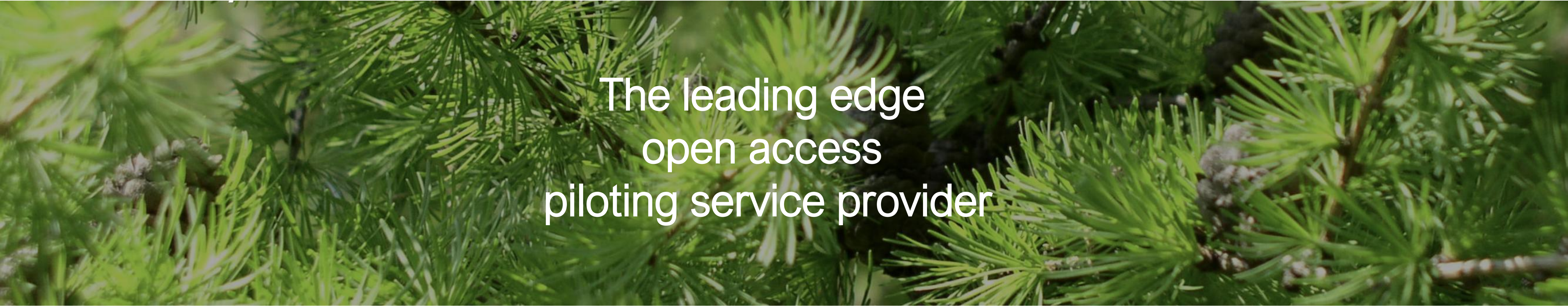


Practical aspects in material processing for recycling

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Outline

- Feedstocks for recycling
- Qualities of valuable circular material
- Material processing steps in recycling
- Practical example: cotton-polyester textile recycling
- Pilot testing for circular material scale-up



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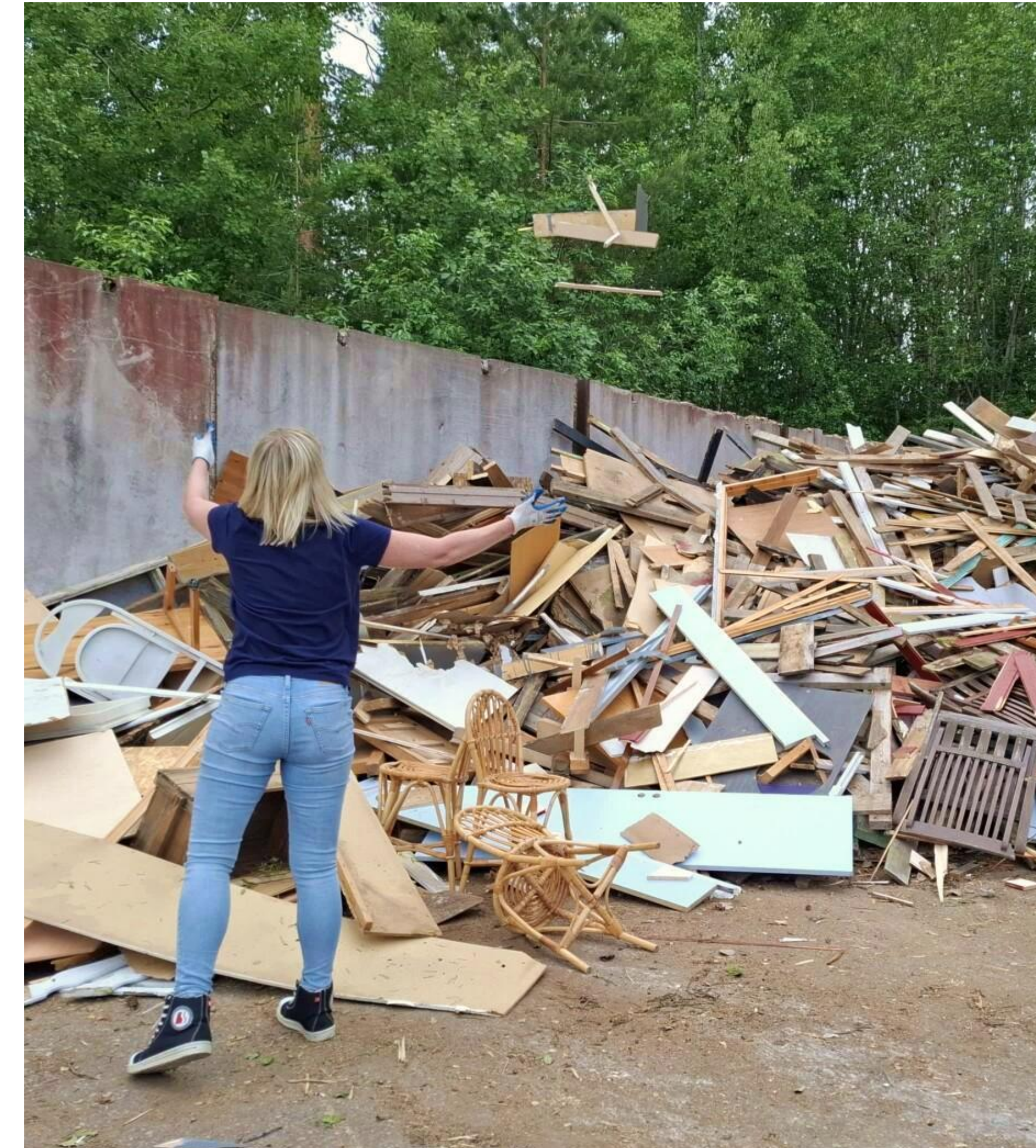


