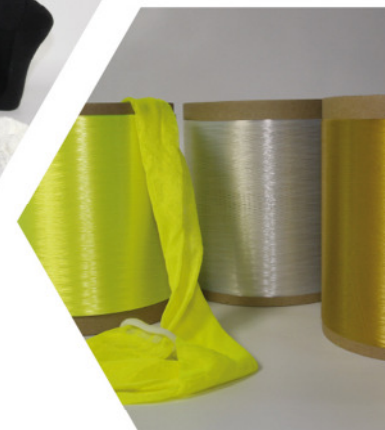


Cell Solution™

new selective filter materials made from Cellulose

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07407 Rudolstadt
Germany



Content

● Lyocell process

Cell Solution™ - activated carbon

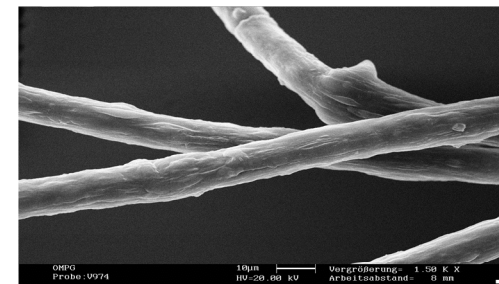
- Manufacturing and Structure
- Sorption capacity, Benefits

Cell Solution™ - Prussian blue

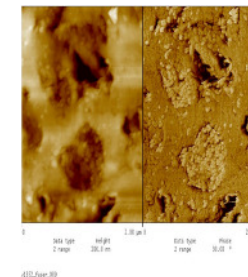
- Manufacturing and Structure
 - Sorption capacity for TI and Cs
 - Benefits
-
- Summary



Broadleaf forest



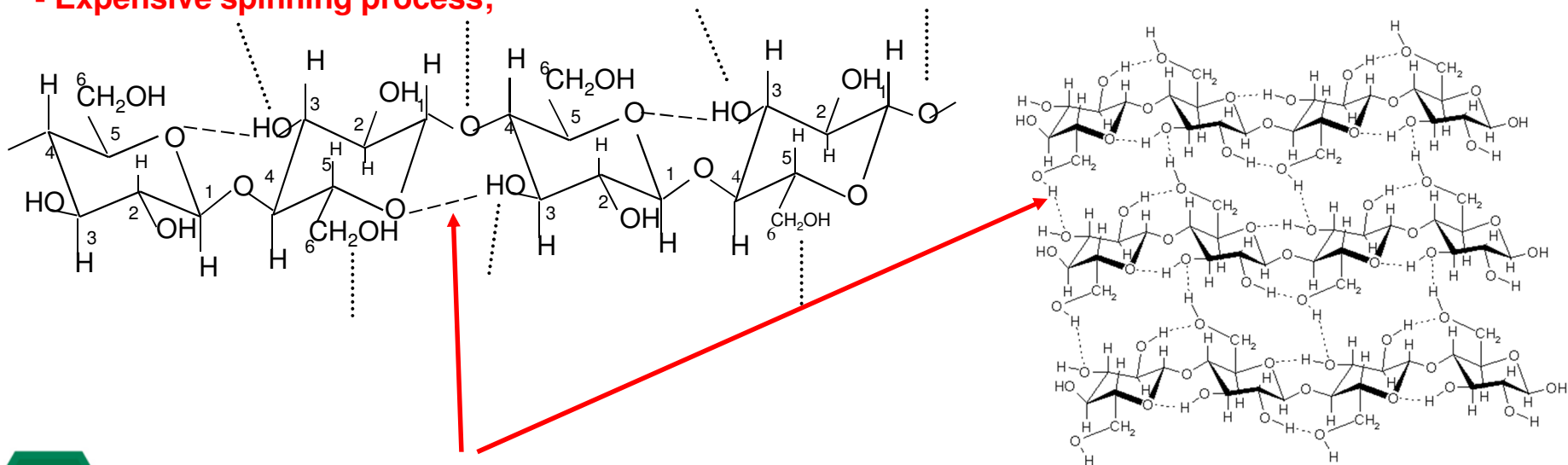
Lyocell Functional-fibre (SEM-picture)



Lyocell Functional-fibre (AFM-picture)

materials made from Cellulose

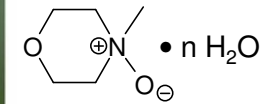
- + Renewable resource;
- + Global unlimited available;
- + CO₂ neutral;
- + Pleasant textile feeling (Cotton, Viscose®, Modal®, Tencel®);
- Not meltable;
- Expensive spinning process;



H-bond-system (intermolecular, intramolecular)

