CHEMARTS

YEARBOOK 2021–2023

Aalto University

CHEMARTS

CHEMARTS is the long-term 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 forces in 2011 with the aim of researching bio-based materials in an innovative way and creating new concepts for their advanced use. The core values of CHEMARTS are the sustainable use of natural resources, experimental working methods, and the respectful cross-pollination of design and material research.

CHEMARTS has arranged cross-disciplinary study courses and other activities since 2012.

This booklet is a documentation of the CHEMARTS activities during the years 2021–2023.

www.chemarts.aalto.fi

aaltochemarts

chemarts.aalto

Aalto University

CHEMARTS TEAM 2021–2023

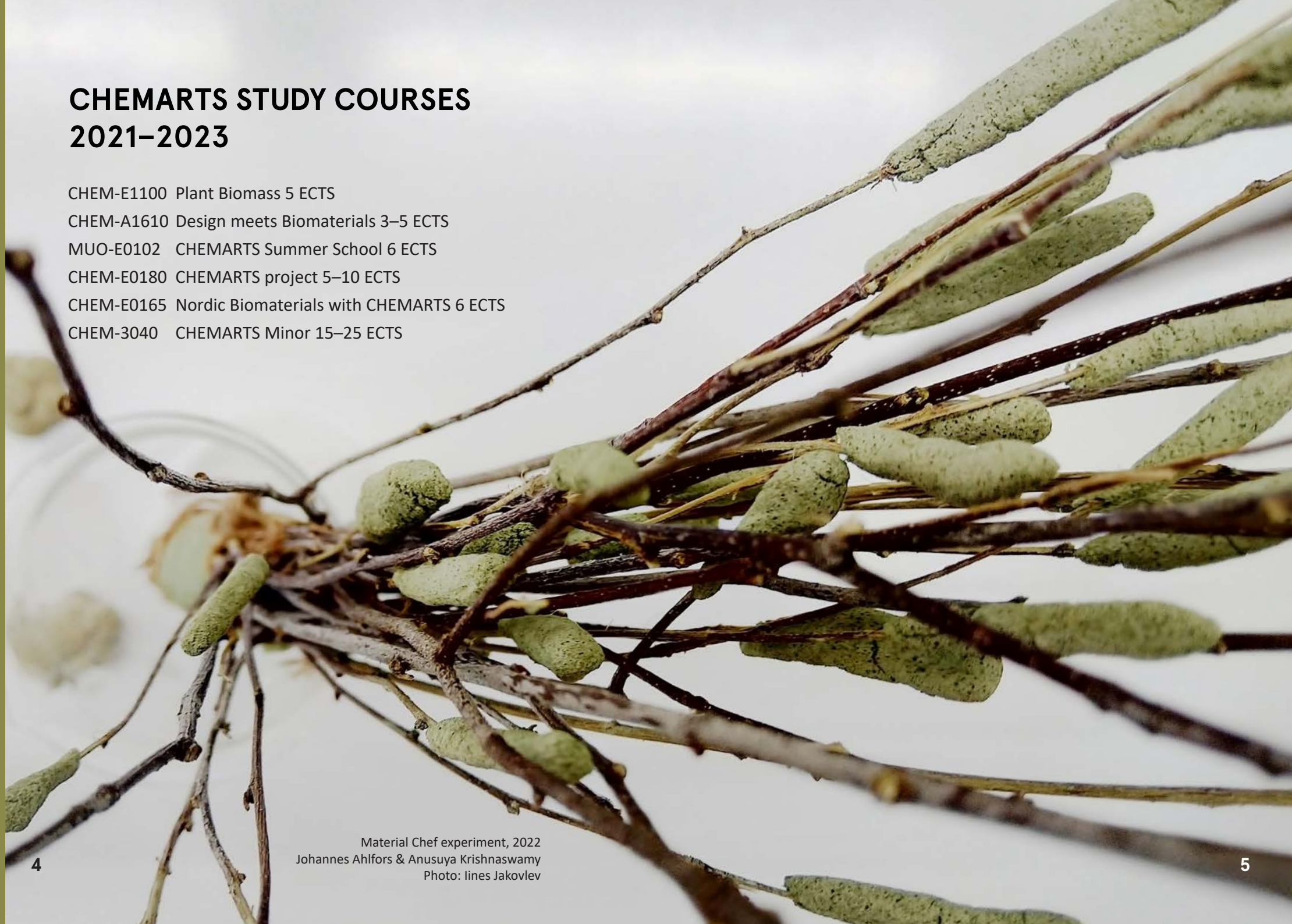
TEACHERS	Pirjo Kääriäinen, Tapani Vuorinen, Janika Lehtonen & Anna van der Lei
TUTORS	Susanna Ahola, Sonja Dallyn, Jinze Dou, Anna Ihamuotila, Iines Jakovlev, Pia Johansson, Tarja-Kaarina Laamanen, Katri Oikarinen, Satu Paavonsalo, Irene Purasachit, Nina Riutta, Aarni Tujula & Lili Yin
PHOTOGRAPHY	See each page
COVER	Samples by Tiina Otala, 2022 Photo by Esa Kapila
PRINTING	PicaScript Oy, 2024
LAYOUT	Iines Jakovlev

CONTENT

In Tension samples, 2022
Megan McGlynn
Photo: Megan McGlynn

CHEMARTS STUDY COURSES 2021–2023

CHEM-E1100 Plant Biomass 5 ECTS
CHEM-A1610 Design meets Biomaterials 3–5 ECTS
MUO-E0102 CHEMARTS Summer School 6 ECTS
CHEM-E0180 CHEMARTS project 5–10 ECTS
CHEM-E0165 Nordic Biomaterials with CHEMARTS 6 ECTS
CHEM-3040 CHEMARTS Minor 15–25 ECTS



Material Chef experiment, 2022
Johannes Ahlfors & Anusuya Krishnaswamy
Photo: Iines Jakovlev

PLANT BIOMASS

Photo: Petri Anttila

Knowledge of **plant biomass** is basis for sustainable use of biomass. The course has focus on the main physiological functions of plants and their anatomical and chemical features from macroscopic to microscopic and submicroscopic levels. The students learn about industrially relevant biomass sources and their fractionation and processing to material and chemical products.

