New additions at Econotech: FTIR & TG

FTIR (Fourier Transform Infrared Spectrometer) and TG (Thermogravimetry Analyzer) are recent additions at Econotech. These are two powerful analytical techniques particularly in analyzing minute amounts of samples both qualitatively and quantitatively. The combination of these two techniques has been employed to solve many process and production line problems. They are expected to be adapted into a wide range of industries and their applications are anticipated to increase exponentially in the near future. The FTIR and TG are briefly discussed below:

FTIR

The infrared region of the electromagnetic spectrum is useful in identifying unknown samples of interest, which has long been established. Everything in nature has a unique finger print to FTIR. Therefore, an infrared spectrum often reveals the nature of the unknown sample and serves as an excellent tool for identification. An unknown sample of interest is first isolated from the bulk and then analyzed using FTIR. Its spectrum is compared to spectra in an in-house IR spectra library, the sample can be identified with the help of search and match programs.

The FTIR spectrometer and the FTIR-microscope are both available for identifying macro and micro amounts of unknown samples. Solids, powders, liquids, plastics, rubber and extractives are identified using one or more of the above-mentioned FTIR techniques. Samples such as pulp and paper process deposits, contaminants, press blanket deposits, plastics, unknown materials, good/failed material comparison and unknown coating material are frequently analyzed.

Econotech's FTIR microscope can analyze a small size of sample. The sample is handled and prepared under a stereo microscope, and subsequently the sample is transferred on to an FTIR-microscope slide for final infrared identification. There are two techniques available: micro transmission and micro reflectance. Micro amounts of pulp and paper contaminants, paper holes, streaks, process deposits, paper coatings, printing defects, tape pull, printing press blanket deposits, fly ash, etc. are often identified using these techniques.

TG

TG is a micro-analytical technique to determine the weight loss profile of samples at elevated temperatures. Usually the temperature is programmed to increase from 40°C to 950°C. TG analysis requires only milligrams of sample and the thermogram

obtained reveals its thermal reactions such as total solids, ash contents at various temperatures, carbon dioxide evolution temperature, degradation temperatures, evolution of chemically absorbed water, etc. This technique is often being adapted to study samples such as uncalcined clay/calcined clay, talc, paper filler, coating colour, paper coatings, process contaminants, corrosion products, etc.

If you would like more information, please give me a call. <<

ERIC CHAO – SENIOR TECHNICAL SPECIALIST
eric@econotech.com

What do you think?

Whether it's about our new look or a topic you would like to see covered in a future issue, we'd like to hear from you. Please contact Jacquie Stanley with your comments or suggestions. <<

JACQUIE STANLEY – ADMINISTRATIVE ASSISTANT
jacquie@econotech.com

Econotech Services Ltd
852 Derwent Way
Delta, British Columbia
Canada V3M 5R1

T+ 604 526 4221
NA+ 800 463 5700
F+ 604 526 1898
info@econotech.com
www.econotech.com

THE LATEST NEWS FROM ECONOTECH AND FRIENDS | SUMMER 2003 | VOLUME NO. 16

Fiber length, and fiber coarseness explained

Fiber length is pretty well self explanatory; the only question that some may have is what is the difference between WWAFL and LWAFL. The arithmetic average of fiber length is not the most commonly used indicator of the fiber length because the effect of the short fibers is emphasized. The commonly used expression is the LWAFL or length weighted average fiber length.

From time-to-time paper makers like to use another expression of fiber length and that is weight weighted average fiber length. In this case the emphasis is on the heavier fibers.

In summary we can see the LWAFL or as some know it the WAFL is weighted towards fiber length and the WWAFL is weighted towards the fiber weight.

Historical data has most often used the LWAFL. Today this is the value most commonly used.

Having both of these values opens the very confusing question of which is correct. Well, they're both correct; however if I was selling pulp based on properties such as tear I would use the WWAFL, which emphasizes the heavier fibers, which not surprisingly, tend to increase the tear value. If I were selling pulp based on smoothness, pliability and low bulk, then I would likely use the LWAFL, which puts the emphasis on the longer fibers. Confused yet?

