Do you know what’s in your sample? Innventia has experienced staff and advanced equipment for complete characterization of specialty celluloses such as dissolving grade pulps and high reactivity cellulose.

The properties of specialty celluloses are to a great extent influenced by their chemical composition and supramolecular structure.

What can we do for you?
Innventia offers unique analysis of the specific surface area of cellulose in water swollen state. The method utilizes solid state nuclear magnetic resonance (NMR) spectroscopy. Furthermore, Innventia offers a wide range of tests of specialty cellulose samples, from chemical and macromolecular characterization, to characterization of supramolecular, fibrillar and bulk properties, for instance:

- Cellulose and hemicellulose content
- Content of impurities (lignin, inorganic matter, etc.)
- Degree of polymerization
- Surface area and porosity
- Water retention value and fibre saturation point
- Fibre length, width and coarseness
- Alkali resistance and solubility
- Fock reactivity

A list of the most frequently ordered testing services related to specialty cellulose is appended. Please contact us for a discussion about how we may help you!

Contact
For more information, please contact Dr Tomas Larsson (tomas.larsson@innventia.com, tel. +46 8 676 7130), or Dr Fredrik Aldaeus (fredrik.aldaeus@innventia.com, tel. +46 8 676 7188). We look forward to your inquiries!
# CHEMICAL AND MACROMOLECULAR PROPERTIES

<table>
<thead>
<tr>
<th>Cellulose and hemicellulose content</th>
<th>Lignin content</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Carbohydrate composition</strong> The content of non-glucose monosaccharides is assumed to correspond to the hemicellulose content. We measure the carbohydrate composition according to standard SCAN-CM 71, and deliver the content of glucose, mannose, arabinose, xylose and galactose in mg per g dry pulp. 2 g of sample is required.</td>
<td><strong>Acid-insoluble (Klason) and acid-soluble lignin</strong> We measure the content of acid-insoluble (Klason) and acid-soluble according to standards TAPPI T 222 om and TAPPI UM 250, and deliver the results in mg per g dry pulp. At least 2 g of sample is required (more if the lignin content is low).</td>
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<tr>
<td><strong>Carbohydrate composition incl. uronic acids</strong> In order to determine both neutral and acidic carbohydrates we use enzymatic hydrolysis in combination with capillary electrophoresis. In addition to the saccharides obtained by the standard method, this procedure provides the content of hexenuronic acid, 4-O-methylglucuronic acid and galacturonic acid. 1 g of sample is required.</td>
<td><strong>Kappa number</strong> We measure the kappa number according to standard ISO 302. 5 g of sample is required.</td>
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<tr>
<td><strong>Alpha-, beta-, and gamma cellulose</strong> We measure the content of alpha-, beta-, and gamma cellulose according to standard TAPPI T 203 om, and deliver the results in percent cellulose per dry pulp. 4 g of sample is required.</td>
<td><strong>Low molecular mass compounds</strong></td>
</tr>
<tr>
<td><strong>Degree of polymerization</strong></td>
<td><strong>Acetone extractable matter</strong> We measure the acetone extractable matter (i.e. extractives) according to standard SCAN-CM 49, and deliver the results in percent extractives per dry pulp. 2 g of sample is required.</td>
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<tr>
<td><strong>Molecular mass distribution</strong> We measure the molecular mass distribution relative to polystyrene using size exclusion chromatography after tricarbanilation, and deliver the results of the weight-average, number-average and peak molecular mass in g per mole, as well as the polydispersity index. 1 g of sample is required.</td>
<td><strong>Inorganic content</strong></td>
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<tr>
<td><strong>Viscosity</strong> We measure the viscosity according to standard ISO 5351, and deliver the results in mL/g. 5 g of sample is required.</td>
<td><strong>Ash content</strong> We measure the residue (i.e. ash) on ignition at 525°C according to standard ISO 1762, and deliver the results in percent ash per dry pulp. 2 g of sample is required.</td>
</tr>
<tr>
<td><strong>Acid-insoluble ash content</strong> We measure the acid-insoluble residue (i.e. acid-insoluble ash) on ignition at 525°C according to standard ISO 776, and deliver the results in mg per g dry pulp. 2 g of sample is required.</td>
<td><strong>Metals/elements content</strong> A variety of different metals and elements may be measured using atomic emission spectroscopy (ICP-AES), for instance Al, Ba, Ca, Cu, Fe, K, Mg, Mn, Ma and P. We deliver the results in mg of each element per g dry pulp. 2 g of sample is required.</td>
</tr>
</tbody>
</table>
### SUPRAMOLECULAR AND FIBRE PROPERTIES

#### Cellulose supramolecular properties

**Specific Surface area of cellulose I**  
One unique analysis at Innventia is the ability to measure the specific surface area of cellulose in water swollen state. The method utilizes solid state nuclear magnetic resonance (NMR) spectroscopy. The result is reported as square meters of surface area per gram cellulose. Approximately 200 mg of cellulose is needed for the analysis.

**Average fibre wall pore size**  
Using heavy water for swelling fibre materials makes it possible to measure average pore sizes in fibre walls by NMR relaxation time measurements. Depending on how the measured data can be interpreted average pore size can be reported in absolute units such as nano-meters or relative units such as percentage of the average pore size in some suitable reference sample. 1–3 g of sample material is required.

#### Fibre dimensions

**Fibre length and width**  
We measure the fibre length and width using an L&W FiberTester, and deliver the results in mm and µm, respectively. 30 g of sample is required.

**Coarseness**  
We measure the coarseness using an L&W FiberTester, and deliver the results in µg/m. 30 g of sample is required.

#### Hornification

**Water retention value**  
We measure water retention area according to SCAN-C 62:00, and deliver the results in g per g dry pulp. 1–3 g of sample is required.

**Fibre saturation point**  
We measure fibre saturation point by the classical method developed by Stone & Scallan. The inability of water bound in fibre wall pore to dilute a high molecular mass dextran solution is used for calculating the fibre saturation point when and an excess of liquid is present. The results are reported as the dimensionless ratio of the mass of the fibre wall water divided by the mass of the mass solids. 5–10 g of sample is required.

### BULK PROPERTIES & REACTIVITY MEASUREMENTS

#### Properties in alkali

**Alkali solubility (Sx)**  
We measure the solubility in alkali of different concentrations according to standard ISO 692, and deliver the results in percent dissolved per dry pulp. 4 g of sample is required.

**Alkali resistance (Rx)**  
We measure the resistance to alkali of different concentrations according to standard ISO 699, and deliver the results in percent undissolved per dry pulp. 4 g of sample is required.

#### Reactivity

**Fock reactivity**  
We measure the reactivity for CS₂ (i.e. Fock reactivity) according to a modified Fock method, and deliver the results in percent reacted cellulose per dry pulp. 2 g of sample is required.
INNVENTIA AB is a world leader in research and development relating to pulp, paper, graphic media, packaging and biorefining. Our unique ability to translate research into innovative products and processes generates enhanced value for our industry partners. We call our approach *boosting business with science*. Inventia is based in Stockholm, Bäckhammar and in Norway and the U.K. through our subsidiaries PFI and Edge respectively.