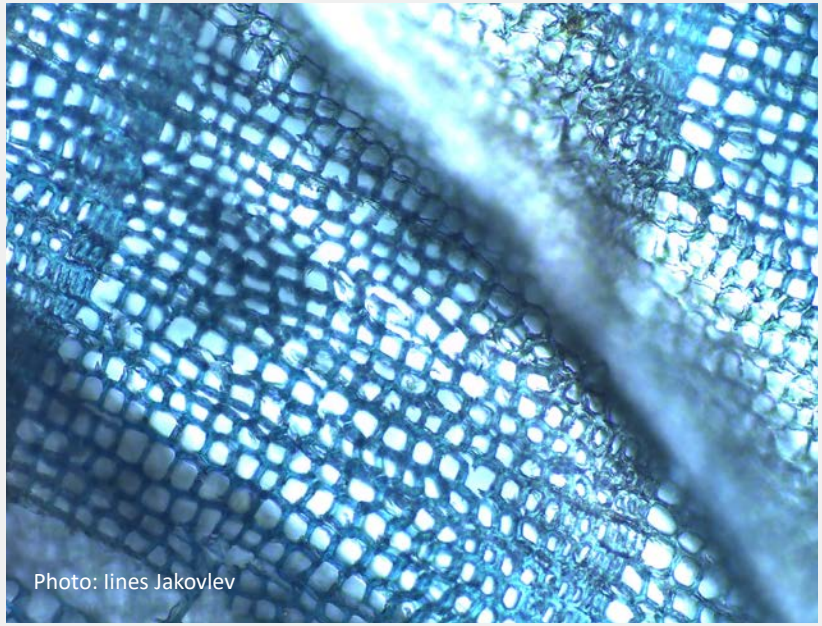


Photo: Iines Jakovlev

DESIGN MEETS BIOMATERIALS

Design Meets Biomaterials is an introductory course to CHEMARTS and open to all Aalto University students. There are no prerequisites, only open mindset, curiosity towards bio-based materials and design, and commitment to work in multidisciplinary groups is required. In CHEMARTS students have freedom to experiment, create and fail - and to succeed. In addition to their personal learning experience, the students can test and share their ideas with others. Some of the study projects are exhibited in CHEMARTS exhibitions.

BioGlitter, 2023
Ana Luís Figueiredo, Anna Saarinen, Iida Berg & Luísa Cardoso
Photo: Iines Jakovlev

CHEMARTS SUMMER SCHOOL

Photo: Petri Anttila

Photo: Iines Jakovlev

CHEMARTS Summer School is an intensive, experimental and inter-disciplinary course focusing on wood-derived materials research. It is strongly based on ecological values. During the course students familiarise with bio-based materials and explore working methods used in materials research and design practice through thematic lectures with group discussions, field trips and creative hands-on workshops.

AALTO UNIVERSITY SUMMER SCHOOL: NORDIC BIOMATERIALS WITH CHEMARTS

Photo: Petri Anttila

Nordic Biomaterials with CHEMARTS is a graduate level international summer school where students with varying backgrounds (design, science, engineering, business) learn to combine design with material research. It introduces a broad spectrum of bio-based materials, especially wood-and plant-based. During the course, students familiarize themselves with practice-based material research, experience how interdisciplinary material research happens in practice, and explore how raw materials could be turned into innovative business ideas in the context of circular economy.

Common reed experiments, 2021
Maria Varon
Photo: Petri Anttila

CHEMARTS MATERIAL CHEF

The winning team in 2022 created birch scrub for natural cosmetics
Tuomas Lakkonen & Azou Fourastie
Photo: Iines Jakovlev

Photo: Pirjo Kääriäinen

CHEMARTS Material Chef is a playful 1-day competition where participants ideate and explore new solutions based on the provided raw materials. Material Chef competition has been part of the CHEMARTS Summer School since 2021. In 2021 students worked with white rotted birch and banana boxes, in 2022 the raw material was birch whisks normally used in sauna and in 2023 the task was to make a light three-dimensional object that was evaluated based on usage of materials and techniques, innovativeness and quality of the object.

BIODESIGN CHALLENGE 2020–2023

Biodesign Challenge is a high school and university competition that offers art and design students the opportunity to envision future applications of biotechnology.

Aalto University CHEMARTS participated four times in the international Biodesign Challenge competition. 2021–2023 the student project was selected from the Design Meets Biomaterials results. You can watch each project video by scanning the QR code.

www.biodesignchallenge.org

bdc

Photo: SBARK team

SBARK – SHIELD OF SPRUCE

Megan McGlynn, Chiao-wen Hsu, Iines Jakovlev, Eveliina Juuri, Nina Riutta & Aarni Tujula, 2020

SBARK – Shield of Spruce is a speculative project where spruce bark's protective compounds are used to create an enhanced fabric. Spruce bark is exceptional in a range of trees because of its phenolic compounds, such as stilbenes, which provide protection against both UV-radiation and microbes.

By extracting protective compounds from bark and embedding them into man-made cellulose fibers, we answer the demands of the changing world in a sustainable way with lightweight, UV-protective and antibacterial fabric for different kinds of applications.

Photo: SBARK team

DIPWRAP

Emilia Ikävalko, Louise Kallai, Sari Kupiainen & Ena Naito, 2021

DipWrap is a sustainable alternative to plastic shrink wrap used to protect grocery store produce. Vegetables and fruits are dipped into an aqueous solution of DipWrap consisting of agar, cellulose nanocrystal, and carnauba wax which then forms a solid film. Once peeled off, the biodegradable film can be easily disposed.

DipWrap won an outstanding science prize in Biodesign Challenge 2021.

Photo: DipWrap team

Photo: SIROTA team

SIROTA

Ayaka Yamada, Aravind Srinivasachari, Joonas Nuorala & Mikko Peura, 2022

SIROTA is a new cellulose and sucrose composite fiber that can serve as a biodegradable and transparent alternative to glass. The goal is to create a long-lasting bio-glass that can block UV radiation while simultaneously providing a softer light sensation to the receiver. There is a great potential for this compound to be used in the built environment, energy and agriculture sector.

At this stage SIROTA is an experimental and conceptual project.

Photo: SIROTA team

BIOMAT MATTERS

Natasa Hódosi, Giorgia Morandi, Kristian Koleno & Lorenz Koch, 2023

The student team explored various materials and production methods to create bio-based, temporary mattresses for emergency situations.

