

The Wet Specimen Method for the Measurement of Wax in OCC

Copyright Gary Wood, Verity IA Software, Inc. July 14, 2019

Authors:

Roy Rosenberger, Verity IA, LLC
William Moore, Fox Valley Technical College
Mahendra Doshi, Doshi & Associates

1. Introduction

Wax and hot melt adhesives are an ever present contaminant in the Old Corrugated Container (OCC) process stream. Their presence in the finished product will cause printing skips in finished linerboard, interfere with adhesion of glues, and in some cases are a source of food contamination. The problem has been to detect their presence in the process early enough to prevent contamination of the finished product.

The wet specimen method uses ordinary handsheets prepared from process samples. The handsheets are dried, however, under carefully controlled time and temperature constraints to induce the waxy components to flow into the fiber surrounding them. These "Curing" conditions if not controlled will contribute to variations in the measurement. The cured handsheet is then placed in water. The water "stains" the brown fiber surrounding the waxy area a dark brown while the fibers wet- out by the waxy components during the curing cycle remain a light brown very close to the dry fiber color. An image analysis system prepared to accept the wet specimen is used to measure the size frequency distribution of the contrasting areas. This method builds upon techniques that have been developed to duplicate the manual methods that required probing and observation of suspected stickies to determine their level of tack and flow characteristics.

2. Scope

2.1 Waxy contaminants in the OCC process share a common property; they are all thermoplastic. This method will detect their presence in the process and provide a reasonable estimate of their quantity.

2.2 By taking advantage of their thermoplastic properties, this method quantifies waxy contaminants, as they would appear on the paper machine, that is, after heating and being subjected to modest pressure. With increased heat absorption the viscosity of a thermoplastic will go down thus making it more likely to be absorbed within the filter paper interstices.

2.3 This method can be used on white as well as brown stock.

3. Significance

3.1 This method eliminates the use of black filter papers, dyes, powder tacky markers, and special coated sheets (1,2), to mark, hot melts, and waxes usually required by laboratory dirt counters.

3.2 It also eliminates the need for manual size classification using microscopy and probing with a microscope pick to determine tackiness.

3.3 The method uses water, blotter papers, and a handsheet dryer (electric or steam) at dryer can temperature, as the primary tools. It employs no solvents or other hazardous reagents.

4. Related documents

TAPPI T 213 "dirt in Pulp", TAPPI T 437 "Dirt in Paper and Paperboard" and TAPPI T 563 "Equivalent Black Area (EBA) and count of visible dirt in pulp, paper, and paper by image analysis.

5. Definitions

5.1 Stickies - Stickies are pulp and paper contaminants that stick to the paper making machinery.

5.2 dirt – Any contaminant carried with the tested pulp that has a contrasting, darker color than the surrounding dry fiber and that does not melt, deform, or become tacky under machine operating temperature and pressure conditions.

5.3 Macro Stickie – A stickie that will not pass 150 micron or 100 micron laboratory slotted screens. Nominally 0.04 sqmm and larger for the 150 micron screen and 0.01 sqmm and larger for the 100 micron screen.

5.4 Micro Stickie – A stickie that passes a 150 micron or 100 micron laboratory slotted screen.

5.5 Wax – A sub class of the stickies group that melts and wets-out surrounding fibers at a temperature nominally less than 100° Celsius.

6. Apparatus

6.1 Description of the apparatus

6.11 Handsheet Dryer: The handsheet dryer must be capable of sustaining 190°C (374°F) for seven minutes or machine dryer can temperatures for seven minutes. Although it has not been tested, a Carver press or other pressing apparatus may useful when set to apply a uniform 69 kpa (10 psi) pressure at the required temperature.

6.12 Wet Specimen Imaging Apparatus: The tools required to handle and place the wet filter paper on the scanner consist of a black plastic palette, and a soft 150mm wide roller. The black palette is used to mount the wet handsheet for scanning and the roller is used to remove the air from between the specimen and the palette. The scanner should have a glass plate whose edge is sealed to prevent water penetration into the scanner body.

6.13 Image Analysis System: An image analysis system, scanner based, able to acquire at least 0.042 mm picture point spacing resolution (600 dpi) image using reflected light. The software must be able to automatically set itself to measure the materials that are lighter than the wet dark brown fiber. Because of the fluctuating nature of the scanner used for imaging the software must be able to set the measurement criteria based upon the optical information contained in the specimen under evaluation using only one scan.

