
KCL
piloting knowledge
The leading-edge open access
piloting service provider

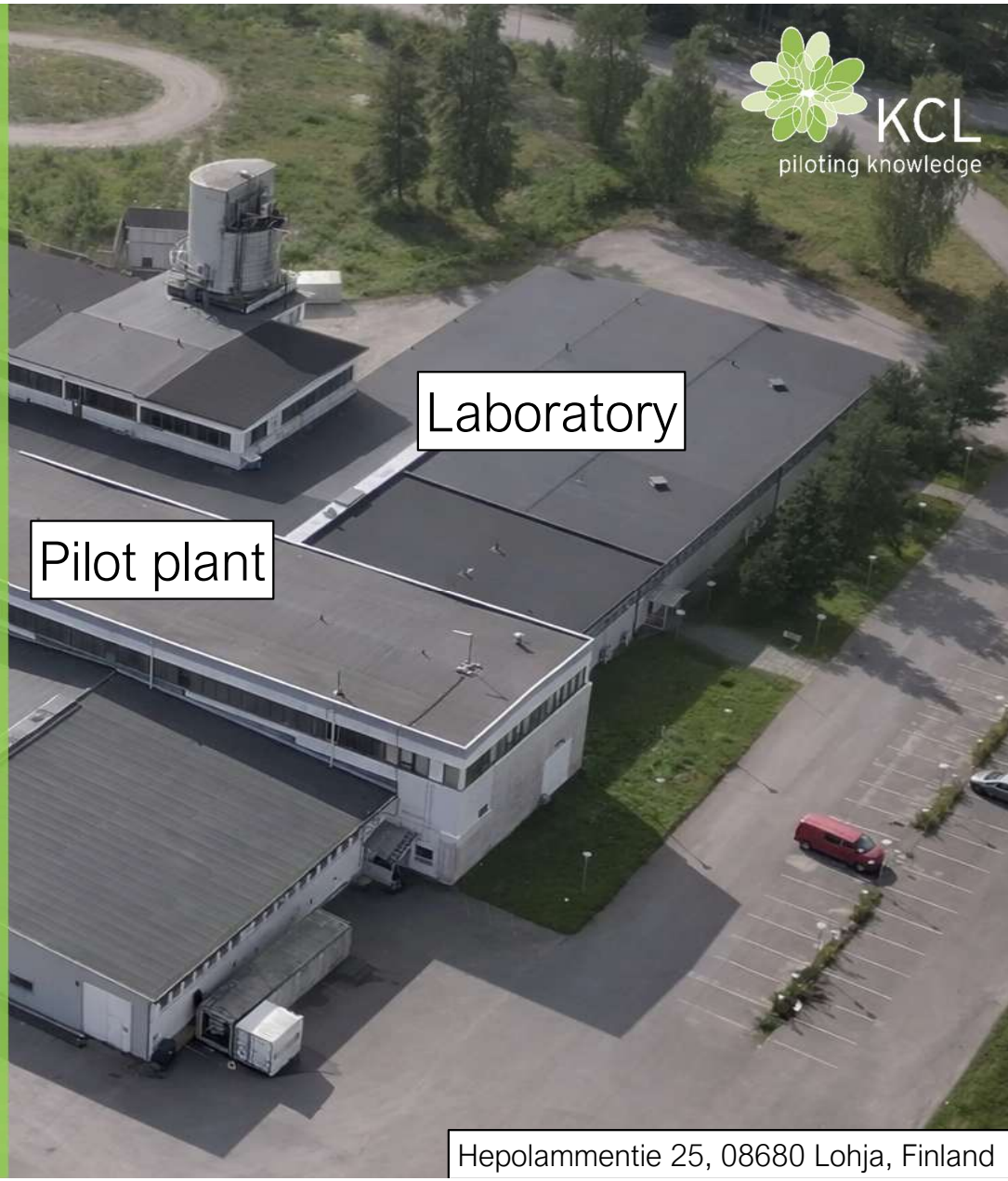
Pilot plant – in a nutshell

History
- Founded in 1916, research of pulp & paper properties
- Independent service provider since 2023