The production process for bioMAT matters is rooted in environmental sustainability. Aiming to minimize the environmental impact, it only uses four ingredients: wood pulp, fibrillated wood pulp, water and bio-based soap. bioMat Matters utilizes fully biodegradable materials, minimizing waste management issues and reducing the accumulation of harmful residues.

From just one tree and with a simple recipe, the team can produce around 90 mattresses. This showcases the incredible potential of bioMAT Matters to provide resourceful sleeping solutions.

Photo: bioMAT team

Photo: bioMAT team

COLLABORATIONS

DATEMATS
ILMI

Photo: Petri Anttila

DATEMATS

Photo: Iines Jakovlev

CHEMARTS participated in **DATEMATS - Knowledge & Technology Transfer of Emerging Materials & Technologies through a Design-Driven Approach** in 2019–2022.

DATEMATS was an European project funded by the Erasmus+ programme. The aim was to create a unique design teaching and learning method in the field of emerging materials and technologies and to boost knowledge transfer from academia to companies in a designerly way. The project focused on four emerging materials and technologies areas (EM&Ts): ICS: Wearable, Advanced Growing, Nanomaterials and Wood-based.

Each of the partner universities organised a 5-day workshop for students to explore one of the EM&Ts. A challenge for the workshop was given by a company. The workshops consisted of expert lectures and presentations, hands-on experimentation and design activities. The participants worked together in multidisciplinary teams to find solutions for the challenge and to create material samples and speculative application concepts. Due to the COVID-19 restrictions the CHEMARTS students were able to participate only in two workshops, in Denmark and in Finland.

Photo: Pirjo Kääriäinen

Photo: Iines Jakovlev

Datemats Workshop in Copenhagen, Denmark, was hosted by KEA – Copenhagen School of Design and Technology. Five CHEMARTS students participated the workshop as a subject of advanced growing emerging materials and technologies. Students experimented growing mycelium and created concept ideas in multidisciplinary teams.

The challenge was given by Dinesen.

ADVANCED GROWING EM&Ts: Materials from a controlled cultivation of organisms (bacteria, yeast, algae, mycelium, etc.) that are directly grown and/or manufactured into their subsequent form, function and performance by tapping into the organisms natural growth behaviour (bio-fabrication).

DATEMATS WORKSHOP
Copenhagen 31 Aug – 3 Sept 2021

Photo: Iines Jakovlev

DATEMATS WORKSHOP
Helsinki 24 – 28 Jan 2022

Photo: Iines Jakovlev

Datemats Workshop in Aalto University by CHEMARTS was about experimental wood-based emerging materials and technologies. In the workshop students from all the participating schools worked in multidiciplinary teams hands-on in the laboratories of the Aalto University School of Chemical Engineering to develop new ideas and find new solutions on how to use recycled cellulose in interior design and construction. As bio-based materials have an important role in the transition towards a sustainable material future, the workshop challenge focused especially in recycling of cellulose waste.

The challenge was given by Honext.

EXPERIMENTAL WOOD-BASED EM&Ts: Materials that are processed either chemically or mechanically from trees or other plants for innovative applications. The materials include cellulose fibers, fibrils (micro- or nano-structured) and derivatives, lignin, bark extractives and novel combinations of these.

Photo: Iines Jakovlev

ILMI PROJECT

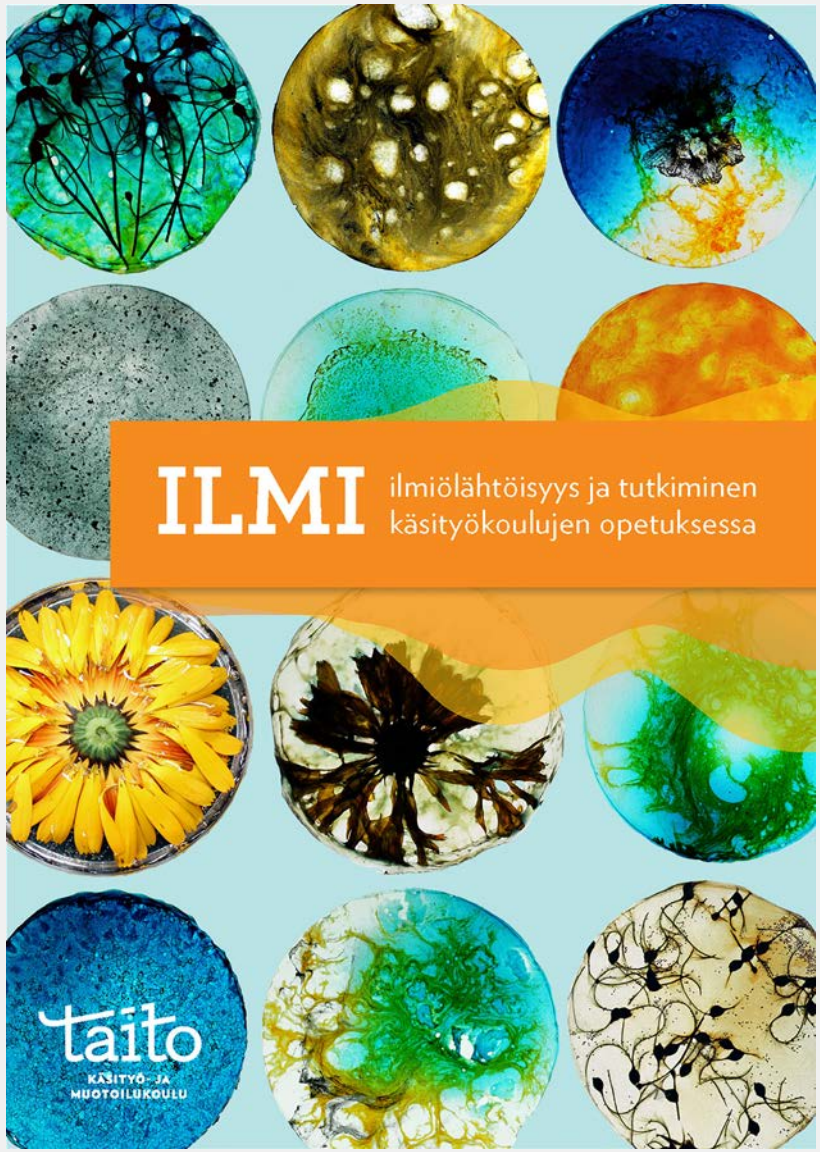
The phenomenon orientation and research in the teaching of craft schools.

