

IMPRESS H2020 project: Towards higher purities of biochemicals by crystallization

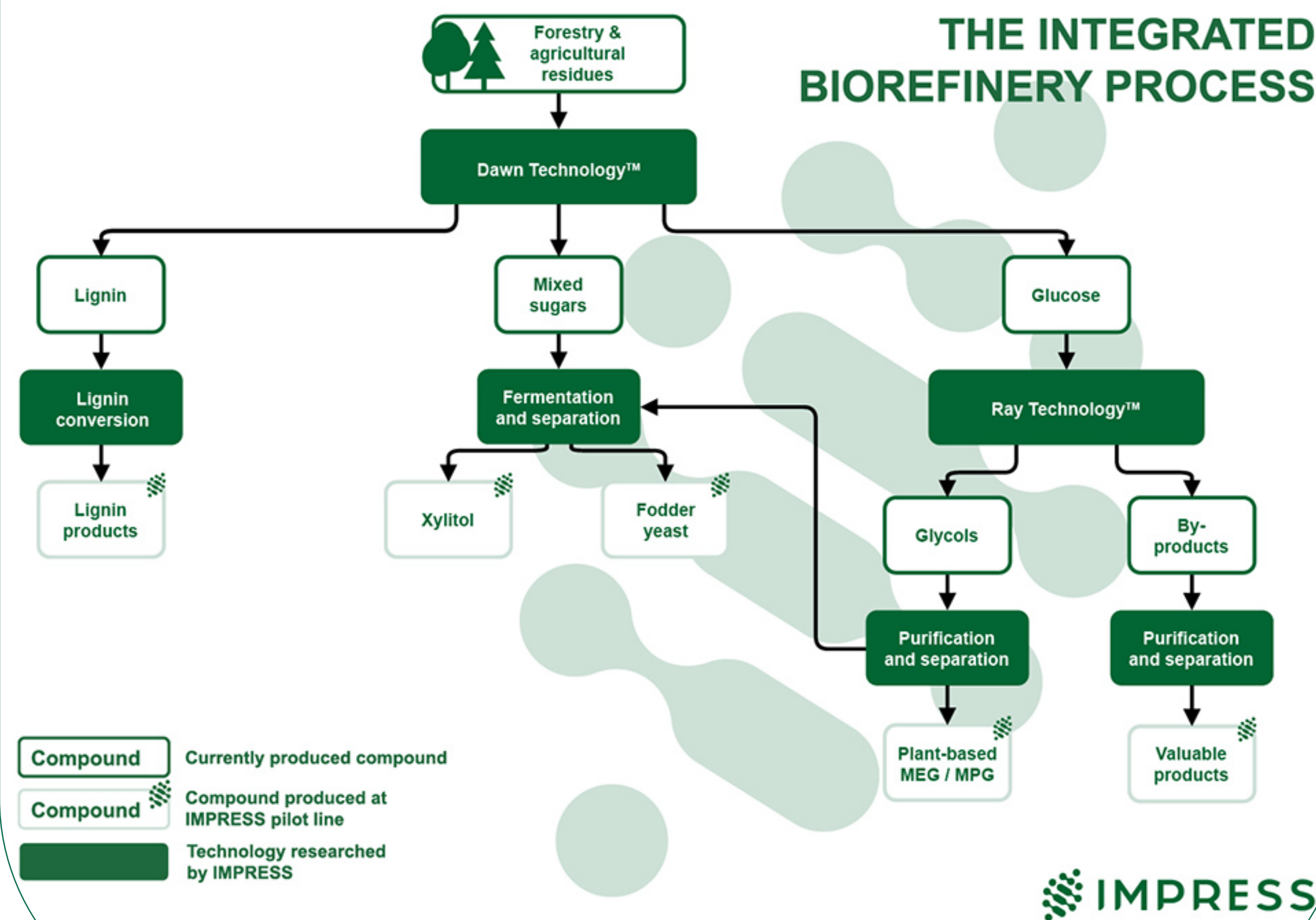
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IMPRESS

Introduction

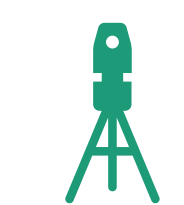
The project aims to develop a hybrid biorefinery process consisting of integrated upstream and downstream technologies in order to refine renewable resources such as non-edible biomass into sustainable bioproducts. The development of separation/purification technique for process streams containing polyols and co-produced impurities is an important stage for production of value-added products.



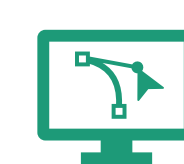
Project objectives



Develop separation and purification methods for Dawn upstream process (Research objective)



