CHEMARTS

SUMMER SCHOOL 2019

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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 arranges multidisciplinary study courses and a Summer School for degree students, thesis projects, and workshops for elementary and high school students. It also participates in externally funded research projects.

SUMMER SCHOOL 2019

The interdisciplinary CHEMARTS Summer School focuses on hands-on material experimentations with bio-based materials. Students are encouraged to explore topics they are personally interested in. This year, the overall theme of the Summer School was ‘value from plant residues’. This exhibition showcases the students’ ideas, processes and the most interesting experiments.

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CHEMARTS
SUMMER CAMP

Bio-material Boot Camp
@ HAMK Lepaa Campus

Lepaa Campus of Häme University of Applied Sciences is the oldest and most prestigious institute in Finland for the study of horticulture and landscape design. They are a large provider of produce in Finland.

The four-day boot camp focused on utilizing side streams of tomato production. This included organic material such as tomato stems and leaves, but also inorganic materials such as plastic and synthetic string.

The purpose of the CHEMARTS Summer Camp is for students to get to know one another, learn to work with bio-based materials, and think creatively about sustainable design. These collaborative projects and others inspired by them were exhibited at Lepaa Campus later in the summer.

Special thanks to
Häme University of Applied Sciences
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www.hamk.fi

To-Matter

Utilizing side streams from tomato production

Meri-Tuuli Porras
M.A. Contemporary Design

Tomato stems and leaves make up roughly 20 percent of the total fresh material of an average yield. As the dry matter content in stems and leaves is higher, approximately 30–40 percent of dry matter is in the stems and leaves. Currently, green biomass (stems and leaves) is treated mostly as waste. The tomato stem has many fibres and can be used in cardboard/paper manufacturing. Farmers could get value out of the biomass by producing their own packaging locally and reduce their carbon footprint as well.

Materials: tomato stem, pine pulp, birch pulp, recycled pulp, microfibrillar cellulose (MFC), hemp

A Palette of Residues:
Tomato Meets Cellulose

Chiao-wen Hsu
M.A. Contemporary Design

Yu Chen
M.A. Creative Sustainability

Tomato plant residues as unmined resources deserve more attention for development. We explored different components of tomato residues and created diverse composite materials with cellulose. The experimental process is aimed to open up the discourse about the dynamic potentials of tomato residues.

Materials: different components of tomato plant residues including stem, leaves, branch, root, tomato skin and the growing medium (artificial sponge), nanofibrillar cellulose (NFC), microfibrillar cellulose (MFC), carboxymethyl cellulose (CMC), microcrystalline cellulose (MCC)

A Palette of Residues:
Feelings Toward Climate Change

Chiao-wen Hsu
M.A. Contemporary Design

Yu Chen
M.A. Creative Sustainability

Climate change triggers human feelings. Materials also evoke our emotions. We attempted to make use of the tomato plant residues in the context of the overuse of resources that is negatively related to climate change, and proceed the material experiments towards the diverse feelings associated with climate change.

Materials: different components of tomato plant residues including stem, leaves, tomato skin and the growing medium (artificial sponge), nanofibrillar cellulose (NFC), microfibrillar cellulose (MFC), carboxymethyl cellulose (CMC), microcrystalline cellulose (MCC), glycerine

Natural UV Protection from Spruce

Santeri Iisakka
B.Sc., Chemical Engineering

Spruce inner bark absorbs strong UV light. This natural UV protection can be applied to bioplastics. What if these spruce extractives could protect our eyes from the sun's harmful UV rays, or provide UV protection for clothing?

Materials: spruce extract, cellulose acetate (CA), cellulose triacete (CTA), cellulose di-acetate (CDA)

Sounds from Nature

Katri Oikarinen
B.A. Design

When I walked in my overgrown garden and picked up a goutweed, long stripes appeared from the plant. I bent the stem into an arch form and the shape started to remind me of an instrument. I wondered if plants could act as a source of music; and I composed and recorded a song together with them.

Materials: rhubarb, birch, carboxymethyl cellulose (CMC), nanofibrillar cellulose (NFC), microfibrillar cellulose (MFC), loncell textile fibres, other instruments like pine and fir cones, rose stem, stones, leaves, weeds, etc.

Wild Dye

Aleksandra Hellberg
B.A. Fashion Design

Jenny Hytönen
B.A. Fashion Design

The incentive of the Wild Dye project was to make our design practices more sustainable by learning about natural dyes and screen printing. Our focus was making dyes from foreign species (in Finnish nature) and creating patterns on textiles with pH-altering printing pastes, which allow multiple colors using only one natural source of color.