Now lets look at fiber coarseness measurement. If one is using an automated optical analyzer such as the FQA, Kajaani or Andritz products, does one include the fines in the sample or not?

James d'A Clark has claimed that fines are not fibers and therefore should not be included in the sample. Several others seem to agree. I don't agree and apparently many of our customers also don't agree as they request the fines to be included. When one uses coarseness values in their pulp specifications this is interpreted to mean the coarseness value for the pulp sold to the papermaker. The fines content of that pulp is an integral part of the product and in fact in mechanical pulp the fines impart much to the optical and surface properties of the pulp. In chemical pulp the fines content might not be significant but it certainly is for mechanical pulp.

It is for these reasons that we, at Econotech, usually include the fines in the sample we use for coarseness measurement. In order to remove the fines one usually makes a 1 gram (o.d. basis) handsheet based on the theory that most (not all) of the fines will go through the sheet machine gridplate.

Of course, by removing the fines the coarseness value will be higher. But is it a true coarseness of your pulp? <<

DON D. McDERMID
MANAGER, PULP & PAPER TESTING
don@econotech.com

The scope(s) of microscopy

From a humble beginning of one microscope and one analyst, the Microscopy department has seen a lot of changes since Econotech's inception in 1972. Though the relationship between analysis and microscope has not changed much in all these years, the range of tests and our efficiencies have improved. Today the Microscopy department consists of four analysts who perform a variety of tests and analyses using four compound microscopes and one stereomicroscope.

All of our compound microscopes are used for fiber analysis. This analysis includes the identification of softwood and hardwood fibers, distinguishing between chemical and mechanical pulps as well as the identification of non-wood types such as synthetic fibers. Each microscope has its own specialty, which is most evident by the test they are used for. Here is an introduction to each member in our microscope family.

The oldest microscope in the bunch is the Zeiss. This scope has been around since the early years and although some may consider it an antique, it is still very important to our department. The Zeiss is not only used for fiber analysis, but also has photography capabilities as well as a video imaging setup. This set up is crucial for cell wall thickness and fiber diameter analysis. The Zeiss is also equipped with reflective light attachments that are required for tests such as ink particle counts.

Next, we have the well-traveled Olympus microscope. This scope was once taken to many job sites where instant asbestos analysis was required. Although Oly, as we like to call him, has retired his traveling shoes, he is available for in-house asbestos analysis (including both bulk samples and fiber counts), as well as fiber analysis and sclereid counts.

The third and fourth scopes are both Nikon microscopes and are proud new editions. While one is a fiber analysis workhorse, the other is equipped with all the bells and whistles including a digital camera. This camera has updated our department; we are now able to take photomicrographs of everything from resin-filled hardwood vessels to chips from woodpiles and can email them to you almost instantly.

The Meiji is the fifth microscope in the Microscopy department. This is our stereomicroscope, and has proved itself very useful for tests such as stickies area and counts analysis as well as constituent characterizations. This scope is also very important in the initial stages of any contaminant projects; spots, particles and even fibers can easily be isolated for further analysis on any of our compound microscopes.

The Microscopy department is constantly updating and broadening our range of testing. Let us know if there is anything you would like to see added to the scope of our analyses. <<

STACEY GOSSELIN – SENIOR TECHNOLOGIST
MICROSCOPY AND WOOD TECHNOLOGY
stacey@econotech.com

The effects that freezing has on the physical properties of pulp

In recent months I have had several requests from clients questioning how the freezing of pulp affects the resulting fiber properties. We were unable to find any definitive answers so we decided to run a PFI on an unbleached pulp sample: both frozen and unfrozen.

A sample of never-dried unbleached softwood kraft from the Pacific Northwest was obtained and refined in our PFI mill using standard TAPPI procedures. Standard hand sheets were prepared using our Messmer semi-automatic sheet machine. The sheets were then pressed and conditioned in our constant temperature and humidity room.

This process was repeated on a sample from the same pulp, which had been frozen for four days at minus 10°C.

The basic physical properties were run in accordance with standard TAPPI procedures and reported in the following table.