Today
- Unique pilot plant, offering services in bio-material processing, coating and printing, laboratory testing
- > 40 persons
- 5 M€ in 2025 with ambition of 10 M€ by 2028

Our customers
- Pulp, paper and biomaterial companies
- Chemical and equipment suppliers
- Research and consulting companies
- Brand owners
- Start-up companies

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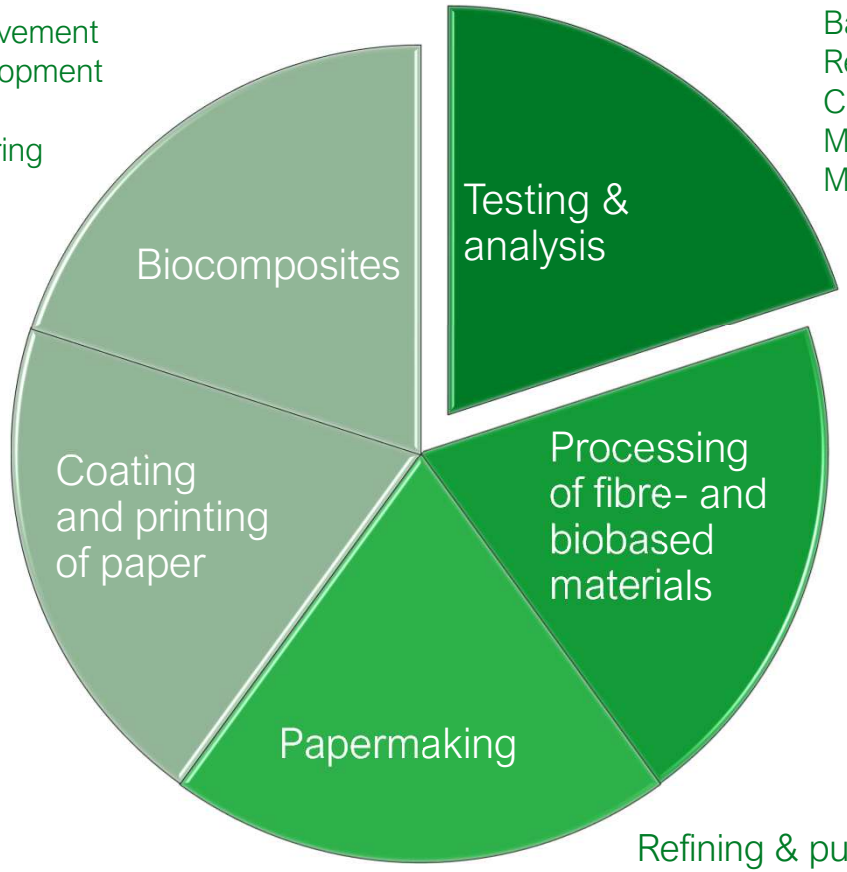
KCL – your partner in fibre-based innovation and development

Comprehensive testing and piloting platform for material and process developments

KCL
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Material testing & improvement
Application driven development
Industrial validation
Commercial manufacturing
Recycling

Testing of board and paper
Barrier properties
Recyclability
Chemical analysis
Microplastics
Microbiology



Dispersion coating
Extrusion coating
Lamination
Printing

Mechanical
Chemical
Liquid
Drying
Pelletizing

Calendaring
Slitting & cutting

Refining & pulp development
(Foam) papermaking

Service offering

- Scale up
- Trial services
- Development projects
- Contract manufacturing
- Platform for pilot collaboration

Extraction and fractionation pilots

LUKE and KCL services for industrial product development and scale-up

Extraction and Fractionation Pilot Facilities seminar
8 October 2026

Risto Hertzberg
Head of Biomaterial Processing
KCL



Short introduction

KCL Bioprocessing Platform offers piloting services for Industry focusing on processing of biomaterials, fibers, liquids and recycled streams in pilot scale:

- Industrial infrastructure
- +150 devices
- Operators, M.Sc.s, PhDs & vast network of industry veterans

Scale from:

- Kg to ton scale
- 10s of Liters 10s of m3

Services

- Product development partnerships
- Upscaling from laboratory to pilot scale
- Demonstration of processes
- Contract manufacturing
- Industrial infrastructure as a service
- In-house laboratory



Who?