Materials: Rosa rugosa, lupine, fireweed and other plants. Wool, viscose and silk fabrics, carboxymethyl cellulose (CMC), baking soda, lemon juice and vinegar

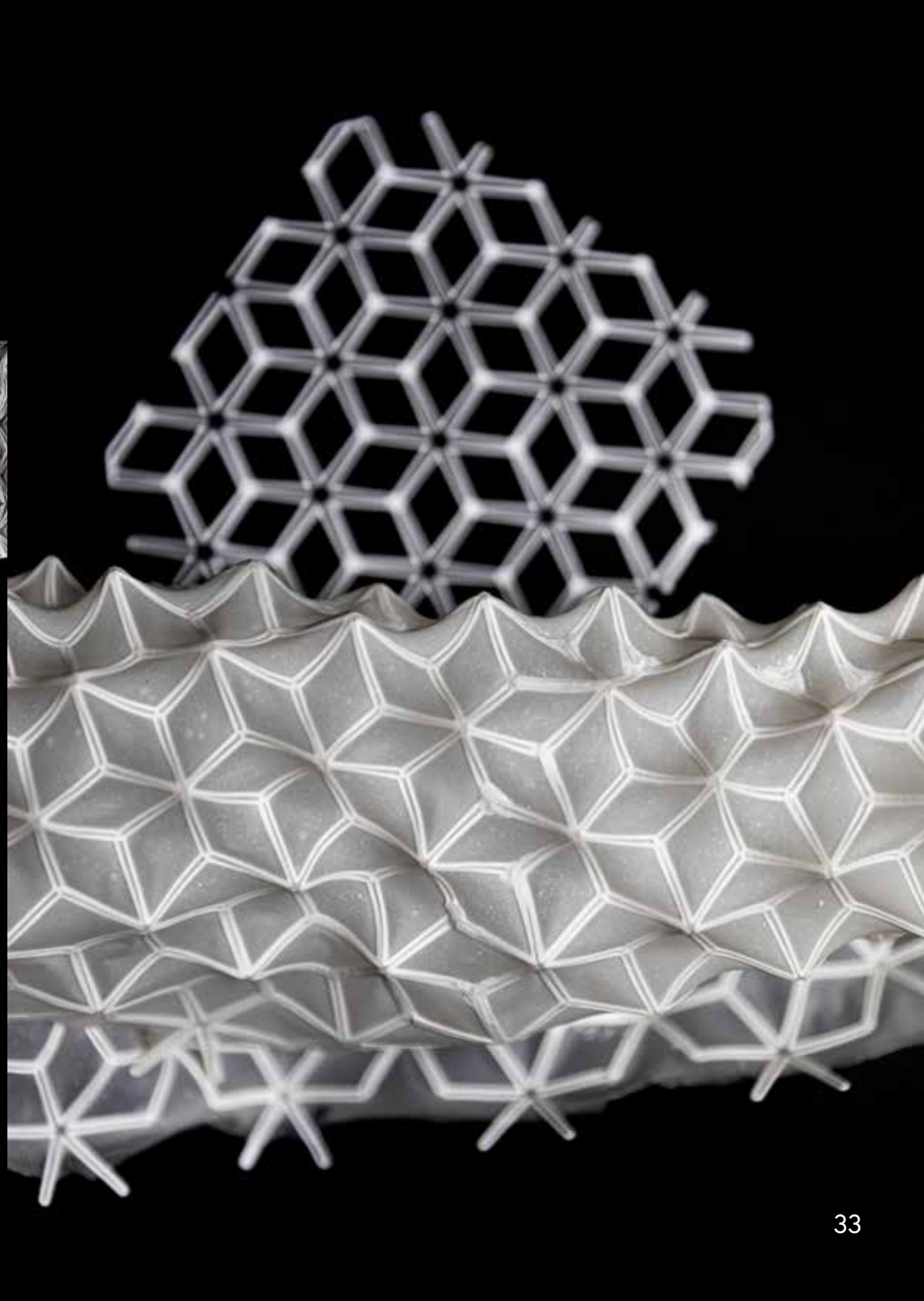

Kuusa-
värjäys II

In Tension

Megan McGlynn
M.A. Contemporary Design

This material experimentation project focuses on shrinkage as an intrinsic quality of drying microfibrillar cellulose (MFC). Encasing geometric tessellations between layers of MFC creates tension in specific directions and produces self-forming curvatures. The encased shapes are 3D printed biodegradable plastic, PLA. The tests include many different patterns, sizes, and drying temperatures. Many of the outcomes were surprising in their strength and peculiarity.

