IMPRESS H2020 project: Towards higher purities of biochemicals by crystallization

Mitra Ila[1]*, Anna Zaykovskaya[1*], Marjatta Louhi-Kultanen[1], Erik Temmel[2], Manfred Stepanski[2], Michael Ginter[3], Ben McKay [4], Siu-Ha Soo-Tang[4], Ed de Jong[4]

[1]Department of Chemical and Metallurgical Engineering, School of Chemical Engineering, Aalto University, Espoo, Finland
[2]Sulzer Chemtech Ltd, Winterthur, Winterthur, Switzerland
[3] Vogelbusch Biocommodities GmbH, Vienna, Austria
[4]Avantium, Amsterdam, Amsterdam, The Netherlands
*mitra.ila@aalto.fi

Keywords: Biochemicals, purification, crystallization

The H2020 Spire IMPRESS project aims to integrate disruptive upstream and downstream technologies in an energy and cost-efficient manner. The IMPRESS concept uses 2nd generation lignocellulosic biomass and turns process streams into value added products and green chemicals to replace existing fossil-based products. The current research covers studies on separation and purification of sugars and sugar alcohols by industrial crystallization.
Since several biochemicals are temperature-sensitive and they may decompose at higher temperatures, the main focus has been solid-liquid separations based on crystallization from multi-component solutions and melts. Therefore, the studied crystallization methods have been melt crystallization and crystallization from solution beside empirical and modelling of the solid-liquid equilibrium and crystallization kinetics.
Melt crystallization is an alternative technique for the production of ultrapure compounds from close boiling and azeotropic mixtures due to its high selectivity towards eutectic organic systems. The production of high purity products from downstream of bioprocesses involves development of a special process based on thermodynamics and kinetics of crystallization.
The aim of the research has been to develop crystallization processes which provide highly pure and the uniform crystalline product in terms of crystal size, shape and structure. Moreover, the targets have been to identify the critical impurities and to create purification and fractional separation technologies with the aim to develop industrial bioproducts and other wood-based and grass-based related production processes to obtain ultrapure final products. Due to low-temperature range operations, the new technologies developed under this project are sustainable and energy-efficient. Furthermore, with the aid of developed approaches, the aim has been to ensure trouble-free operation in biorefineries, which is an essential required outcome for bioproduct processing.

Acknowledgements

The authors would like to thank the European Union's Horizon 2020 Research and Innovation Programme for funding this work within the project IMPRESS under grant agreement No 869993.