Risto Hertzberg, M.Sc. (Tech.)
10 years of Industrial project experience

- 4+ years at KCL Heading the KCL Bioprocessing
- Previously in Technical consulting, Big industry R&D and hands on product development
- Hundreds of projects for the bio-based industry globally

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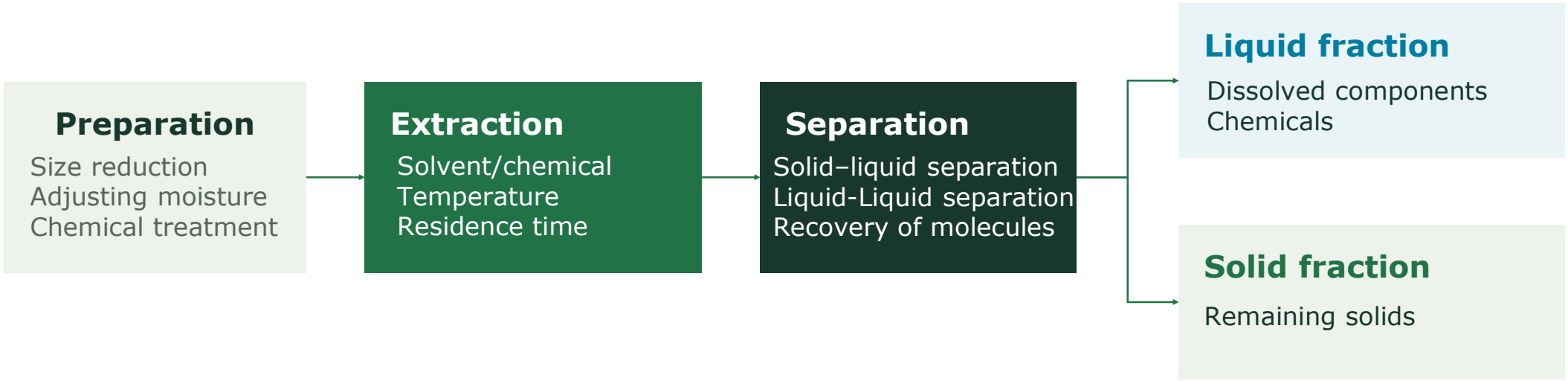
Extraction and fractionation

Extraction

A solvent transfers selected compounds from biomass into an extract

Fractionation

Separation creates streams with different compositions and uses



A pilot follows both fractions through recovery and application testing

Feedstocks and target fractions

The intended product determines which process is used







Feedstock examples	Fractions to investigate	Potential applications
Bark, sawdust and forest residues	Extractives and soluble carbohydrates	Preservatives, glues, cosmetics, pharmaceuticals
Hulls and agricultural side streams	Soluble components and fibre-rich solids	Nutraceuticals, Vitamins, Proteins, Fertilizers
Berry and other food processing side streams	Extracts, phenolics and remaining solids	Food and cosmetics additives, natural essences, medicinal components

Pilot routes for different feeds

Selected equipment in the LUKE–KCL service route

Pre-treament
Crushing
Milling
Drying
Mixing
Sieving

Process route	Equipment volume	Potential processes
Pressurized batch	300 and 4,000 L	Controlled extraction and fractionation with a defined batch charge
Atmospheric continuous	10, 450 and 2,200 L	High-solids extraction, washing and chemical treatment
Atmospheric mixed batch	From 1L up 20,000 L	Heated extraction and mixing of larger material batches
CO_2 batch	10 L	A separate extraction route for suitable target components

Working charge and operating conditions are trial-specific

Further processing of both fractions

Liquid fraction

Remove suspended solids

Clarification and filtration before concentration or further separation

Concentrate or separate

Water removal or target molecule collection

Check recovered product

Composition, stability and
Performance analytics
Application of the product

Solid fraction

Press and wash

Recover retained liquid and reduce carry-over into the solids

Dry or modify

Milling, refining or fibrillation according to the material target

Test material performance

Samples for the intended product and the next processing step

What changes at pilot scale?

