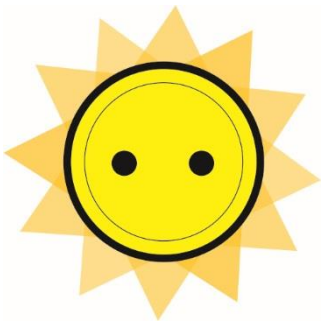

Sustainable production concepts on integrated biorefining industry (SusBioRef)

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Abstract
In this project, the target is to increase the feasibility of industrial ecosystems for sustainable, distributed production of biochemicals and biofuels by developing new hybrid separation systems and improving new value chains for biorefining processes. Add to that, sustainability of biorefining processes utilizing hybrid separation systems will be evaluated. Sustainable production concepts utilizing hybrid separation techniques are evaluated as chosen case studies related to existing bioenergy or biorefining industry: fast and slow pyrolysis and dissolving pulp process.
These case studies tackle the challenges industrial ecosystems are meeting: technical aspects of refining side fractions, economical issues and sustainability of the process itself. The research is focused by three itemized hypotheses: 1) novel, decentralized biorefining systems will beneficiate from the hybrid separation systems, 2) new raw materials and efficiency in industrial side streams use enables more profitable industrial ecosystems functioning, 3) there are significant sustainability

benefits with efficient industrial ecosystems. Value chains for case studies are constructed from raw material to whole array of products, covering the raw material selection and actual treatment of material to valuable biochemical.

From previous studies, it is known that the sustainability of the concepts is highly dependent on the recovery of the valuable components (e.g. furfural, acetic acid, levoglucosan) in the reactor outlet streams. The recovery is enabled by applying energy-efficiently the combination of membrane separation with thermal operations, e.g. distillation and evaporation in this project. Furthermore, different heat pump technologies are applied to improve the energy efficiency of the hybrid concepts. The technical feasibility of the new hybrid separation concepts will be evaluated based on the combination of extensive experimental and modelling work. The experiments will include both vapour permeation and pervaporation testing. The experimental results are used in the formulation of phenomenon-based models to evaluate the feasibility of the new concepts.
For the sustainability analysis, EU accepted, directive 2009/28/EC fulfilling voluntary sustainability tools are used and together with the ecological, social and economical sustainability, the regional economy is taken into account.

Overall, the successful execution of the project will significantly improve the research lines focus on the lignocellulosic biomaterials conversion to biochemicals and accelerate the development of the selected novel biorefinery concepts towards implementation in practice. Decentralized production of energy and biochemicals in the SME companies operating as a member of industrial ecosystem would present one opportunity and model for integrated forest biorefinery in the future.