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Separation and Purification of High-Value Products by melt crystallization

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Melt crystallization is a cost-effective method for the separation of compounds produced in various industrial sectors to meet high purity standards. Our findings suggests that melt crystallization offers advantages for the purification of azeotrope forming, close boiling point, heat sensitive compounds and high viscosity melts by selective crystallization of the desired compound. Our research is focused on the purification of diols and polyols as important biorefinery products derived from renewable biomass resources.

To develop an efficient crystallization process, the actual driving force of crystallization can be quantified as a measure to optimize the process conditions which ultimately effects the growth kinetics and purity of final products. It also gives insight on the influence of additives/ modifiers employed to remove purification barriers and reducing the need for further purification steps. The actual driving force is the difference in chemical potential of solute between supersaturated and saturated liquid phase [1]. To determine this driving force, the activity coefficient of liquid phase was estimated based on the measured equilibrium phase diagram. The solid-liquid equilibrium data were measured by a dynamic approach (Differential Scanning Calorimetry) or an equilibrium approach depending on the characteristics of the compounds. To optimize an efficient separation, the role of applied driving force was evaluated by studying the layer growth rates against quality of final product.

[1] Valavi, M., Svärd, M., & Rasmuson, Å. C. (2016). Improving Estimates of the Crystallization Driving Force: Investigation into the Dependence on Temperature and Composition of Activity Coefficients in Solution. Crystal Growth & Design, 16(12), 6951–6960. https://doi.org/10.1021/acs.cgd.6b01137

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