# Information about DIACEL ® - Cellulose Filter Aids

Pulp is derived from wood by removing of impurities like lignins, hemicelluloses, extracts with the aid of pressure, temperature and certain chemicals during the pulping process. The end product of all these processes is called “pulp” and this is the raw material for the production of **DIACEL**® - cellulose filter aids.

Cellulose is the most common organic substance in nature (regenerative raw material). Cellulose, derived from wood and cotton, is predominantly used for the production of **DIACEL**® - cellulose filter aids. Chemically, it is a polysaccharide composed of glucose molecules.

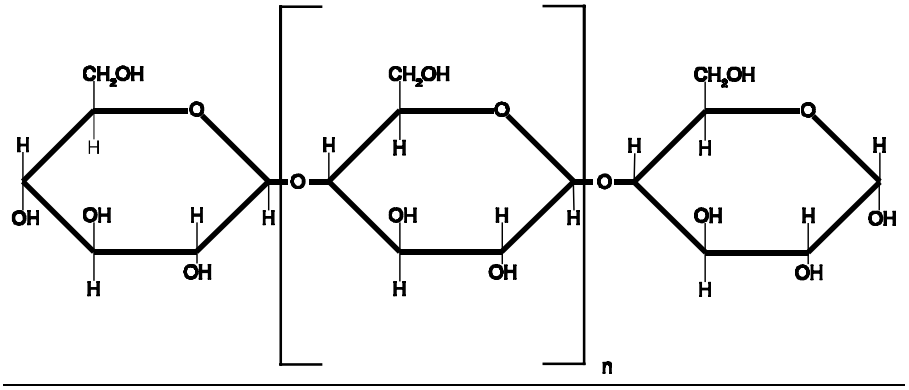



Exhibit 1: Schematic Structure of a Cellulose Molecule

For the production of **DIACEL**® - cellulose filter aids, cellulose is ground into various particle sizes (see Table 1).

TO BE MADE INTO TABLES

## Particle Size

**Used as**

**DIACEL ® 2500 and**

**DIACEL ® 1000**

Fibre length up to approx. 3000 my

Density approx. 50g/l

Wet density approx. 80g/l

Coarse, fibrous filter aid with low clarity, but high permeability and high drainage effec

**DIACEL ® 300 and**
**DIACEL ® 200**
Fibre length up to approx. 300 my
Density approx. 60g/l
Wet density approx. 160g/l
Fibrous filter aid with high clarity, but still high permeability

**DIACEL ® 180 and**
**DIACEL ® 150**
Fibre length up to approx. 150 my
Density approx. 150g/l
Wet density approx. 220g/l
Fine fibrous filter aid similar to a powder, therefore higher clarity (fine filtration) and still sufficient permeability, broad range of
application

**DIACEL ® 90 and**
**DIACEL ® 75**
Fibre length up to approx. 75 my
Density approx. 190g/l
Wet density approx. 260g/l
Filter aid powder with excellent clarity (fine filtration), but therefore reduced permeability

Table 1: Categories of DIACEL® - Cellulose filter Aids

## 1 DIACEL® - Application as a Filter Aid

As already mentioned in table 1, **DIACEL®**, in contrast to inorganic filter aids, has a fibrous structure (see exhibit 2).