Note: The Image Analysis System and Plastic Palette & Roller apparatus are available from: Verity IA Software, Inc, 800 677 0810.

6.14 Calibration: The image analysis system must be able to do an internal calibration using successive measurement comparisons to assess the stability and reproducibility of the system. The scanner provides no adjustments to its resolution or to its warming and stabilization. Successive measurement comparisons will be made automatically until the reported stickies measurement absolute difference between scans is 5% or less. Once the measurement difference is within the tolerance the results of the last scan are reported. The target is the specimen itself and the settings used to measure the specimen.

6.15 Contrast setting: The contrast setting or sensitivity of the image analysis system must be set at 25% or less from the background reflectivity. The background reflectivity is the statistical mode of the entire measurement area pixel gray value frequency distribution. Since the measurement is being made of those materials lighter than the wet specimen the contrast calculation is the percent difference between the mode and the threshold reflectance value used to determine which image objects are to be measured.

7. Sampling and test specimens

The amount of stock to be screened is dependent upon the process but generally will be 100 gm oven dry from which a suitable number of 1.2 gm handsheets will be produced. Whatever amount is determined to be enough to get a representative sample

must be kept constant for that location and process. The contaminant level expected at the sample point determines the number of handsheets measured; fewer specimens are required at high levels of contamination.

8. Procedure

8.1 Obtain a process sample and produce a 2.4 gm British Mould handsheet using conventional means.

Note: The nominally 155 mm (6") diameter handsheet must be 2.4 gm dry weight to accommodate the curing cycle in step 8.2 and so it has sufficient wet strength to be turned over to measure the both sides.

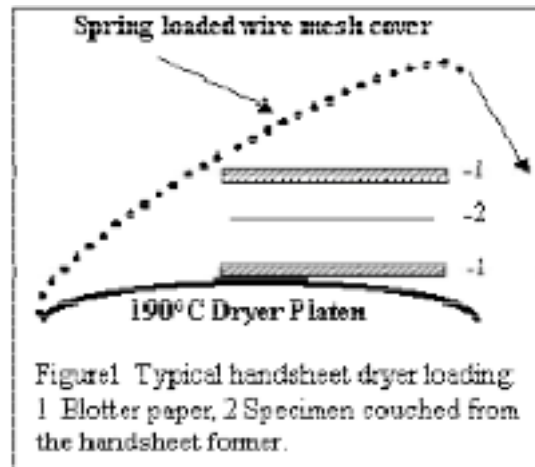
8.2 Place the handsheet between two pieces of blotter paper and place the stack in the handsheet dryer at 190°C for seven (7) minutes.

Note: The time and temperature cycle are critical to the test results being reproducible. The waxes will migrate into the blotter paper if left too long or at too high a temperature in the handsheet dryer.

8.3 Remove the stack from the dryer and part the blotters from the specimen. To prevent blotter fibers from being torn away by the wax contaminant in the specimen, this should be done while the stack is hot.

8.4 Place the cured specimen in room temperature tap water, carefully remove it when it is saturated, place it on the black palette #1 side down so it touches the edges, roll it gently to remove the air and place it on the scanner glass. The placement of the palette must follow the manufacturer's specifications for image acquisition location. (Before placing the specimen on the glass, dab away any water drops that may be left from previous tests.)

8.5 Start the image analysis calibration and measurement sequence using the settings described in the apparatus section. The system will record the data from the first side.



8.6 Carefully remove the specimen from the black pallet turn it over and repeat the image analysis measurement for side #2.

9. Report

The results are reported as PPM of the total area measured on both sides of the specimen in the current test and cumulative for the series of tests. Frequency distribution by size may also be reported.

10. Precision

11. Keywords

Wax, OCC, linerboard, contaminant, contraries, stickies, measurement, stickies count, stickies PPM, image analysis, paper, paperboard, pulp, screens.

12. Literature cited

Heise, O; Cao, B; Dehm, J; Holik, H; Schnabel, Dr S; Kriebel, A; "A New Stickies Test Method", 1998 TAPPI Recycling Symposium Proceedings, p213-229

Doshi, M.R. ; Dyer, J.; "Management and Control of Stickies", Paper Recycling Challenge, Vol III, p195 – 233, sect 3