CHEMARTS was a partner for an educational pilot project carried out 1. August 2021 – 31. December 2022 by two handicraft and design schools in South Ostrobothnia (Näppi) and in Jyväskylä, Central Finland. The goal of the project was to explore new methods and pedagogy to combine scientific research and craftwork.

After an introductory online lecture by professor Pirjo Kääriäinen, a team of four craft school teachers joint a 1-day hands-on training at the Aalto University CHEMARTS laboratory. The teachers tested different materials and methods in practice, to be able to design their own educational course pilots.

Co-operation with the ILMI project was a valuable learning experience. CHEMARTS team had an opportunity to share the know-how, and got a great view on the teaching of handicrafts for kids and youth.

Photo: Anne Honkala



CHEMARTS EXHIBITIONS AND EVENTS 2021–2023

2021

CHEMARTS 10 years: Materialising the Future – Materiaaleja Tulevaisuuteen
Where: Aalto University Campus, Väre 1st floor
When: 8.–29.9.2021

2022

Design Festival Bern: Exchange for Change
Where: Kornhausforum, Bern, Switzerland
When: 6.–8.5.2022

Blooming Futures
Where: Aalto University Campus, Dipoli
When: 17.6.2022

CHEMARTS at Dutch Design Week Eindhoven (DDW)
Where: Klokgebouw, Strijp-S, Eindhoven, Netherlands
When: 22.–30.8.2022

Designs for a Cooler Planet: Second Nature by CHEMARTS
Where: Aalto University Campus, Väre 1st floor
When: 7.9.–12.10.2022

CHEMARTS at Aalto Family Day
Where: Aalto University Campus, Väre F102
When: 10.9.2022

2023

Designs for a Cooler Planet: Unlikely Materials
Where: Aalto University Campus, Väre ground floor
When: 6.9.–6.10.2023

CHEMARTS at Dutch Design Week Eindhoven (DDW)
Where: Klokgebouw, Strijp-S, Eindhoven, Netherlands
When: 21.–29.8.2023

Wheat straw samples, 2022
Tiina Otala
Photo: Esa Kapila

Photo: Saara Kantele

CHEMARTS 10 years: Materialising the Future – Materiaaleja Tulevaisuuteen

Where: Aalto University Campus, Väre 1st floor
When: 8.–29.9.2021

Materialising the Future – CHEMARTS 10 years exhibition is inspired by often asked questions related to bio-based materials, such as: Why to recycle bio-based materials? Can bio-based materials replace plastics? Does it make sense to use trees as materials?

Photo: Saara Kantele

Photo: Claudio Ratti

Photo: Claudio Ratti

CHEMARTS at Design Festival Bern:
Exchange for Change

Where: Kornhausforum, Bern, Switzerland
When: 6.–8.5.2022

CHEMARTS was invited to participate in Design Festival Bern.

The exhibition “New Traditions” brought together around 12 Finnish designers who explore craftsmanship and tradition in the context of contemporary design and sustainability. CHEMARTS was showcasing The CHEMARTS Cookbook and a set of experimental bio-based materials. In addition, CHEMARTS alumna Iines Jakovlev organised an open hands-on workshop with patterning of cellulose.

Blooming Futures

Where: Aalto University Campus, Dipoli
When: 17.6.2022

The Ceremonial Conferment of Doctoral Degrees in Technology and the conferment dinner and ball were record breaking sizewise in the Aalto University history.

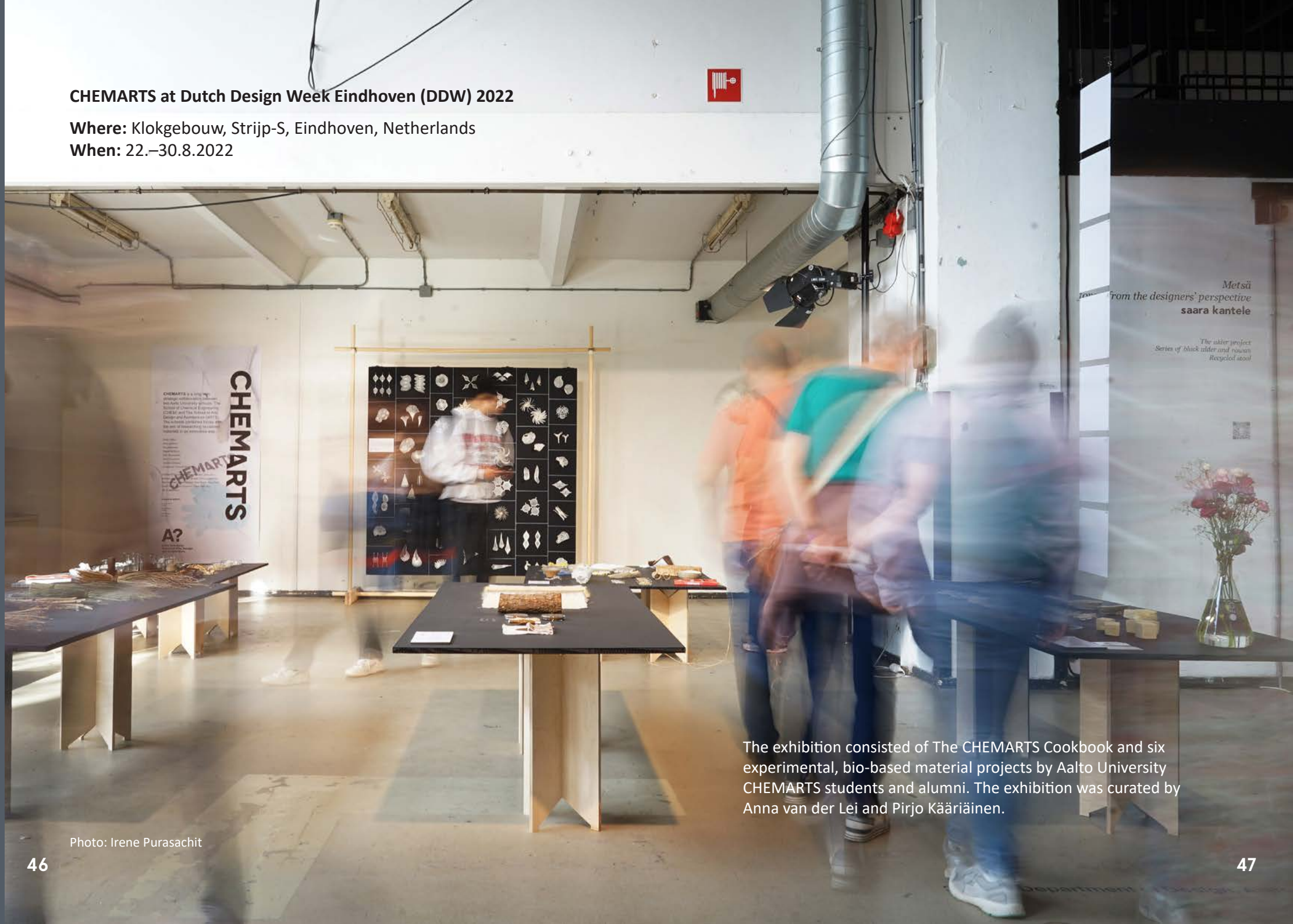
CHEMARTS alumna Irene Purasachit's research with recycled flowers was shown as part of the table decorations and ten honorary doctorates were gifted a wallet made of flower waste.

