



**CHEMARTS**  
*chemarts.aalto.fi*

30.10.2020



Aalto University

# CHEMARTS

= bio-based materials + collaboration + hands-on experiments  
+ student-driven approach + co-learning



We use wood-based materials and also other bio-based and/or natural materials.

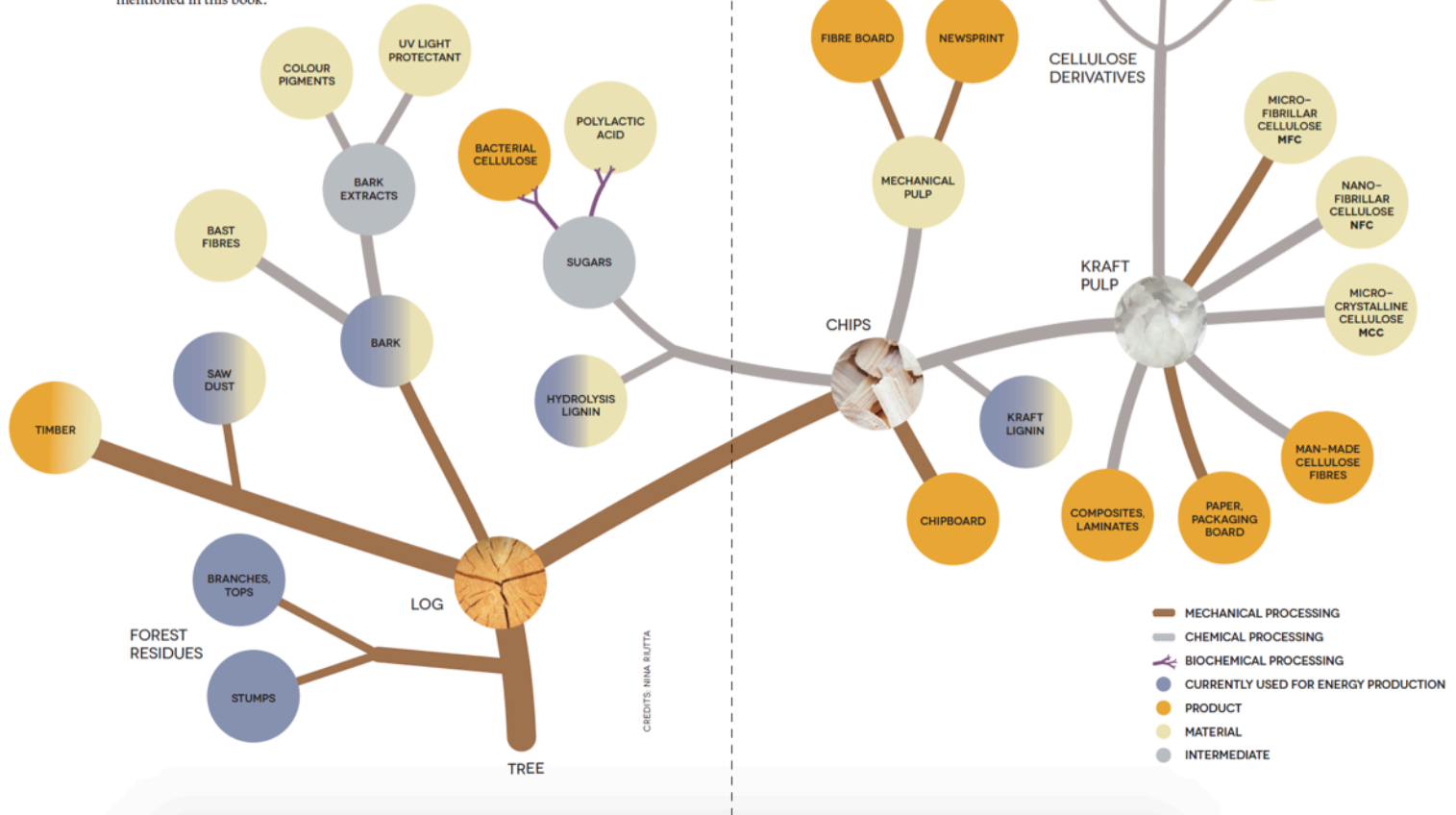
# From The CHEMARTS Cookbook:

## Tree of wood-based materials

### PROCESSING OF WOOD BIOMASS

Tapani Vuorinen & Nina Riutta

The processing of wood biomass into the various materials and products mentioned in this book.