- Thermal degradation, no thermoplastic processing
- Not soluble in common organic solvents

The Lyocell-Process



N-Methylmorpholin-*N*-oxide

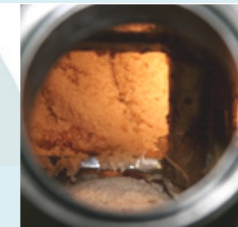


native pulp
(Cellulose)



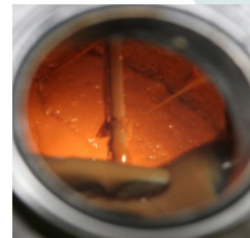
solvent: **NMMO**

Premixing



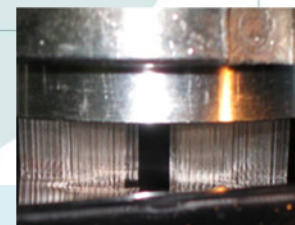
addition of functional agents

Dissolving

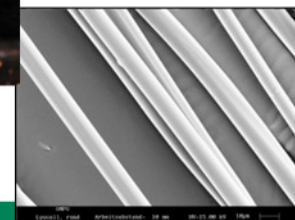


Solvent Recovery

Spinning



After-treatment

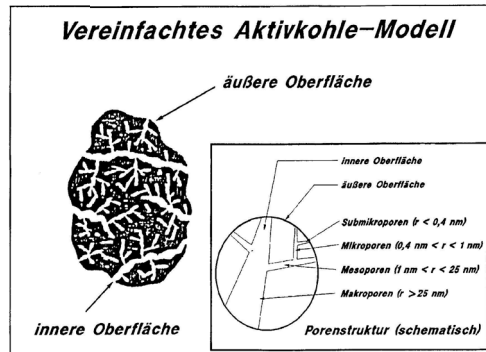


fibres, filaments, films

Cell Solution™ - new functional materials



Cell Solution™ - activated carbon



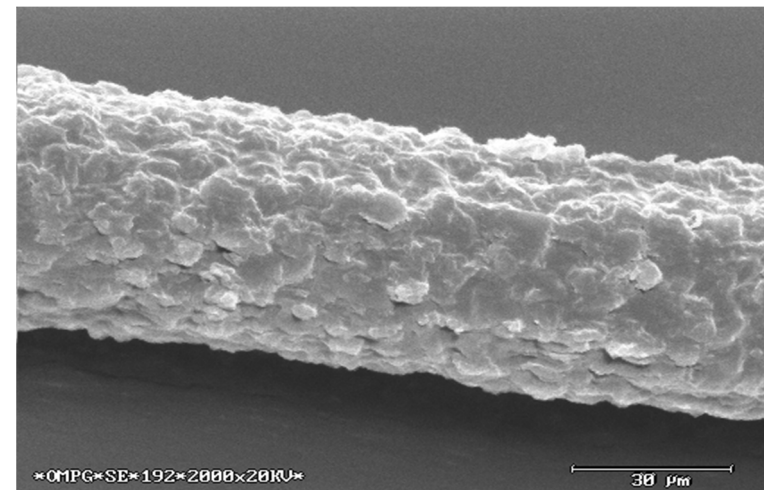
activated carbon;
spec. surface 1000 - 2000 m²/g

aim:

- adsorption of organic pollutants
- textile processing

problems:

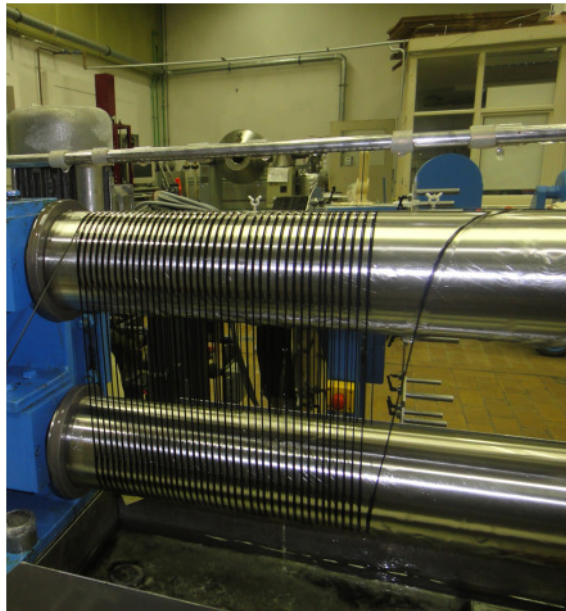
- grain size distribution
- Thermal stability of Lyocell spinning dopes



