

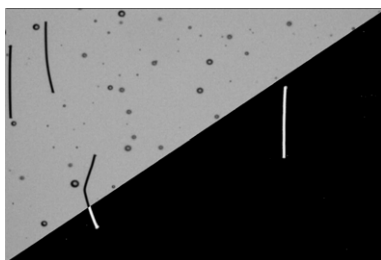


OpTest Equipment Inc.

HiRes Fiber Quality Analyzer

The HiRes FQA features a flow cell that stays clean and does not plug. It easily measures difficult pulps without special pretreatment or screening. These pulps include:

- High Shive Content Pulps
- Mechanical Pulps
- Linerboard Pulps
- Diaper Fluff and Pulps with High Flocculation Propensity
- Recycled Fibers
- Non-wood (plant) Fibers and Long Synthetic (birefringent) Fibers



The 3mm rayon fibers above have no fines. However, air bubbles in the non-polarized part appear as fines.



The same cellulose fiber viewed with circular polarized light (left) and linear polarized light (right). The ends of the curled fiber disappear in linear polarized light.

ADVANTAGES:

- Rapid & accurate measurement of length, width, curl & kink on fibers up to 10 mm
- All fiber values are measured simultaneously with a single camera
- Combined fiber length and width data provides useful tool for pulp blending
- Circular polarized light provides the most accurate measurement of fiber length and shape
- Sample cleaning and de-airing are unnecessary, unlike many non-polarized light methods



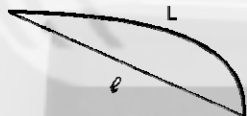
- More precise than non-polarized light methods
- The patented cytometric flow cell stays clean and prevents plugging
- Characterize pulps with contaminants such as ink, fillers, extractives and pitch
- Exceeds the Standard specifications of Tappi T271, PAPTAC B.4, and ISO 16065-1
- Minimal maintenance
- Optional software available for:
 - Coarseness
 - Hardwood/Softwood Blending Ratio
 - Shive and Vessels Elements

HiRes

Fiber Quality Analyzer

FIBER ANALYSIS MEASUREMENTS

Fiber length is reported either as the fiber contour length, L , or the end-to-end (projected) length, ℓ .



Fiber Curl is the gradual and continuous curvature of a fiber and is defined by:

$$\text{Curl Index} = (L/\ell) - 1$$

Kink is an abrupt change in the curvature of a fiber and is defined by the modified Kibblewhite's Kink Index. It is the weighted sum of the number N_x , of kinks within a range of "x" kink angles:

$$\text{Kink Index} = [2N_{(21-45)} + 3N_{(46-90)} + 4N_{(91-180)}] / L_{\text{TOTAL}}$$

The test results include means, variances and distribution histograms for:

- Fiber lengths (L_n , L_w , L_{ww}) at ranges up to 10 mm and at a sensitivity of 0.01mm.
- Fiber widths and fiber width as a function of length graphs. Measurement sensitivity is $< 1 \mu\text{m}/\text{fiber}$ and $< 0.1 \mu\text{m}/\text{test}$ (see Note 1)
- Curl Index (numeric & length weighted)
- Kink Angle and Kink Index
- Numeric %-fines with user selected size limits and ranges

A dedicated LCD screen displays results and allows test selection via an optical mouse or optional touchscreen. The individual fiber values are stored and can be exported, via LAN or USB port, for additional analysis. Also, fiber images can be stored for subsequent examination.

OPTIONS

- Coarseness & Hwd/Swd Ratio Software
- Shive Analysis Software
- Vessel Element Analysis Software
- AutoFeeder to automatically test up to 99 specimens
- Calibration Check Fiber Kits
- Non-polarizing Optics

DIMENSIONS

	L	W	H
• Sensor Unit	610 (24")	560 (22")	610 mm (24")

WEIGHT

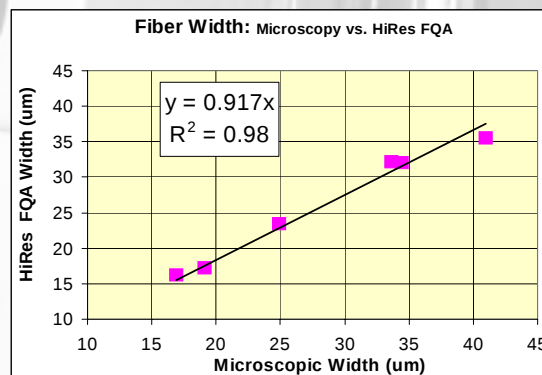
- Sensor Unit 60 kg (132 lbs)

CONNECTIONS

- Power: 600W stable within 2% and transient free within 10%
- Water: Pressure = 275 kPa (40 PSI)
 - mineral free (less than 50 mg/L residue after evaporation)
 - filtered (external at $5 \mu\text{m}$)
 - air-free (less than 0.05% free and bound air by volume)
- Instrument Air: Pressure = 680 kPa (100 PSI)

Note 1: Dynamic reverse dithering is applied to the edge pixels of the fiber image. Measuring the width several times along a fiber, combined with dynamic reverse dithering, provides a fiber width having a "measurement sensitivity" $< 1 \mu\text{m}/\text{fiber}$. This is possible because the HiRes FQA uses circular polarized light that produces a very high contrast fiber image. For several thousand fibers, the average width sensitivity is better than $0.1 \mu\text{m}$. This approach was tested on pulps on which the average fiber width was determined by microscopy.

Sample Fibre	Rayon 1.5	Rayon 3.0	NIST hwd	Blk Spruce	Doug. Fir	TMP R28
Paprican Microscopy, W (μm)						
Avg.	19.1	24.9	16.9	33.6	41.0	34.4
std. dev.	1.9	1.8	3.7	9.7	13.4	n/a
HiResFQA, W (μm)	17.2	23.4	16.2	32.2	35.6	32.0



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