



Institute of Paper Science and Technology

Technology Transfer Fact Sheet

Routine and Specialized Testing Services

MEET INDUSTRY NEEDS WITH IPST'S MULTIDISCIPLINARY EXPERTS

IPST's *Research Testing Services Unit* is uniquely qualified to address the technical needs of member company facilities regarding process and product development and quality control. Professional scientists and engineers – who are knowledgeable about the industry – work with clients to identify the analyses required and to interpret results. Consultation with Institute faculty and staff is a unique offering that IPST provides during nonroutine investigations.



Technical staff review experimental results.

Applications

IPST's *Research Testing Services Unit* offers a full range of services. We are prepared to analyze:

Pulping and Bleaching

- pulp properties from specified pulping and bleaching conditions
- the influence of process factors in delignification and bleaching stages
- pulping and bleaching effluents
- kraft process parameters for yield improvement
- the effects of silvicultural treatment on pulp quality of southern pines
- machine deposits and evaporator scales
- white, green, and black liquor
- fine solids in pulping liquors
- corrosion products

Paper and Board Performance

- surface cracking
- glue adhesion
- container strength
- sizing and wicking
- delamination/separation
- surface roughness
- bonding and refining characteristics of fibers
- fiber orientation

Product Quality

- chemical characterization of wood, pulp, and paper
- contaminants and defects
- mineral fillers in paper
- method development for testing
- product specifications
- competitiveness

- wire and felt patterns in paper and board
- furnish composition
- coating microstructure

Chemical Analysis

The activities of the *Chemical Analysis Laboratories* range from routine testing to research. Some specific areas of expertise include chemical characterization of machine deposits, evaporator scale, and product contaminants; chemical analysis of wood, pulping liquor, pulp, and paper; product defect analysis; and methods development.

Several recent projects have involved the use of gas chromatography/mass spectrometry for the identification and quantification of specific resin acids, fatty acids, lipids and phytosterols in various pulp mill process streams. These inherent components of wood extractives have important implications with respect to a mill's productivity and its impact on the environment. The analyses cited support diverse investigations ranging from premature clogging of paper machine felts to research into the effect and fate of these materials in the aquatic environment.

The Chemical Analysis group also recently supported technical staff at a pulp supplier who needed to know if the contamination spots they periodically observed in their bleached kraft pulp sheets had the same chemical composition as spots that appeared in paper manufactured by one of their largest customers. Samples were analyzed and contaminant spots were analyzed using Fourier Transform Infrared (FTIR) Microspectroscopy along with several micro-chemical assays. The supplier pulp contaminant was determined to be silicone oil, whereas the contaminant spots in the paper were hydrocarbon-softened styrene latex with agglomerated minerals including kaolin clay, calcium carbonate and iron.

Capabilities

- kappa number
- residue (ash, moisture, solids)
- lignin (total, acid insoluble, acid soluble)
- solvent extractives
- pulp viscosity
- carboxyl functional group concentration
- phenolic hydroxyl functional group concentration
- tall oil content
- pH (cold water extract pH, hot water extract pH, surface pH)
- elemental analysis (metals, N, S)
- anions
- carbohydrates
- alpha, beta, gamma-cellulose
- sizing agent identification
- wet strength agent identification
- fatty acids/resin acids
- polymer characterization

Principal Analytical Techniques

- chromatography (GC-FID, GC-TCD, GC-ECD, HPLC-PDA, HPLC-RI)
- mass spectrometry (low-resolution quadrupole, ion trap)
- capillary ion electrophoresis
- infrared spectroscopy (FTIR microscopy, attenuated total reflectance, diffuse reflectance, transmission)
- emission spectroscopy (axial plasma ICP, radial plasma ICP)
- titrimetry
- gravimetry
- spectrophotometry

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Paper Analysis

The *Paper Analysis Laboratories* have a wide complement of testing equipment to quantify paper, board, and specialty-product performance in compliance with standard physical test methods.



Staff members test paper properties.

Investigations into product performance frequently require special conditioning capabilities. IPST's walk-in environmental chambers accommodate most instruments to perform tests under conditions ranging from refrigeration to tropical climates. Accelerated aging of materials in electronically controlled ovens provides specific conditions that allow evaluation of optical and surface properties and strength performance of materials before and after the aging process.

Equipment for precision surface grinding of both paper and board sheets is used to prepare specific sample sections for further testing. Subsequent analyses involve ashing to determine the z-directional distribution of mineral materials in the sheet or in-plane ultrasonic measurements to identify changes in sheet structure through the z-direction. Other unique testing methods include needle abrasion testing to predict relative slit and knife blade wear caused by abrasive components in both basesheet and coating materials. Recent evaluations of printing

materials have involved optical and surface properties testing combined with hygroexpansivity measurements and air permeability. Typical evaluation of pulps may include refining curves (PFI mill or Valley Beater) and handsheet trials with related strength testing (tensile, tear, burst, fold, zero-span tensile).

Capabilities

- optical properties (brightness, color, opacity, scattering/absorption)
- strength properties (burst, tear, fold, stiffness, tensile in the MD/CD and z-direction, abrasion)
- moisture/dimensional stability (hygroexpansivity, curl, WVTR)
- air permeability testing (PPS, Bendtsen, Gurley, Frazier low pressure)
- surface properties (roughness by Sheffield, Print-surf, Bendtsen, and Emveco stylus methods, static and kinetic coefficient of friction according to ISO 15359)
- liner and combined board (STFI, Concora, ring crush, ECT, flat crush, bending stiffness, box crush)

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Microscopy and Fiber Analysis

The focus of the *Microscopy and Fiber Analysis Group* is problem solving through the microcharacterization of pulp, paper, coatings, and mill materials. Using the latest digital-imaging acquisition and analysis equipment allows the group to quickly execute paper and contaminant characterization.

Recently, technical staff at a market pulp supplier approached the Microscopy and Fiber Analysis Group because they had received complaints that their pulp did not dye uniformly for use in colored sheet

production. IPST's experts located and extracted problem fibers using light microscopy with fiber stains. The fibers were determined to originate from sources external to the pulp supplier. Once identified, a possible source of the contaminants was proposed and an explanation was suggested for the non-uniform dyeing.

Other recent projects include using the combined power of backscattered electron imaging and elemental x-ray analysis in the SEM to identify and determine the distribution of pigments in paper, solids in green liquor, and bands in evaporator scale.

Capabilities

- fiber identification
- fiber morphology and measurement
- identification of contaminants
- composition and structure of evaporator scales
- analysis of fine solids in green and black liquor
- identification and distribution of mineral fillers in paper
- detection of felt and wire patterns in paper and board
- characterization of surface roughness in packaging board
- structure, composition, porosity of black liquor chars

Principal Analytical Techniques

- light microscopy
- scanning electron microscopy (SEM)
- elemental analysis by EDS
- image analysis
- cross-sectioning
- automated fiber analyzers
- x-ray diffraction



Mixed furnish as viewed by light microscopy.

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For a focus on problem understanding from a structural perspective, please refer to the Technology Transfer Fact Sheet titled *Investigate the Root Cause of Problems From a Structural Standpoint*.

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