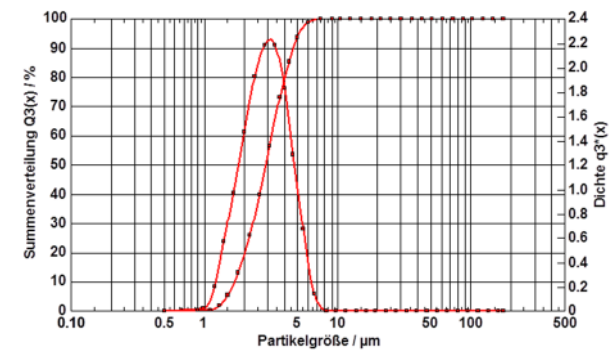
Cell Solution™ - activated carbon
fibre with 50% activated carbon

Cell Solution™ - activated carbon

- Milling (AFG 100)
- Use of a grain size filter $< 10 \mu\text{m}$

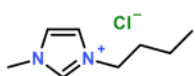


Production of Cell Solution™ - activated carbon

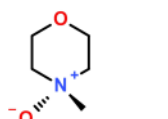


Cell Solution™ - activated carbon

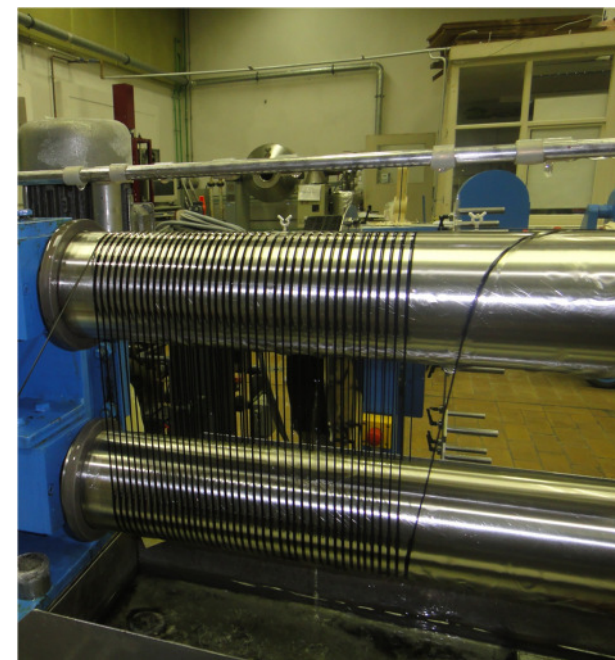
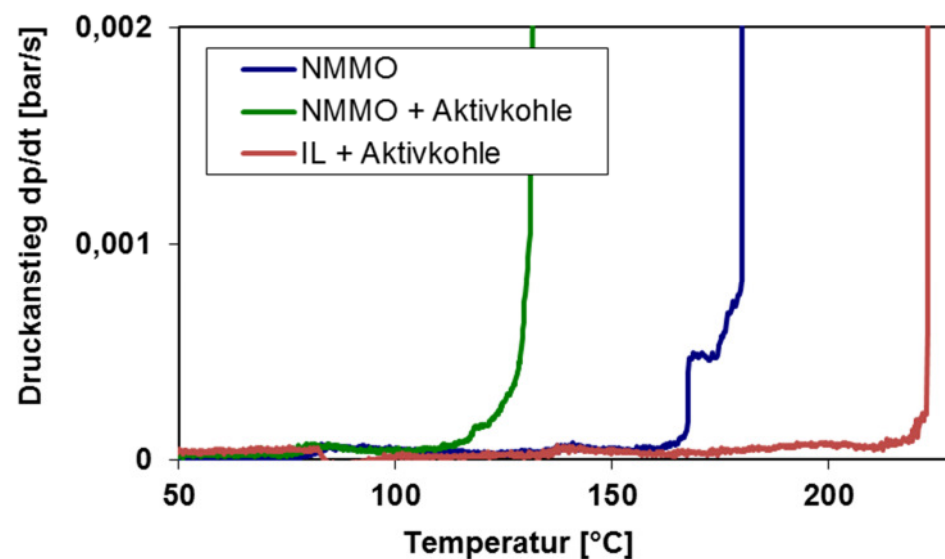
1-Butyl-3-methylimidazolium-chlorid



N-Methyl-morpholin-N-Oxid (NMMO)