In addition, Irene Purasachit curated the CHEMARTS exhibition at the lobby.

Photo: Irene Purasachit

CHEMARTS at Dutch Design Week Eindhoven (DDW) 2022

Where: Klokgebouw, Strijp-S, Eindhoven, Netherlands
When: 22.–30.8.2022



The exhibition consisted of The CHEMARTS Cookbook and six experimental, bio-based material projects by Aalto University CHEMARTS students and alumni. The exhibition was curated by Anna van der Lei and Pirjo Kääriäinen.

Photo: Irene Purasachit

Coral, 2022
Installation made of 3D printed PLA
and microfibrillated cellulose
Project and photo by Megan McGlynn

Photo: Iines Jakovlev

Designs for a Cooler Planet 2022:
Second Nature by CHEMARTS

Where: Aalto University Campus, Väre 1st floor
When: 7.9.–12.10.2022

In 2022, the CHEMARTS exhibition in the Designs for a Cooler Planet exhibition showcased six nature-inspired projects combining design and materials research.

Designs for a Cooler Planet 2023: Unlikely Materials

Where: Aalto University Campus, Väre ground floor
When: 6.9.–6.10.2023

Unlikely Materials table presented a collection of bio-based material experiments and their raw materials. From cellulosic bubble wrap to wood-based superblack colour pigment and textiles made of invasive, abundant plant species, the exhibition invited to imagine an alternative future of materials choices that could do good for the planet.

Curators: Pirjo Kääriäinen, Enni Äijälä & Anna van der Lei

Soy hull waste sandals, 2021
Taisa Ferreira Ribeiro & Ena Naito
Photo: Esa Kapila

Photo: Kalle Kataila

CHEMARTS at Dutch Design Week Eindhoven (DDW) 2023

Where: Klokgebouw, Strijp-S, Eindhoven, Netherlands
When: 21-29.8.2023

Inspired by the long-term CHEMARTS activities, Aalto University Bioinnovation Center (BiC) participated in the Dutch Design Week for the first time. The shared stand showcased five research projects by the BIC doctoral candidates and an array of experimental CHEMARTS student projects. Together with the neigbouring stand by the FOLD research project, the entity reflected beautifully the long development journey from the first ideas towards commercial applications made of new bio-based materials.

Curators: Pirjo Kääriäinen & Anna van der Lei

Photo: Iines Jakovlev

Photo: Pirjo Kääriäinen

AALTO FAMILY DAY WITH CHEMARTS

Photo: Irene Purasachit

Photo: Irene Purasachit

CHEMARTS at Aalto Family Day

Where: Aalto University Campus, Väre F102
When: 10.9.2022

Aalto Family Day 2022 was hosted by Aalto University for staff, alumni and their family members in Otaniemi campus. During the day visitors explored Aalto's topical projects and achievements and took part in numerous activities.

CHEMARTS organized a paper making workshop led and inspired by Irene Purasachit's work with discarded flower waste.

Visitors had chance to paint with experimental nanocellulose paints and learn about different materials and recipes from The CHEMARTS Cookbook.

STUDENT PROJECT HIGHLIGHTS

FROM WILLOW TO ALL-IN-ONE TEXTILE DYE
Juulia Holm, CHEMARTS Project 2021

TRANSFORMABLE BOWL MAT
Jingting Ma, CHEMARTS Project 2021

ECOLOGICAL BIODEGRADABLE CLEANSING PAD
Henri Moisanen, CHEMARTS Project 2021

BUBBLES WITH BENEFITS
Satu Paavonsalo & Valentin Schwarz, Nordic Biomaterials with CHEMARTS 2022

LIGNIN AS COLOURANT
Pia Johansson, Biocolour Research Project 2022

BLOOMING FLOUR
Ida Parkkali, Mukesh Kumar, Riccardo Guiducci & Robert Hedengren, Design Meets Biomaterials 2022

COSTUME PARTY IN THE SHRUBBERY
Jaana Pippola, Enni Rasia, Aaro Vanninen & Danel Zilinski, Design Meets Biomaterials 2022

LUPIN FIBRES
Maija Vaara & Mithila Mohan, Nordic Biomaterials with CHEMARTS 2022

ÄRT
Mari Koppanen, Nordic Biomaterials with CHEMARTS 2022

FORAGED FIBERS
Iines Jakovlev, CHEMARTS Project 2022

BACK TO YOU
Anna Ihamuotila, CHEMARTS Project 2022

PARFUM D'ESPOO
Azou Fourastié & Johannes Ahlfors, CHEMARTS Project 2022

ALGAE HAT
Nina Riutta, CHEMARTS Alumna Project 2022

BIO-(FLORAL) FOAM
Irene Purasachit, CHEMARTS Alumna Project 2022

MATERIALS FROM COFFEE WASTE
Valenti Soler Casas, CHEMARTS Summer School 2023

TYPHANTASTIC
Ada-Natalia Luukkanen, Harvey Shaw, Tilda Ostberg Alagarda & Lukas Schuck, Design Meets Biomaterials 2023