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<https://shop.aalto.fi/p/1193-the-chemarts-cookbook/>







# OUTLINE OF A CIRCULAR ECONOMY

## PRINCIPLE

# 1

Preserve and enhance natural capital by controlling finite stocks and balancing renewable resource flows  
ReSOLVE levers: regenerate, virtualise, exchange

# CHEMARTS activities

Renewables     Finite materials

Regenerate    Substitute materials    Virtualise    Restore

Renewables flow management

Stock management

## PRINCIPLE

# 2

Optimise resource yields by circulating products, components and materials in use at the highest utility at all times in both technical and biological cycles  
ReSOLVE levers: regenerate, share, optimise, loop

Regeneration



Biochemical feedstock

Farming/collection<sup>1</sup>

Cascades

Extraction of biochemical feedstock<sup>2</sup>

Parts manufacturer

Product manufacturer

Service provider



Collection



Share

Maintain/prolong

Reuse/redistribute

Refurbish/remufacture

Recycle

Minimise systematic leakage and negative externalities

## PRINCIPLE

# 3

Foster system effectiveness by revealing and designing out negative externalities  
All ReSOLVE levers

1. Hunting and fishing  
2. Can take both post-harvest and post-consumer waste as an input

Source: Ellen MacArthur Foundation, SUN, and McKinsey Center for Business and Environment; Drawing from Braungart & McDonough, Cradle to Cradle (C2C).

<https://shop.aalto.fi/p/1193-the-chemarts-cookbook/>

(also free pdf here)

Aalto-112020

the CHEMARTS Cookbook

# the CHEMARTS Cookbook

How can we make flexible and transparent wood-based materials? What kinds of materials can we derive from trees, while still respecting the preciousness of nature? Could the innovative use of renewable cellulosic materials change our material world?

The CHEMARTS Cookbook gives both simple and more advanced ideas and recipes for hands-on experiments with wood-based materials. The book showcases the most interesting explorations focusing on raw materials that are processed either chemically or mechanically from trees or other plants: cellulose fibres, micro- or nano-structured fibrils, cellulose derivatives, lignin, bark and wood extractives.

Get inspired, test our recipes either at workshops or chemistry labs, and develop your own experiments!



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BUSINESS +  
ECONOMY

ART +  
DESIGN +  
ARCHITECTURE

SCIENCE +  
TECHNOLOGY

CROSSOVER

DOCTORAL  
DISSERTATIONS

**A!** Aalto University

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(Eds.)

CHEMARTS is the long-term strategic collaboration project of two Aalto University schools: the School of Chemical Engineering (CHEM) and the School of Arts, Design and Architecture (ARTS). These schools combined their forces in 2011 with the aim of researching bio-based materials in an innovative way, and creating new concepts for advanced cellulosic materials. The core values of CHEMARTS are the sustainable use of natural resources, experimental working methods, and respectful cross-pollination between design and material research.

CHEMARTS arranges multidisciplinary study courses and the Summer School for degree students, thesis projects, workshops for elementary and high school students and externally funded research projects. This publication was produced by CHEMARTS.



The CHEMARTS Cookbook team clockwise: Professor Tapani Vuorinen (CHEM), Designer Nina Riutta, Photographer Eeva Suorlahti, Professor Pirjo Kääräinen (ARTS) and Design manager Liisa Tervinen.



The most important thing whenever working at ABio (Aalto Bioproducts Center) and CHEMARTS Lab:

# WORK SAFETY

**In case you neglect the safety rules, your access to the laboratories will be denied.**







*Havu cosmetics  
from the Finnish nature  
by Lumi Maunuvaara  
CHEMARTS 2017.  
Photo Eeva Suorlahti*