- Solvent: use of Ionic liquids instead of NMMO



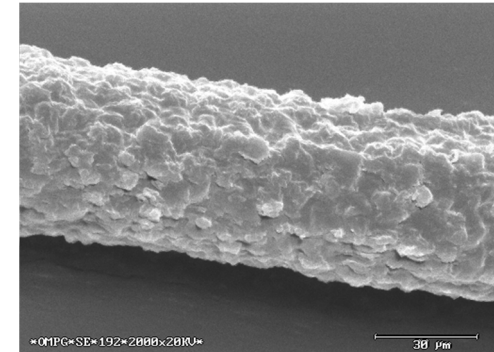
Production of Cell Solution™ - activated carbon

Cell Solution™ - activated carbon

Textile processing

Cell Solution™ - activated carbon fibres – typical values:

- 33 % activated carbon (< 5 μm , 2000 m^2/g)
- Stable bond of activated carbon into the polymer matrix
- BET Cell Solution™ - activated carbon (6 dtex) up to 500 m^2/g after activation
- High adsorption capacity
- Textile processable fibres



SEM-Image of an A-charcoal-loaded fiber

	31 % A-coal
Fineness [tex]	0,65
Elongation [%]	16,3
Tenacity, dry [cN/tex]	10,9

Example of an A-charcoal-loaded fiber being suitable for textile processing



Application: Single-use-mask

Cell Solution™ - new functional materials



bioactive



activated carbon



hygienic

Cell Solution™



Prussian blue



algae control

Cell Solution™ - Prussian blue

State of the art:

- $\text{Fe}_4[\text{Fe}(\text{CN})_6]_3$ – Prussian Blue make stable complex compounds with Thallium and Caesium
- Use for decontamination of ^{137}Cs
- Use as powder or add to sawdust

Problem:

- Dusty powder, strong coloring

Solution:

- Stable incorporation into a polymer
- Binding capacity?



Measurement of radioactivity by Spezial forces at a field inside of the Tschernobyl security zone (May 1986). © dpa



The Science of the Total Environment 223 (1998) 167–176

the Science of the
Total Environment
An International Journal for Interdisciplinary Research
into the Environment and its Relationship with Man

The use of hexacyanoferrates in different forms to reduce radiocaesium contamination of animal products in Russia

A.N. Ratnikov^a, A.V. Vasiliev^a, R.M. Alexakhin^a, E.G. Krasnova^a,
A.D. Pasternak^b, B.J. Howard^{c,*}, K. Hove^d, P. Strand^e

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^d Department of Animal Science, Agricultural University of Norway, P.O. Box 5025, N-1432 Ås, Norway

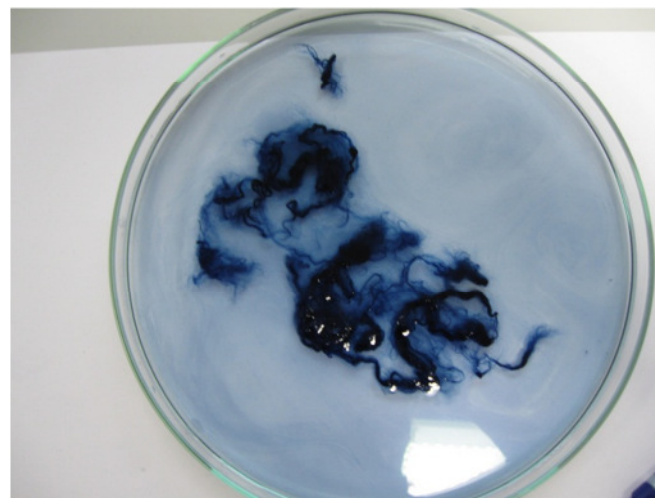
^e Norwegian Radiation Protection Authority, P.O. Box 55, Østerås, N-1345, Norway

Received 3 June 1998; accepted 7 September 1998

Cell Solution™ - Prussian blue



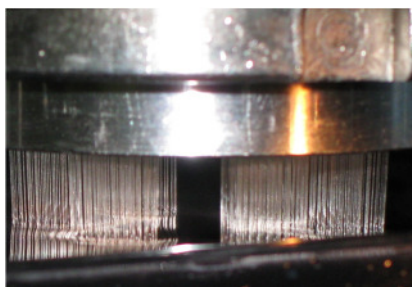
Cellulose fibres treated with chemicals to build Prussian blue in situ



Wash out of particles from the fibre Materialt



Prussian blue powder



Incorporation into fibres via the Lyocell spinning process



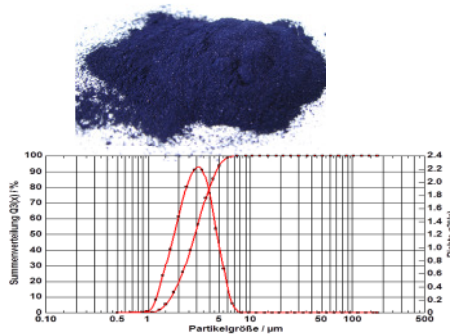
No wash out from the Cell Solution™ Prussian blue fibres