Post-consumer and industrial material streams

- Recycling becomes more challenging once materials become part of broader waste fractions

Case example: end-of-life furniture and composite wood

- Different material compositions: solid wood, fiberboard, particleboard, laminated veneer
 - Surface treatments: coatings, paints, laminates
 - Metal and plastic components: fittings, fasteners
 - Adhesives and resins used in panel production
-
- In practice, a sorting operation is required to get well-defined feeds for further processing.
 - Industrial side streams are better controlled in terms of composition, impurities, and foreign material → more straightforward to process to well-defined circular material



Picture: Rosk'n Roll

What makes a circular material valuable in practice?

Consistency

- Controlled composition
- Batch-to-batch uniformity
- Stability in storage

Cleanliness

- Absence of foreign material
- Target-level purity

Processability

- Homogeneous size and shape
- Predictable behavior in further processing

A circular material becomes valuable when it is not only recovered, but consistently processable and fit for purpose.

Circular material processing steps in practice

Size management

- Shredding / milling / sieving to create a uniform feed

Purification and fractionation

- Washing and extraction to remove impurities and separate valuable components
- For example: hot water, alkali, acid, detergents, enzymes, bleach

Separation and drying

- Screening / filtering / decanting
- Mechanical dewatering
- Thermal drying

Liquid processing

- Recovery of dissolved components
- Water recirculation to upstream processes
- Wastewater volume reduction by concentration

Practical example: cotton-polyester textile recycling

Size reduction

- Produce homogeneous feed for processing

Alkaline treatment with a catalyst

- Solubilize PET

Hot water washing

- Remove the soluble components

Dewatering

- Separate solid and liquid fractions

Circular cotton

Liquid processing

- Recover chemicals and recycle process water



Photo: Nelli Kaskirinne
MSc thesis (KCL)

Pilot testing for circular material scale-up

New material streams with no established industrial process technology

- Generate reliable scaling data for process design and investment decisions

Combining multiple unit operations into one continuous process

- Validate product quality, yields and mass balance in realistic operating conditions

Obtaining representative material batches for end-use qualification

- Produce material in large enough quantities to support demonstration products, market validation, and first commercial steps

From process concept to market acceptance: pilot-scale production enables both technical validation and customer engagement.

Conclusion

Practical aspects in material processing for recycling

- Circular materials become valuable when they are consistent, clean, and processable
- Industrial side streams are typically more straightforward to process because their composition is better controlled
- New circular material streams often lack established industrial processes
- Recycling is rarely a single unit operation, as demonstrated by the cotton-polyester example
- Pilot-scale processing provides important scaling data, mass balances, and enough material for end-use qualifications, even for first commercial steps

Ready to scale your circular material concept? KCL helps you take the next step.



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