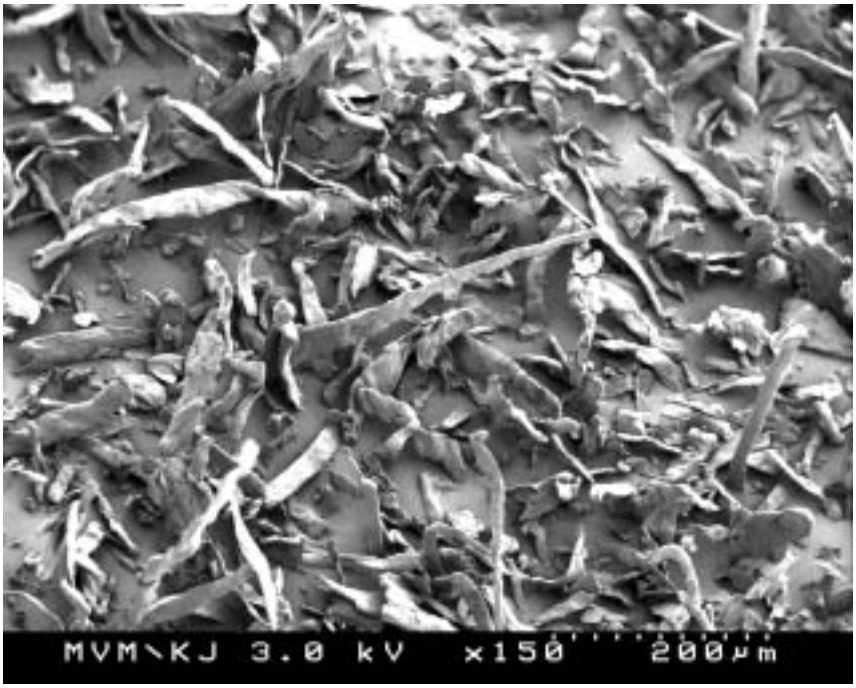
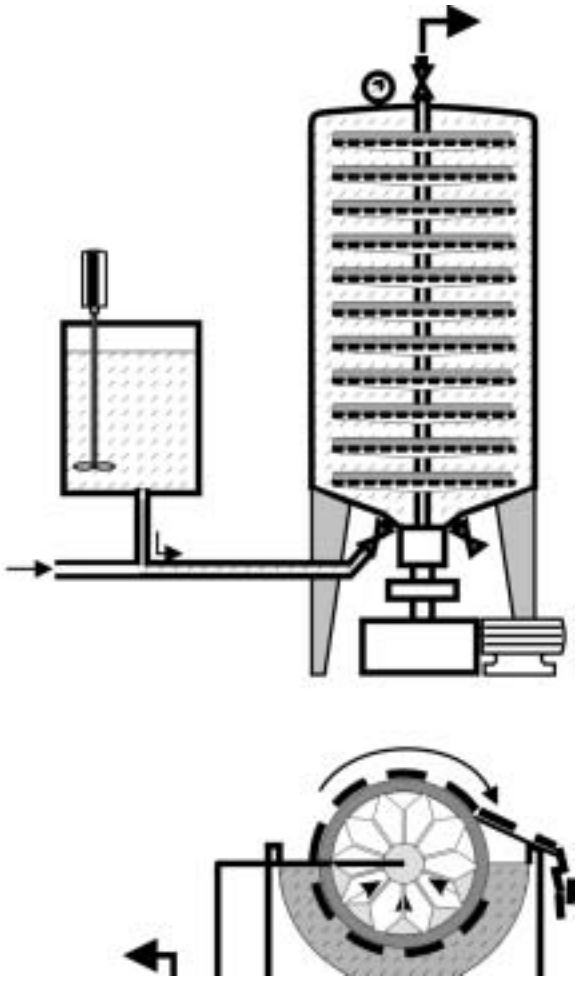



Exhibit 2: 150 x enlargement of cellulose fibre for filtration (company image DIACEL® 150; CFF)

The broad applications of **DIACEL®** as a cellulose based filter aid can be attributed to the following characteristics:

- non-toxic and biodegradable
- stable filter cake
- compressibility of the filter cake and therefore limited remaining moisture
- drainage effect of the fibres (filter cake dehydration)
- practically no abrasion
- disposal advantages (incineration, animal feed, etc.)
- lower tendencies for sedimentation (vacuum rotary filter)



Precoat filtration is possible with one precoat, two precoats with different grades and with or without continuous dosing of the filter aid.

It is an important goal to maintain a long filtration cycle with minimum loss in pressure and continued clarity.

In practice this requires series of tests to find the optimum setting for the particular situation.

## 2 Chemical Characteristics of DIACEL®

One advantage of cellulose is the excellent chemical consistencies in a wide range of pH-values and temperatures. This attribute can be most easily explained in that cellulose as a polymer (see exhibit 1) has only a minimum ability to react.

The application of cellulose in pH-values of 4-14 can be viewed as problem free. Even the short term use of cellulose in ranges below pH 4 is possible, however, temperature plays a significant part and must be kept as low as possible to avoid a saccharification of wood.