Materials: nanofibrillar cellulose (NFC), microfibrillar cellulose (MFC), polylactic acid (PLA)



Cellulose on Ice

Exploring the effect of freezing on biomaterials

Anna Alho
B.A. Design

Cellulose on Ice is less a premeditated study, and more a series of accidental discoveries and surprises. A pykrete experiment turned into throwing stuff in the freezer and seeing what happens. After noticing a change in the structure of MFC after freezing, I methodically froze and then dried various biomaterials to observe the effect. I then tried applying this effect in my side project of molding objects, and appreciating the organic shapes that appear in MFC in particular. While this project is not the scientific study such an underdocumented phenomenon deserves, it showcases the endless dimensions and possibilities of biomaterials.

Materials: microfibrillar cellulose (MFC), nanofibrillar cellulose (NFC), microcrystalline cellulose (MCC), carboxymethylcellulose (CMC), wood pulp, wood powder and flakes, used coffee grounds, pine bark, sand

Ouroboros

Side Streams as Substrates

Xinquan Wen
M.A. Collaborative and Industrial Design

Ouroboros utilises the side streams of food production, like tomato stems, to offer a more sustainable and economically efficient choice for growing mediums in vertical farming. Imagine having new crop produced from last year's tomato stems.

Materials: tomato stem, rice straw, pulp

Cellulose Leather

Jui-Fan Yang
M.A. Collaborative and Industrial Design

In recent years, people have become more aware of animal rights. This trend makes many companies to produce products with artificial leather. However, most artificial leathers are made of PVC or different kinds of plastic composites: it might be animal-friendly but not eco-friendly. The aim of this project is to create a leather-like and biodegradable material suitable for daily use out of the wood cellulose and other bio-based materials.

Materials: microcrystalline cellulose (MCC), carboxymethyl cellulose (CMC), sodium dodecyl sulfate (SDS), birch pulp, corn starch, vinegar, water, glycerine, food coloring

Acoustic Brick

Yingjie Liang
M.A. Product and Spatial Design

This eco-friendly and biodegradable material is made by foaming wood cellulose (pulp) and lignin, a by-product of cellulose production. As acoustic material, it is affordable, lightweight, porous, mouldable and has unique vintage look. It could also be used as an insulation material if additives are added to prevent molding. This product causes less dust during the installation process then the traditional cellulosic insulation which is loosely formed of recycled cardboard and paper.

Materials: pulp, lignin

FoRest

Multisensorial materials to evoke associations with nature

Aarni Tujula
M.A. Contemporary Design

People associate different meanings with different materials, but with new materials there is often no familiarility or emotional relationship. This project is about creating multisensorial new materials, which are made by using local forestry residues such as pine needles and spruce bark. Scent, feel and appearance of the materials have been considered to create positive associations with nature, hoping to evoke calming and relaxing feelings.

Materials: pine and spruce needles, pine, spruce and willow bark, microfibrillar cellulose (MFC), nanofibrillar cellulose (NFC), glycerine

The Alder Project

Saara Kantele
M.A. Product and Spatial Design

A deep dive to understand the tree as a being and a material to be used in design practices. According to recent studies, trees are social beings with the ability to learn. Monoculture of the planted Finnish forests is a threat to biodiversity and limits our material possibilities. Of every tree trunk cut, more than half is chips, shawdust, and bark, branches and leaves, byproducts are not yet used efficiently. The Alder project researches the undiscovered potential and possibilities.

Materials: self-harvested Alnus incana (grey alder), microcrystalline cellulose (MCC), nanofibrillar cellulose (NFC), self-produced microfibrillar cellulose (MFC)

Edible Potato Tableware/Package

Xuyang Zhang
M.A. Collaborative and Industrial Design

Rethinking waste produced during food processing. Currently, waste from the potato starch industry amounts to four to five times the actual potato starch produced. There is a clear need to utilize food processing waste more efficiently. Edible Potato tableware is made of leftover starch that is biodegradable and is truly edible. A product of this kind could be one of the new sustainable choices for single-use tableware.

Materials: potato pulp (residue from potato starch industry), glycerine, food coloring