness and opacity, and also improved printing characteristics and bulking.

Apparatus

For the UV method:

1. *Ultraviolet spectrophotometer*, any commercially available spectrophotometer covering the UV region from 200 to 390 nm is satisfactory.
2. *UV cells*, two matched 1-cm path length cells, UV transmitting.

Approved by a Working Group of TAPPI in accordance with the Useful Method Guidelines
TAPPI

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3. *Erlenmeyer flasks*, 250 mL, 24/40 standard taper flasks with water-cooled condensers to fit.
4. *Blender*.
5. *Hot plate*.
6. *Pipet*, 100 mL volumetric.

For the gravimetric method:

Soxhlet extraction apparatus, with 33 × 80 mm cellulose thimbles

Reagent

Chloroform, reagent grade.

Sampling

Ultraviolet method. From each test unit of the sample obtained in accordance with TAPPI T 400 "Sampling and Accepting a Single Lot of Paper, Paperboard, Containerboard, or Related Product," cut an approximately 4 × 4 in. (100 × 100 mm) piece of paper (about 0.4 g) from the sheet and weigh to the nearest milligram. Then cut into 0.5 in. (12.7 mm) strips and then into 0.5 in. (12.7 mm) squares and transfer to the Erlenmeyer flask through a wide neck polyethylene funnel.

Gravimetric method. Cut a piece of paper sheet weighing about 5 g into approximately 1-in. (2.5-mm) square and grind dry in a blender at high speed until completely macerated (usually about 30 s).

Procedure

Ultraviolet method

Run all procedures using chloroform under a fume hood approved for the use of this chemical. Add exactly 100 mL of chloroform to the sample in the Erlenmeyer flask and reflux on a hot plate for 1 h under a water-cooled condenser, then stopper and cool to room temperature under running water, with intermittent loosening of the stopper to release the vacuum.

Run a "paper blank" of approximately equal weight, formulated with all the ingredients except the polystyrene. Measure the absorbencies at 250 and 260 nm of both sample and paper blank in a 1-cm cell versus pure chloroform in a matched cell on the spectrophotometer.

Depending on the polystyrene concentration and absorbance range of the spectrophotometer, more or less sample may be used to give a practical absorbance reading. It is not necessary to run a different weight of paper blank for each weight of sample. A simple correction is made for the absorbance of the blank equivalent to the weight of sample taken for analysis; however, run a new paper blank for each different paper formulation.

The corrected absorbance at the two wavelengths is calculated by subtracting the absorbance of the paper blank from that of the sample.

The absorptivity of the sample at 250 and 260 nm is calculated as follows:

$$a = A / LC \tag{1}$$

where

a	=	absorptivity
A	=	measured absorbance relative to the "paper blank," % or fraction
L	=	cell length, cm
C	=	sample concentration, g/1000 mL extract

NOTE 1: Following the procedure outlined in this UM, the cell path length (L) is equal to 1 cm and the concentration (C) is equal to the weight (grams) of sample used times 10.

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