Cellulose produced from wood pulp has the following components:

Cellulose content:
Approx. 93 % (α-cellulose)

Hemicellulose content:
Approx. 6 %

Water soluble substances:
Approx. 1 % (calcium and magnesium salts)

Iron content:
< 10 ppm

Heavy metals (DAB)
< 10 ppm

## 3 Mechanical Properties of DIACEL®

The cellulose fibres allow the build up of a very stable filter cake which remains sturdy even during variations in pressure ( common danger of tears in the filter layer).

This is also the reason why **DIACEL®** is frequently mixed with inorganic filter aids to benefit from this property.

Cellulose fibres also bridge tears in the filter screen without problems, prevent breaks and increase processing safety.

The filter screen can have a larger mesh due to the stable structure of the filter aid layer. This increases the filtration throughput.

Although the cellulose filter layer can be compressed in practice this generally causes no problems. The compressibility of the filter aid is only perceivable when the pressure exceeds 2 bar. To avoid unnecessary energy consumption most filtration processes are terminated when pressure differences of 2 bar are reached.

An additional characteristic is the swelling property of cellulose. Cotton, for example, swells in water by approx. 15 %. This is, however, hardly perceivable during the build up of a filter cake.

**Wet density** is a very important attribute for the construction of a filter cake. A wet density of 200 g/l means for example that 200 g of the filter aid form a filter cake of 1mm heights over 1 m_ of screen. Cellulose filter aids have wet densities ranging from 80 to 300 g/l.

## 4 Areas of Application for DIACEL®

The application is divided into three main areas:

**Food**
**Technical Processes**
**Pharmaceuticals**

**Type: DIACEL® XXX**
**Type: DIACEL® XXX-1**
**Type: DIACEL® XXX-** **Pharma**

- wine
- cooling lubricants
- antibiotics

- beer
- brine (electrolysis)
- blood plasma

- fruit juice

- condensate
- vitamin solutions

- sugar
- grinding water
- proteins

- edible oils
- galvanic baths

- alginate - gelatins
- anodic oxidation treatments

- vinegar
- solvents

- pectins
- mineral oils

Typical Products:
Typical Products:
Typical Products:

**DIACEL® 75**
**DIACEL® 90-1**
**DIACEL® 150 Pharma**

**DIACEL® 150**
**DIACEL® 150-1**
**DIACEL® 180 Pharma**

**DIACEL® 200**
**DIACEL® 200-1**
**DIACEL® 200 Pharma**

**DIACEL® 2500**
**DIACEL® 1000-1**

Due to the increasingly high quality standards required, cellulose filter aids are now available in accordance with international pharmaceutical standards (DAB, EP, USP, etc).

## 5 Characteristic Numbers for Cellulose

**Specific density:**
Approx. 1.5 g/cm_

**Combustion energy:**
Approx. 17.5 J/g

**ECOIN number:**
(Volume1, Unit 721, Column 1, page 361) 9004-34-6 Cellulose 56996-61-4 Pulp, Cellulose

**EINECS number:**
2 326 749 Cellulose
2 659 958 Pulp, Cellulose

**GGVS:**
No hazardous material

**ADR class:**
4.1

**Water endangering class:**
0

**Explosion class:**
2

## 6 Helpful Hints for the Handling of DIACEL®

Cellulose is a non hazardous material according to OASHA, but it is recommended to avoid generating dust.

Since cellulose filter aids are a fibrous organic material, the following points should be observed:

- **Flow character**

  Cellulose has a tendency to form lumps in storage containers.

  This can be avoided by adaptation/ modification of construction.

- **Precoat**

Cellulose should be dispersed with a stirring mechanism.
The precoat cycle should run until there is no turbidity
on the filtration side.

- **Danger of Explosion**

As is true with all organic materials that have very fine particles, the generation of dust should be avoided and all necessary precautions should be taken.

## 8 Disposal

Disposal difficulties and the new recycling legislations contribute to the steadily increasing use of cellulose as a filter aid. As a naturally regenerating raw material, cellulose meets the requirements of a closed cycle.

An important advantage is that cellulose is compressible and can with installation of an additional pressing apparatus be reduced to less than 20 % moisture. Thus no thermal drying is required and the pressed fluid can be utilised and returned to the filtrate. This leads to reduced environmental stress and optimises costs.

If cellulose is incinerated, the advantage is that cellulose burns practically ash free and as a regenerative raw material it forms a closed $CO_2$ cycle (application for example: reclaiming of precious metals).

In the area of food filtration the filter cake can be composted or utilised in agricultural applications.