SPRUCE CONE PANELS
Iines Jakovlev, CHEMARTS Project 2023

WOOLFLOWER
Joi Gao, Ilona Rönkä, Aleksanteri Sihvonen & Andrzej Tarasiuk, Design Meets Biomaterials 2023

BIOLLET
Ayaka Yamada, CHEMARTS Project 2023

Parfum d'Espoo, 2022
Azou Fourastié & Johannes Ahlfors
Photo: Esa Kapila

Photo: Esa Kapila

FROM WILLOW TO ALL-IN-ONE TEXTILE DYE

Juulia Holm, CHEMARTS Project 2021

Dyeing textiles at home with environmentally friendly natural dyes should be as simple as dyeing with synthetic dyes. What if we could buy dye tablets made of natural colorants such as willow bark? In this experimental research project, the student developed non-toxic dye tablets that would be placed straight into a washing machine, and the depth of the dye result can be altered by adjusting the number of the tablets.

TRANSFORMABLE BOWL MAT

Jingting Ma, CHEMARTS Project 2021

By combining two different bio-based materials, the flat material with geometric patterns becomes easily foldable into 3D shapes.

The project draws inspiration from japanese origami and connects to traditional Finnish birch bark dish used for baking food in oven.

Photo: Esa Kapila

ECOLOGICAL BIODEGRADABLE CLEANSING PAD

Henri Moisanen, CHEMARTS Project 2021

The project was born from a need to have ecologically safe cleansing pads for trekking and other outdoor activities. The foam pads are bio-based and biodegradable, containg ecological cleansing gel (Taika), essential oils from birch and birch sap with skin caring effects. Pads are light to carry when they are dry, can be used with small quatities of water, and harmless to environment.

Photo: Esa Kapila

BUBBLES WITH BENEFITS

Satu Paavonsalo & Valentin Schwarz,
Nordic Biomaterials with CHEMARTS 2022

Bubbles with Benefits is an experimental material project to create cellulose-based bubble wrap that provides the benefits of plastic bubble wrap without harming the environment. The material is flexible and contains poppable air bubbles that provide cushioning to protect fragile items during delivery – exactly like plastic bubble wrap. However, Bubbles with Benefits is a fully plastic-free, non-toxic, and biodegradable material, which in the future could offer a sustainable alternative to plastic bubble wrap, a widely used but environmentally problematic packaging material. Bubbles with Benefits won the Wood U Innovate prize in the spring 2023.

Bubbles with Benefits is a proof-of-concept which has formed a basis for a material research project starting in 2024.

Photo: Esa Kapila

Photo: Esa Kapila

LIGNIN AS COLOURANT

Pia Johansson, Biocolour Research Project 2022

Lignin is one of the three main components of wood. The project explores could the deep brown color of lignin be used in the textile industry of tomorrow? The topic is explored by using a limited color palette based on lignin and some other natural dyes to create woven and printed textiles. In addition to the beautiful range from light beige to darker brown, these biocolourants have good washing and rubbing fastness.

Photo: Esa Kapila

BLOOMING FLOUR

Ida Parkkali, Mukesh Kumar, Riccardo Guiducci &
Robert Hedengren, Design Meets Biomaterials 2022

This project looked critically at the bread waste in the baking industry and retail. What happens to the leftovers that can't be used for nutrition?

The project focused on using bread waste as a raw material for a new, biodegradable product for distribution and diplays. The regular plastic packaging could be replaced. At the same time, the customers could be informed of the huge amount of food waste and of the need to circulate all materials.

Photo: Esa Kapila

COSTUME PARTY IN THE SHRUBBERY

Jaana Pippola, Enni Rasia, Aaro Vanninen &
Danel Zilinski, Design Meets Biomaterials 2022

The project got inspired by the idea of replacing synthetic costume embroidery materials with more sustainable alternatives for sequins, rhinestones and pearls. The experimental samples are biodegradable, but withstand mild physical stress and even humidity.

The outcome came in multiple different colours, shapes and sizes. The main raw material is sucrose octaacetate.

Photo: Esa Kapila

LUPIN FIBRES

Maija Vaara & Mithila Mohan,
Nordic Biomaterials with CHEMARTS 2022

Lupine is a beautiful plant but also considered an invasive species in Nordic nature. This project investigated how fibres could be extracted from the local plants for alternative textile materials. Long fibres from the Lupine stems were spun to yarns by using traditional drop spindle.

The project has continued as an interdisciplinary research project.

Photo: Anne Kinnunen

ÄRT

Mari Koppanen, Nordic Biomaterials with CHEMARTS 2022

The project investigated the utilization of peapod peels as a lignocellulosic resource in packaging materials. It is the result of a 2-week material experimentation with peapod peels and various cellulose derivates. It proposes possible future applications for pea peel waste and demonstrates decomposable packaging alternatives.

Photo: Rainer Paananen

Photo: Esa Kapila

FORAGED FIBERS

Iines Jakovlev, CHEMARTS Project 2022

The aim of this project was to explore uncommon but inspiring fiber sources such as willowherb, dandelion, willow and common reed harvested from Finnish nature. Bast fibers, leaf fibers and seed-hair from these plants were extracted by tearing, soaking and cooking, and finally handspun into experimental yarns.

Photo: Esa Kapila

BACK TO YOU

Anna Ihamuotila, CHEMARTS Project 2022

The project was an exploration into replication. The goal for the research was to develop a plant-based watercolour alternative, and more specifically to generate a cellulose-based watercolour binder. The key to this lay in aiming to replicate the qualities of gum arabic, which has become the standard base ingredient in water-based paints, such as gouache and watercolour, due to its versatility. The research takes a look at the old, traditional ingredients used in ink and paintmaking, and allowed to reflect on personal approach to sustainability and switching “back” to greener alternatives.

A recipe for a functional watercolour binder was developed by using a blend of three different types of cellulose and other natural ingredients. Earth pigments were used to create a set of three different watercolours.