INITIAL	UNFROZEN	FROZEN
C.S. Freeness, mL	737	728
Burst factor	31	24
Tear factor	257	280
Breaking length, km	4.6	4.1
Bulk, cc/g	1.74	1.82
Fold, MIT	159	74

4800 REVS	UNFROZEN	FROZEN
C.S. Freeness, mL	480	507
Burst factor	82	73
Tear factor	97	103
Breaking length, km	10.9	10.7
Bulk, cc/g	1.38	1.40
Fold, MIT	2159	2358

2000 REVS	UNFROZEN	FROZEN
C.S. Freeness, mL	630	630
Burst factor	69	66
Tear factor	117	125
Breaking length, km	9.5	9.1
Bulk, cc/g	1.46	1.50
Fold, MIT	1967	1815

6500 REVS	UNFROZEN	FROZEN
C.S. Freeness, mL	385	360
Burst factor	86	86
Tear factor	100	97
Breaking length, km	10.9	10.7
Bulk, cc/g	1.37	1.38
Fold, MIT	2414	2400

Based upon the results from one sample it appears that there is very little, if any, difference between the two samples. <<

DON D. McDERMID – MANAGER, PULP & PAPER TESTING, don@econotech.com

Can I see some ID, please?

TREE IDENTIFICATION

An expert can easily identify a tree. He can name a tree from a distance just by its appearance. However, for most people it's not that simple.

The most effective way to identify a tree is to examine a branch of its leaves or needles. Short and scaly needles means it's a cedar. Needles that occur in bundles mean the tree is a pine or larch. Two needles in a bundle, it's lodgepole pine. Three needles in a bundle mean it's a ponderosa pine. Five needles in a bundle, it is a western white pine. For fifteen or more needles in a bundle, it is a larch.

When identifying single needle trees, it is very helpful to know if the cones on the tree are hanging upright or downward. Cones on a fir tree hang upright, while cones on the spruce, Douglas fir and hemlock all hang downward. In addition, a spruce has four-side single needles. A Douglas fir has flat, single needles with pointed tips. A hemlock has flat, single needles with blunt ends.

If the rules above haven't made you an expert yet, let me recommend "The Tree Book" with more detailed information about learning to recognize trees. It is published by Forestry Canada and Ministry of Forests of British Columbia. You can buy or download this book from the following website: www.for.gov.bc.ca/hfd/library/documents/treebook/index.htm

Another helpful website is "A Quick and Easy Way to Identify 50 Common Native North American Trees": www.forestry.about.com/library/treekey/bltree_key_id_start.htm. You just need to collect a leaf of a tree and answer the questions on the web screens. At the end of the interview, you will find out what kind of tree it is.

WOOD CHIP IDENTIFICATION

It is more difficult to identify wood chips than to identify a tree. Many different species wood chips look similar. Even within the same species, there are many things that influence chip identification, like chip moisture, age, and the differences between heartwood chips and sapwood chips. They all make the chips look different.

Econotech has specific procedures to do wood chip species identification. First, about 120 g.o.d. wt. of wood chips are placed in a bomb digester and cooked with kraft cooking liquor through a kraft cooking process. After cooking, the cooked chips are defibered, mixed and washed. The fibers are then prepared onto microscope slides. The slide is placed under a microscope and the fibers are identified by an experienced microscopist.

A representative chip sample is important to the accuracy of identification for mixed species chips. That means, more chips need to be collected from the chip pile and more chip load in the lab digester should be increased in order to achieve accurate species composition analyses. Econotech has two lab circulating digesters with chip load 3000 g.o.d. wood chips. They can provide well-cooked and well-mixed wood fibers for the slide preparation and species analysis. <<

(Thanks to Graham Vandegriend who prepared the photos and reviewed the article.)

KEVIN LAM
TECHNICAL SPECIALIST
kevin@econotech.com

SPRUCE CHIPS (LEFT) AND HEMLOCK CHIPS (RIGHT)

SCALY CEDAR LEAVES

WESTERN HEMLOCK NEEDLES & CONE

PINE NEEDLES

SPRUCE NEEDLES