Cell Solution™ - Prussian blue

1. Milling

grain-size distribution: x_{50} 3 μm ; x_{99} 8 μm

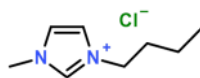


2. Spinning via Lyocell-process

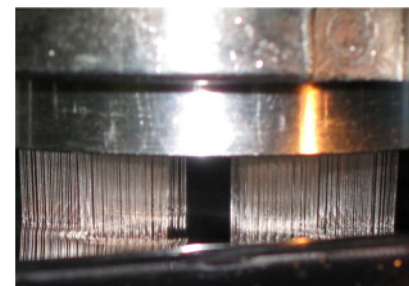
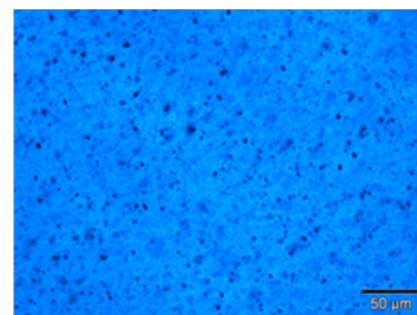
Problem: chemical reactions with solvent NMMO

Use of IL's is necessary

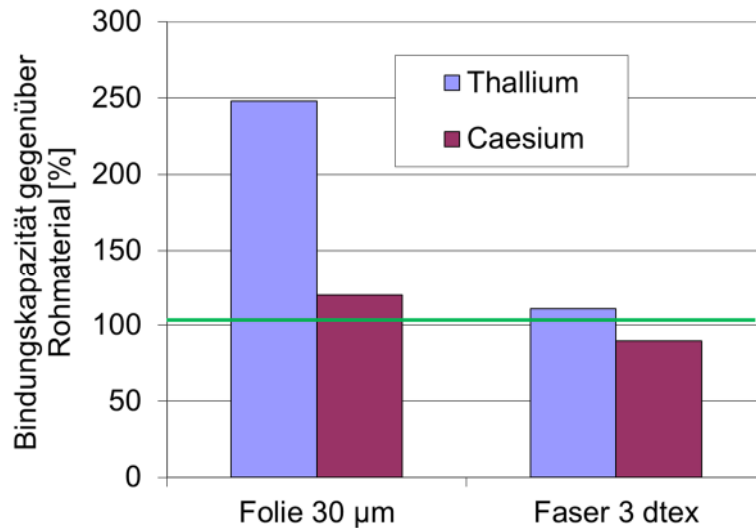
Solvent: 1-Butyl-3-methylimidazolium-chloride



*Lyocell-Composite-Material with 10 %
Prussian Blue*



Cell Solution™ - Prussian blue



Adsorption capacity of the Lyocell-Composite-Material with 10 % Prussian Blue

Cell Solution™ - Prussian blue fibres – typical values:

- 10 % activated carbon (< 5 µm, 2000 m²/g)
- Stable incorporation into the polymer matrix
- High adsorption capacity
- Textile processable fibres



Measurement of radioactivity by Spezial forces at a field inside of the Tschernobyl security zone (May 1986). © dpa

Cell Solution™

new selective filter materials made from Cellulose



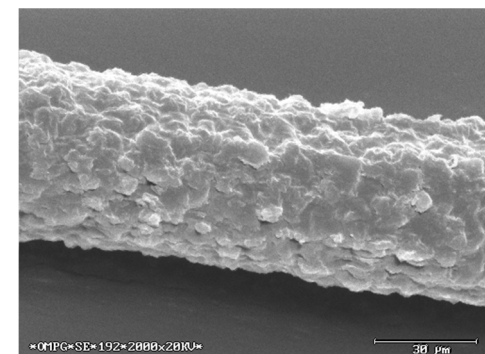
Summary:

Cell Solution™ - activated carbon fibres:

- Fibres with 33 % activated carbon
- High adsorption capacity for organic pollutants
- Textile processable fibres
- Stable bond of activated carbon into the polymer matrix

Cell Solution™ - Prussian blue fibres:

- Fibres with 10 % Prussian blue
- No bleeding of Prussian blue particles
- High adsorption capacity for Thallium- and Caesium-ions
- Textile processable fibres



SEM-Image of an A-charcoal-loaded fiber



Lyocell-Composite-Material with 10 %
Prussian Blue



Thank You for Your Attention!



Rudolstadt

SCHILLERS HEIMLICHE GELIEBTE

