

Cellulose chemistry

Course information



Aalto University
School of Chemical
Engineering

Prof. Eero Kontturi

6th June 2023

Learning outcomes

After the course, the student will be able to:

- Distinguish the common pathways of cellulose modification
- Identify the main challenges and bottlenecks in cellulose modification
- Identify the main pathways, motivation, and challenges in cellulose degradation
- Choose a correct approach to attach a certain functional group on cellulose / nanocellulose
- Select a suitable analytical approach to analyze the modification and quantify its extent

How the course proceeds

- **8 lectures given on 6th – 9th June 2023**
- **Group work: literature review related to the topic of cellulose modification**
- **Group work commences on the lecture week (6th – 9th June)**
- **Deadline to submit the group work: 15th August**

Lecture schedule

Time / Date	Tue 6th June	Wed 7th June	Thu 8th June	Fri 9th June
10-12	Cellulose chemistry: Introduction Eero Kontturi	Cellulose dissolution Alistair King (VTT)	Modification of nanocellulose Wim Thielemans (KU Leuven, Belgium)	Shaping of cellulose through dissolution and regeneration Michael Hummel
12-13				
13-15	Cellulose degradation Eero Kontturi	Modification of cellulose, Part I Alistair King (VTT)	Modification of nanocellulose during isolation Eero Kontturi	GROUP WORK
15-16	GROUP WORK	Modification of cellulose, Part II Alistair King (VTT)	GROUP WORK	GROUP WORK

Group work

- Performed in groups of **2 students**
- Consists of a literature review, written in a style of a critical review article
- Must encompass at least 40 references
- 4 slots are dedicated to getting started with the group work this week: I will be there to help you with it
- Submit through a Turnitin link on MyCourses homepage
- Deadline: 15th August

Group work – remarks on grading

- **Be clear of the motivation: Why has the review been written? What is the target audience? What other reviews exist on a similar topic and how are they different from yours?**
- **Be critical of the sources – do not just descriptively list what has been done**
- **Besides qualitative comparison, try to include also quantitative comparison of the sources with each other – compile data into tables (or even figures) if possible**

Group work – getting started

We will start on Tuesday afternoon (6th June)

- (1) Form the groups, that is, find a pair with whom you will do the group work**
- (2) Choose a topic or identify an area of research: I can help you to find a more explicit topic**
- (3) All groups should come up with the exact topic on Thursday afternoon (8th June) at the latest**
- (4) Get started; I will be here this week to help you find literature and make other recommendations**

Possible topics / research areas

- **Regioselective modification of cellulose**
- **Analyzing the chemical modification of nanocellulose**
- **Modification of cellulose by inorganic groups**
- **Carboxymethylation/acetylation/methylation pathways for cellulose**
- **Heterogeneous vs. homogeneous modification of cellulose**
- **Modification of cellulose/nanocellulose for a certain functionality (materials purpose)**
- **Modification of cellulose nanocrystals vs. cellulose nanofibres**

Possible topics / research areas

- **Industrial usage of a common cellulose derivative: carboxymethyl cellulose, methyl cellulose, cellulose acetate**
- **Acid hydrolysis vs. enzymatic hydrolysis of cellulose**
- **Aqueous pathways for nanocellulose modification**
- **How the supramolecular structure of cellulose influences its degradation behaviour**
- **Modification of cellulose with the aim to regenerate films/fibres**