Photo: Esa Kapila

PARFUM D'ESPOO

Azou Fourastié & Johannes Ahlfors, CHEMARTS Project 2022

Parfum d'Espoo project consists of different perfumes created with handpicked locally sourced natural materials. The ambition was to steer away from harmful chemicals the big cosmetics industry relies on, and highlight the importance of appreciating one's immediate surroundings. Local materials are a crucial part of the concept, to create a deeper connection between the materials and the user experiencing the products. This ensures more respectful attitude towards the product and promotes more ecologically conscious way of consuming.

Most of the raw materials are collected from Aalto University Otaniemi campus area, and orange peel is a side stream material sourced from local shops orange juice machine. Spruce resin is ordered from a Finnish harvester. The materials are distilled or infused in a few different ways to extract the essential oils and scents, which are then mixed to carriers. Result is a range of solid-, oil- and liquid perfumes.

Photo: Esa Kapila

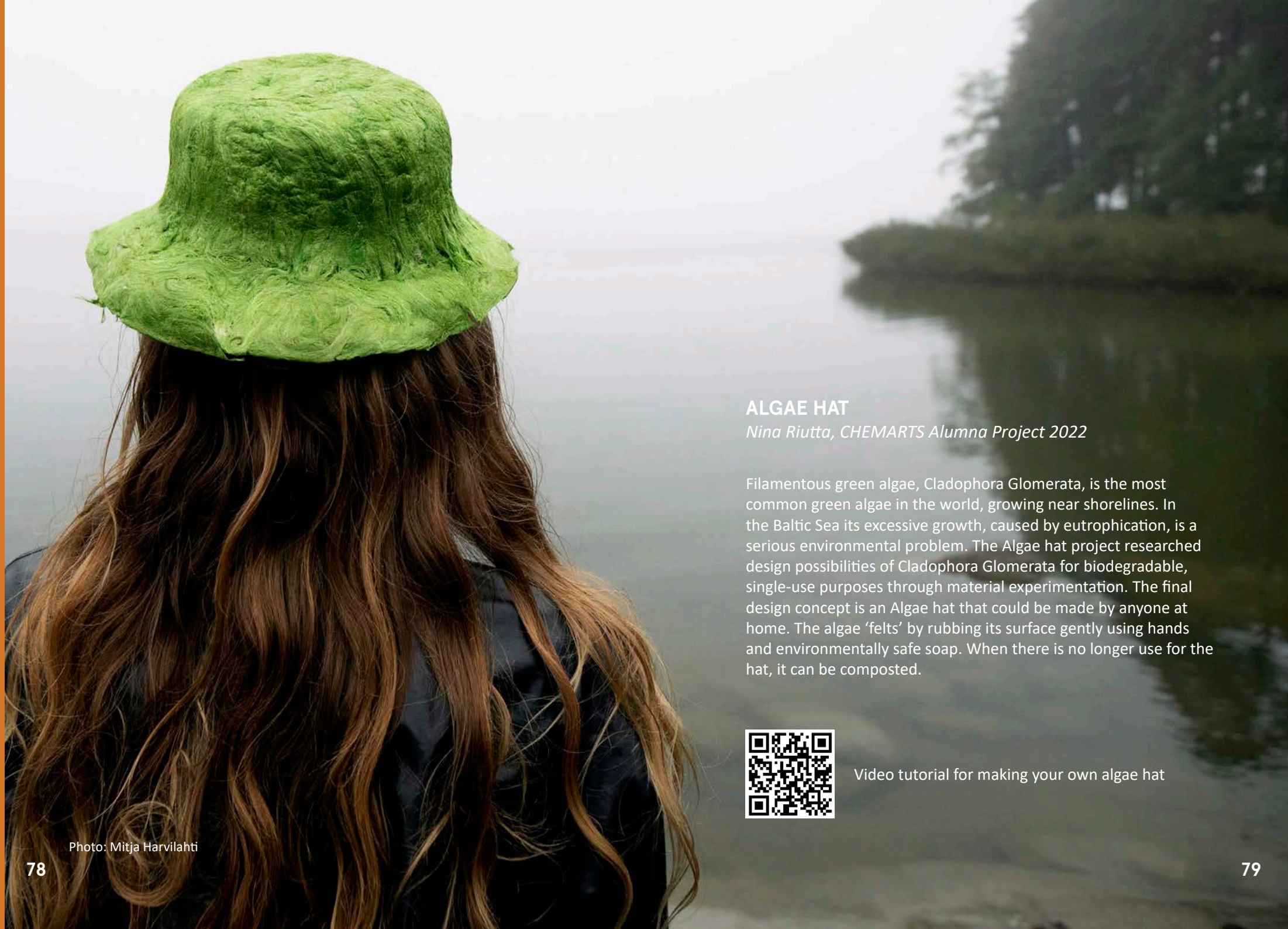


Photo: Mitja Harvilahti

ALGAE HAT

Nina Riutta, CHEMARTS Alumna Project 2022

Filamentous green algae, Cladophora Glomerata, is the most common green algae in the world, growing near shorelines. In the Baltic Sea its excessive growth, caused by eutrophication, is a serious environmental problem. The Algae hat project researched design possibilities of Cladophora Glomerata for biodegradable, single-use purposes through material experimentation. The final design concept is an Algae hat that could be made by anyone at home. The algae 'felts' by rubbing its surface gently using hands and environmentally safe soap. When there is no longer use for the hat, it can be composted.

Video tutorial for making your own algae hat

BIO-(FLORAL) FOAM

Irene Purasachit, CHEMARTS Alumna Project 2022

Floral foam is widely used in modern floral arrangements. The current foam available in the market is phenol-formaldehyde foam which is essentially an oil-based material with several toxic chemicals.

This Bio-(floral) Foam is made of 100% fiber from flower stem (mainly carnation and iris). The material aims to simulate and act as an alternative for floral foam. Therefore, it has the properties to absorb and retain water together with the ability to hold flowers. The material is biodegradable, contains no oil-based ingredient or additive, is made of 100% flower waste and is microplastic-free.

Photo: Irene Purasachit

MATERIALS FROM COFFEE WASTE

Valenti Soler Casas, CHEMARTS Summer School 2023

Finland is the world's second-leading consumer of coffee with over 180 litres of coffee per capita being consumed annually. Industrial coffee processing creates plenty of pre-consumer waste which today is mainly burned for energy.