**A!**

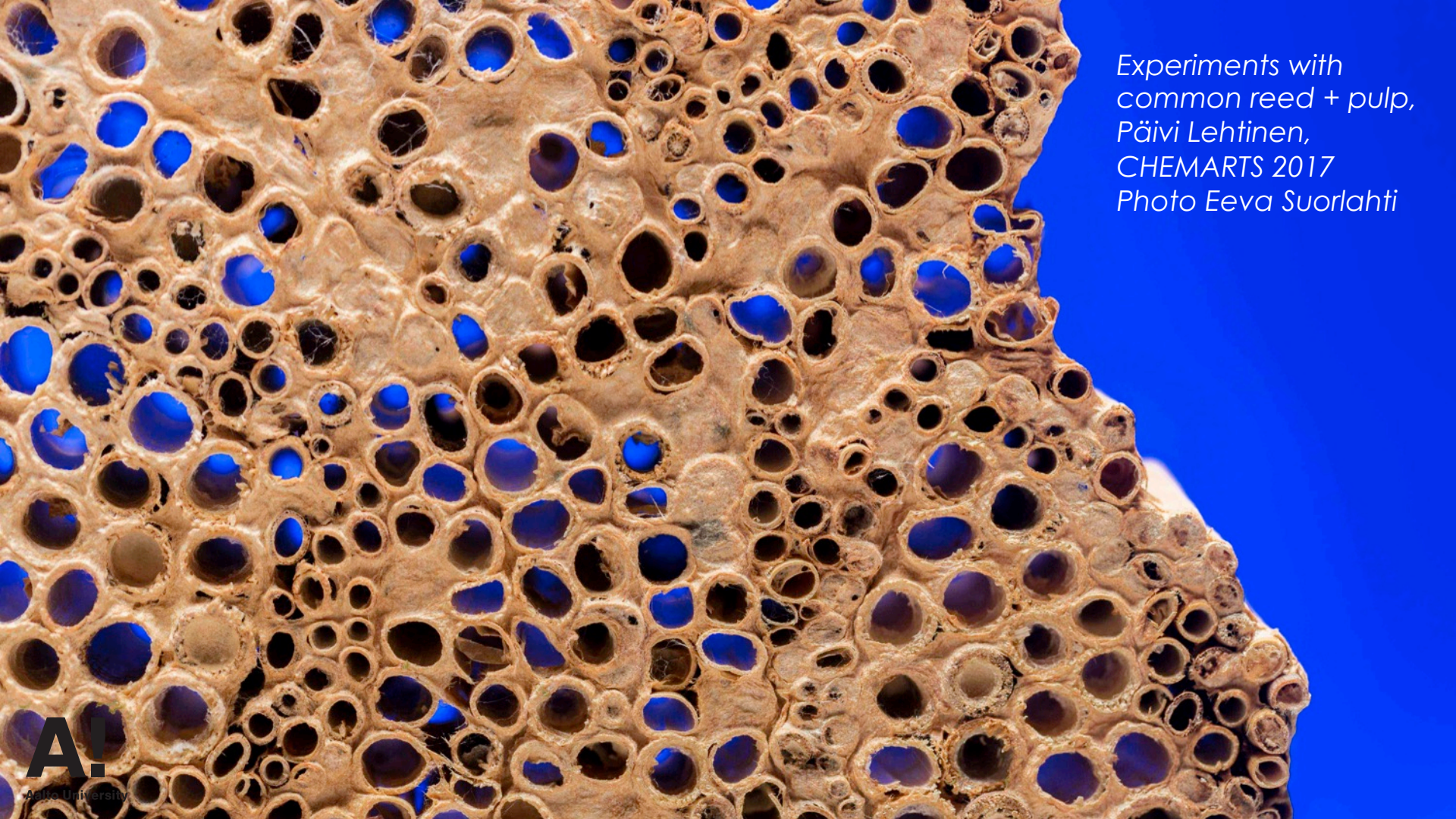
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*Eco Luxury jewelry by Ines Jakovlev CHEMARTS 2017. Photo Eeva Suorlahti*





Experiments with  
common reed + pulp,  
Päivi Lehtinen,  
CHEMARTS 2017  
Photo Eeva Suorlahti





3D printing of cellulosic materials  
by Anastasia Ivanova and Ville Klar  
with VTT, DWoC project 2015-2018  
Photo Eeva Suorlahti.

## Timberfill® (Wood Composite)



### Timberfill®

- Bio-sourced real wood fiber composite
- An authentic look and smell of wood



Filament made of biopolymers **containing fibers from real wood**.  
The printed objects have an authentic look and smell of wood.  
Thanks to the bio-sourced origin of the material, it is **100% biodegradable**.





*Photo Eeva Suorlahti*



*Photo Veera Konsti*

*Fibers from willow bark and manmade cellulose textile fibers (loncell)*







# CHEMARTS course list 2020-2022

**INTRO to CHEMARTS: CHEM-A1610 Design Meets Biomaterials**, 3-5 cr (periods VI-V)

**MUO-E0101 CHEMARTS Summer School 2.0**, 5 cr (June)

**CHEM-E1100, Plant Biomass**, 5 cr (period I)

**CHEM-E0180 CHEMARTS Project, 5-10 cr** (any time, based on student's own plan, prerequisite: Design Meets Biomaterials or Summer School)

**CHEMARTS Minor CHEM3040, 15-25 cr** (no special application process)

*Also Pack-Age minor program deals with bio-based materials, focusing on packaging.*





**Thank you!**  
Have an inspiring course!