

THE CHEMICAL SEPARATION METHODS FOR BIOBASED MATERIALS

LUT University's Chemical Separation Methods (CSM) research group focuses on advanced separation technologies for biorefining and sustainable biomass processing.

The group specializes in separation methods based on molecular-level interactions between dissolved biomass and separation materials. Examples of biomass-derived compounds include monosaccharides and polysaccharides of various origins, polyphenols such as flavonoids and lignin, phytochemicals, organic acids, and proteins.

The group's goal is to advance design and optimization of sustainable separation processes. This is achieved through systematic investigation of fundamental phenomena, acquisition of high-quality experimental data, and the development of predictive models through computational simulation. Model predictions are subsequently validated through bench-scale and mini-pilot-scale experimentation.

The laboratory infrastructure CSM uses allows the group to perform adsorption-based separation processes in columns, with feed volumes ranging from milliliters to tens of liters. This enables the purification of biomass hydrolysate batches of up to tens or even hundreds of liters. CSM has also in its use a continuous chromatography system consisting of several columns that can be used to implement both crossflow processes and Simulated Moving Bed (SMB) processes.

The group also investigates the application of conventional machine learning algorithms and generative artificial intelligence as tools for accelerating process development.



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FOCUS AREAS

Separation process design methodology

Adsorption, ion-exchange, chromatography and liquid-liquid extraction

Continuous chromatographic separation processes (SMB)

Artificial intelligence and machine learning in process development

APPLICATIONS

Lignin removal, recovery, and purification processes. Converting cellulosic wastes into valuable organic acids. Separation and purification of carbohydrates from agricultural and forest biomass.