A larger trial reveals the constraints that a small sample may hide

Feed handling and mixing

Feeding stability, wetting and solids transport

Heating and cooling

Time to temperature and the full process cycle

Separation

Filtration rates, plugging and retained liquid

Repeatability and recovery

Variation between runs and losses at each step



Evidence for the next scale

Process evidence

Dry feed, recovered fractions
and identified losses

Conditions, rates, cycle times
and observed bottlenecks

Product evidence

Composition and quality
of the liquid and solid fractions

Performance against the agreed
customer specification

Data for mill investments, upscaling, technology readiness

A joint pilot campaign

01

Define the brief

Agree specifications

02

Select conditions

Discuss suitable conditions

03

Run the pilot

Analyze samples and data

04

Assess the new information

Agree next step



Planning your pilot

Useful starting information

Feedstocks
Target fraction and application
Current results and main process challenges
Sample requirement and next scale

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Extraction and Fractionation Pilot Facilities seminar

Practical up-scaling & testing route with LUKE and KCL

Raw material examples
- Logging residue
- Agricultural waste
- Wood bark
- Hulls
- Berries
- Wood chips
- Pine and spruce needles

Mechanical processing via
e.g. Hammermilling or shredding
- Laboratory scale 50-1000 grams
- Pilot scale 50-1000 kg

Extraction or fractionation
- Batch 300L or 4000L in high pressure
- Continuous 10, 450 or 2200 L high solids
- Batch atmospheric heated 10 000L mixed extraction

Extracted liquids processing via
e.g. membrane filtration or screens
- Removal of insoluble solids
- Concentration of extractives
- Separation of compounds

Extracted solids processing via
e.g. presses or milling
- Further pressing or extracting
- Drying & crushing to powders
- Further processing as raw materials

Products for e.g.
Food additives
Fertilizers
Feed compounds
Cosmetics
Medicinal compounds

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Scale up the process – and both material streams

Connect raw material preparation, extraction and downstream processing in one pilot route.



SELECT THE PILOT ROUTE

Pressurized batch	Atmospheric continuous	Atmospheric mixed batch
300 / 4,000 L	**10 / 450 / 2,200 L**	**10,000 L**
Extraction • fractionation • digesting	High-solids extraction • washing	Heated extraction • mixing

Equipment volumes, not throughput. Working charge and operating conditions are defined for each trial.

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What needs to work beyond the laboratory?

A proposed trial brief

USE THE PILOT TO TEST

1

Material behaviour

Will the prepared feedstock mix and process as expected at larger scale?

2

Heat transfer & capacity

How do heating, cooling and processing times change when the volume increases?

3

Separation & product demonstration

Can both fractions be processed further and supplied for application testing?

JOINT PILOT CAMPAIGN

Define feedstock & target fractions → Choose the route → Demonstrate the process

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Service for the Extraction & Fractionation ecosystem

LUKE & KCL offer the whole extraction and fractionation service from raw material sourcing to products and laboratory analyses

kgs to tons, liters to tens of m3s

Raw material KnowHow
- Sourcing
- Composition
- Material strategies

Preparation
- Particle size reduction
- Drying
- Steaming, mixing, heating etc.

Extraction & Fractionation
- Pressurized batch extraction / fractionation / digesting
- Atmospheric continuous high solids content extraction / washing / chemical treatment
- CO2 extraction (limited to 10 L reactor)
- Atmospheric heated mixing processing

Processing of extracted liquids
- Concentration
- Recovery of chemicals/components
- Removal of solids
- Purification

Processing extracted solids
- Fiber processing, Fibrillation, refining
- Bleaching
- Product demonstration

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Challenges and solutions for industry

Real world challenges	Process solutions
Green Chemistry requirements, legislation	Water or green solvent usage
Raw material scarcity / sourcing	Side/waste stream utilization
Material behavior expected vs. actual	Test the actual phenomena
Mixed raw material composition	Utilize specified strategy to get specific compounds
Industrial cooperation (win-win strategies)	Upgrading waste streams and turn them to raw materials
Operability and footprint	Minimizing waste streams and maximize product streams
Investing budgets	Moderate CAPEX and low OPEX in extraction technologies

Composition and feasibility studies can be done in smaller scale

Phenomena, capacity, scalability, heat transfer etc. will manifest in bigger scale
It is also possible to produce larger

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