

## Characterization of hemicellulose samples

**The properties of hemicelluloses are to a great extent influenced by their chemical and molecular structure. Innventia has long experience and advanced equipment for characterization of hemicelluloses on different structural levels.**

Hemicelluloses are heteropolysaccharides and their structure and polymeric properties vary depending on origin, *i.e.* plant species, industrial processing as well as isolation and purification procedure.

### What can we do for you?

Innventia possesses a range of characterisation methods which, in combination, offer complete characterisation of hemicellulose samples, for instance determination of:

- Chemical composition
- Carbohydrate composition
- Content and distribution of side groups
- Average molecular mass and molecular mass distribution.

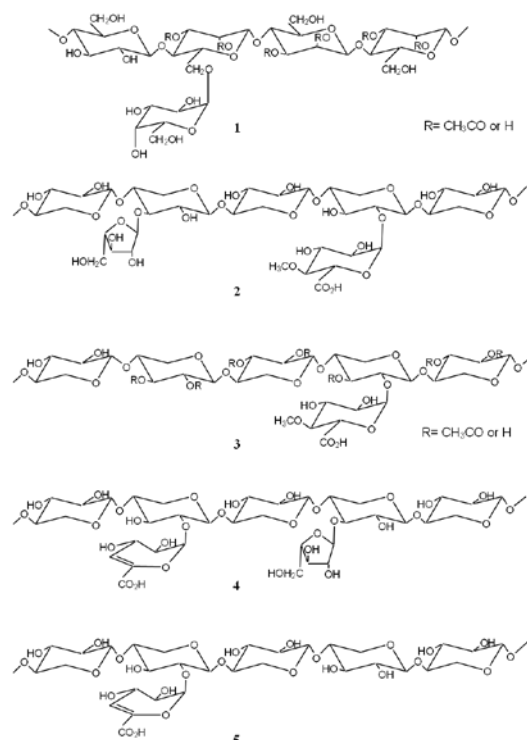
A list of analytical services related to hemicelluloses is appended. Please contact us for a discussion about how we may help you!

### Contact

For more information, please contact Dr Anna Jacobs ([anna.jacobs@innventia.com](mailto:anna.jacobs@innventia.com), +46 8 676 7152), or Dr Fredrik Aldaeus ([fredrik.aldaeus@innventia.com](mailto:fredrik.aldaeus@innventia.com), +46 8 676 7188). We look forward to your inquiries!



A sample of isolated hemicellulose



Typical partial structures of hemicelluloses from wood and pulp. 1) Galactoglucomannan, 2) Arabinoglucuronoxylan, 3) Glucuronoxylan, 4) Arabinohexenuronoxylan, 5) Hexenuronoxylan



## CHEMICAL AND MACROMOLECULAR PROPERTIES

### Chemical composition

#### Carbohydrate composition (standard method)

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.

#### Carbohydrate composition incl. uronic acids

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.

#### Acetyl group content

The content of acetyl side groups is determined by deacetylation followed by quantification by ion chromatography. 1 g of sample is required.

The acetyl group content can also be studied by NMR spectroscopy\*.

### Molecular structure

#### Molecular mass distribution

At Innventia, we use size-exclusion chromatography (SEC) characterise different molecular properties of hemicelluloses. We have calibrated the molecular mass scale for hemicellulose analysis by collection of narrow-polydisperse hemicellulose fractions from the SEC system, followed by mass spectrometric (MALDI-TOF-MS) analysis of each fraction. 0.1 g of sample is required.

#### Distribution of side groups

Partial acid hydrolysis in combination with MALDI-TOF-MS\* gives information about the distribution of side groups, for instance uronic acid or acetyl groups, along the polysaccharide backbones.

Information about distribution of acetyl groups between different saccharide units can be obtained by NMR spectroscopy\*.

### Impurities

#### Acid-insoluble (Klason) and acid-soluble lignin

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. 2 g of sample is required.

#### Acetone extractable matter

We measure the acetone extractable matter (*ie.* extractives) according to standard SCAN-CM 49, and deliver the results in percent extractives per dry pulp. 2 g of sample is required.

#### Ash content

We measure the residue (*ie.* ash) on ignition at 525°C according to standard ISO 1762, and deliver the results in percent ash per dry pulp. 1 g of sample is required.

#### Metals/elements content

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, Na, S and P. We deliver the results in mg of each element per g dry pulp. 2 g of sample is required.

\*) NMR spectroscopy or MALDI-TOF-MS can be offered as or included in analytical projects; no fixed prices are available.

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*. Innventia is based in Stockholm, Bäckhammar and in Norway and the U.K. through our subsidiaries PFI and Edge respectively.