This experimental material project aimed to ideate new materials by combining coffee waste with wood-based cellulose derivatives. The focus is on possible applications for interior architecture and furniture industries. A systematic approach and intensive experimentation period in the lab resulted in a promising selection of hard materials for boards and soft and flexible foams.

Waste coffee grounds were provided by Paulig and Natural Indigo Finland.

Photo: Anne Kinnunen

TYPHANTASTIC

Ada-Natalia Luukkanen, Harvey Shaw, Tilda Ostberg Alagarda & Lukas Schuck, Design Meets Biomaterials 2023

Typha latifolia, broadleaf cattail, is commonly found on lake shores, including those on the Aalto University campus. The aim of this interdisciplinary project was to develop an alternative to styrofoam or blue craft foam in architectural model building. To understand the properties and potential of the cattail plant, the team experimented with the cattail stems and leaves. As a proof of concept, they created a biomaterial composite with shredded Typha leaves and stems combined with microfibrillated cellulose.

Photo: Anne Kinnunen

SPRUCE CONE PANELS

Iines Jakovlev, CHEMARTS Project 2023

Children have been playing with spruce cones for centuries. In this project the idea is to explore this natural and abundant material for aesthetic purposes. The spruce cones were a starting point for a material experiment, where their structure has been broken-down and reshaped into new surfaces and textures, preserving the organic aesthetic qualities. By using only biodegradable materials, for example CMC as an adhesive, the environmental friendliness can be maintained when creating these visually enchanting material samples or pieces of art.

Photo: Anne Kinnunen

WOOLFLOWER

Joi Gao, Ilona Rönkä, Aleksanteri Sihvonen & Andrzej Tarasiuk, Design Meets Biomaterials 2023

Currently a lot of products used in interior design contain plastics. The Woolflower project explored ways to fabricate a wood & wool based composite material that could be used as an interior design element. Three possible usages were identified: a flexible, textured wallpaper; a hard tile panel; and lastly a spongy acoustic panel mounted on the wall. Each of these have the possibility of being in a variety of shades and forms. The Woolflower panel experiment combined traditional wet felting technique and corn starch, a home-cooking material.

Andrzej Tarasiuk developed the idea further in his SoftAcoustics Panels project later in 2023. This project combined two waste streams - industrial pre-consumer coffee waste and discarded local wool.

Photo: Anne Kinnunen

BIOLLET

Ayaka Yamada, CHEMARTS Project 2023

Ballet slippers are very special kinds of shoes: there are no significant distinctions in the design between genders, nor any distinction between left and right. Despite their uniform structure, they must enable a multitude of highly demanding ballet movements.

Although demand for sustainable products has been increasing due to the growing awareness of environmental issues, only a minority of products on the market are made from materials that consider the impact on the environment. The Biollet project explored how ballet slippers could be 100% biodegradable. The aim of the project was to deepen research understanding of bio-based materials such as caoutchouc (raw rubber), natural latex, wood-based cellulosic materials and cotton. While the project explored ways to create shoes from 100% plant-based materials, another target was identifying barriers to market entry.

Photo: Anne Kinnunen

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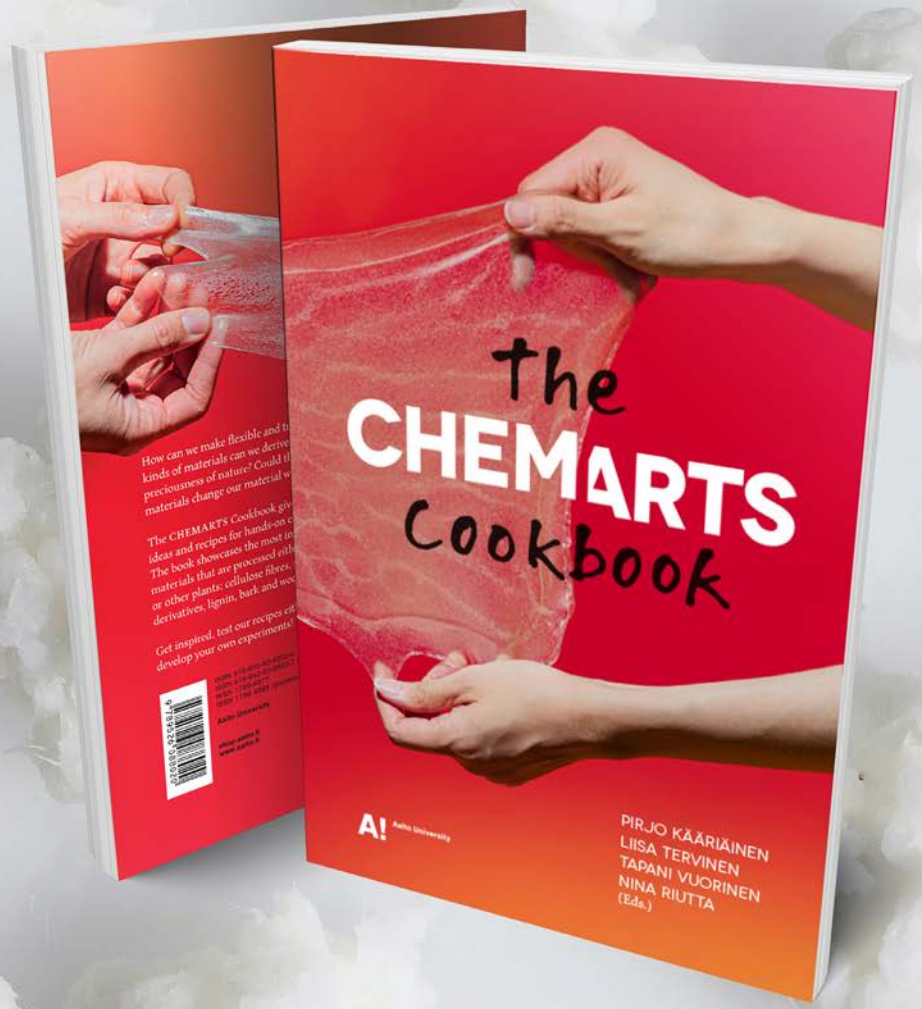

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The CHEMARTS courses were organised at the laboratories with special arrangements throughout the COVID-19 in 2020-2022