Develop and upscale modular downstream processes



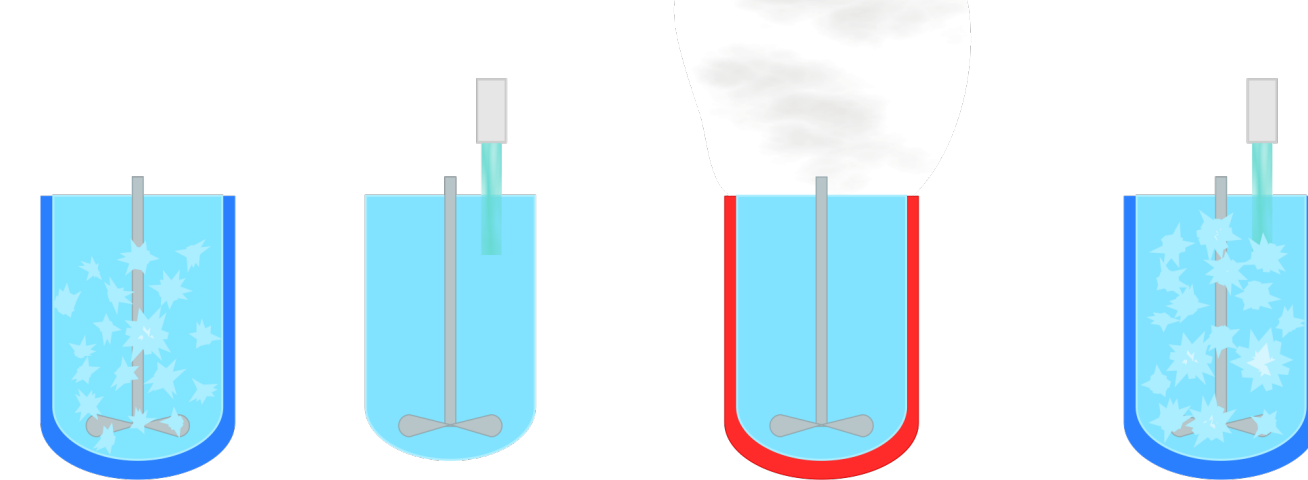
To execute a conceptual process design (CPD), and to prepare an environmental life cycle assessment



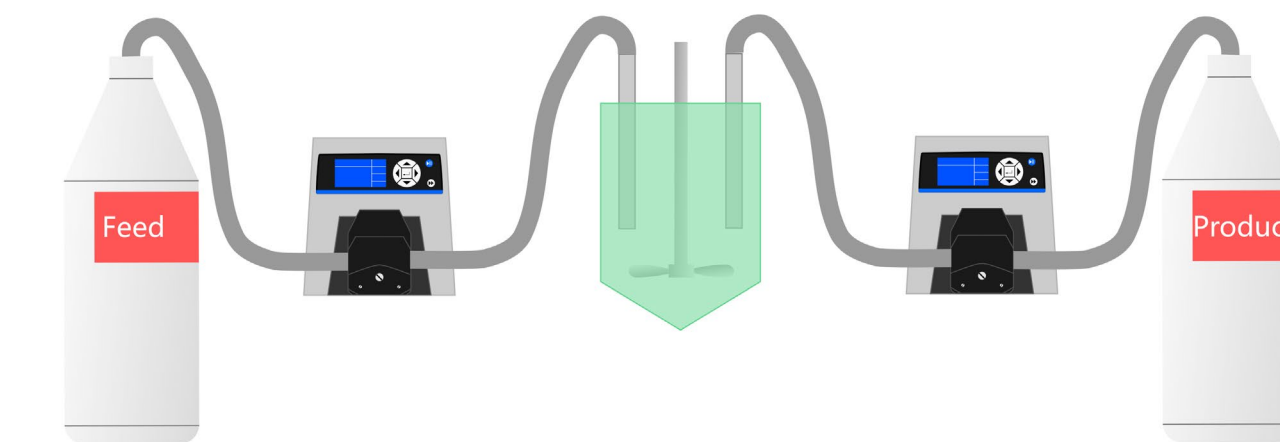
Validate the IMPRESS concept by integrating the upstream and downstream processes

Research methodology

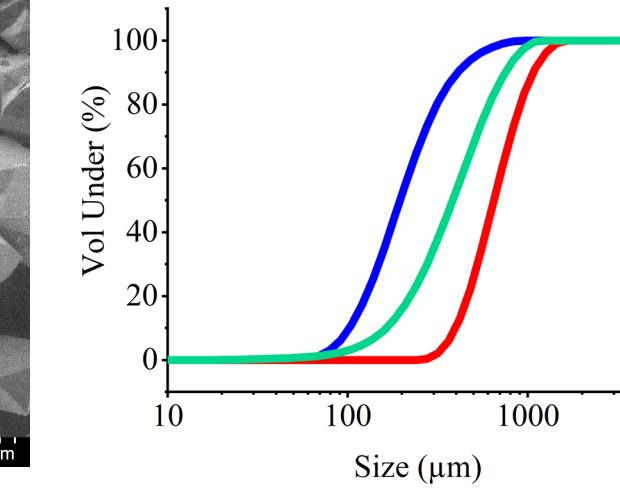
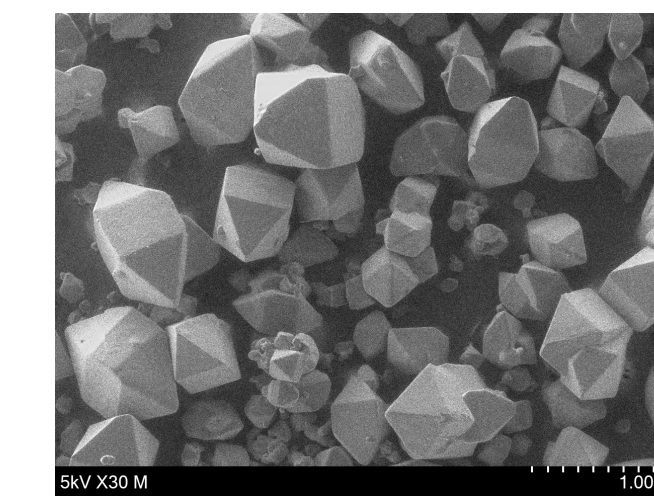
Crystallization from solutions



- Crystallization by cooling, antisolvent, evaporative and cooling crystallization with an antisolvent addition



- Continuous crystallization



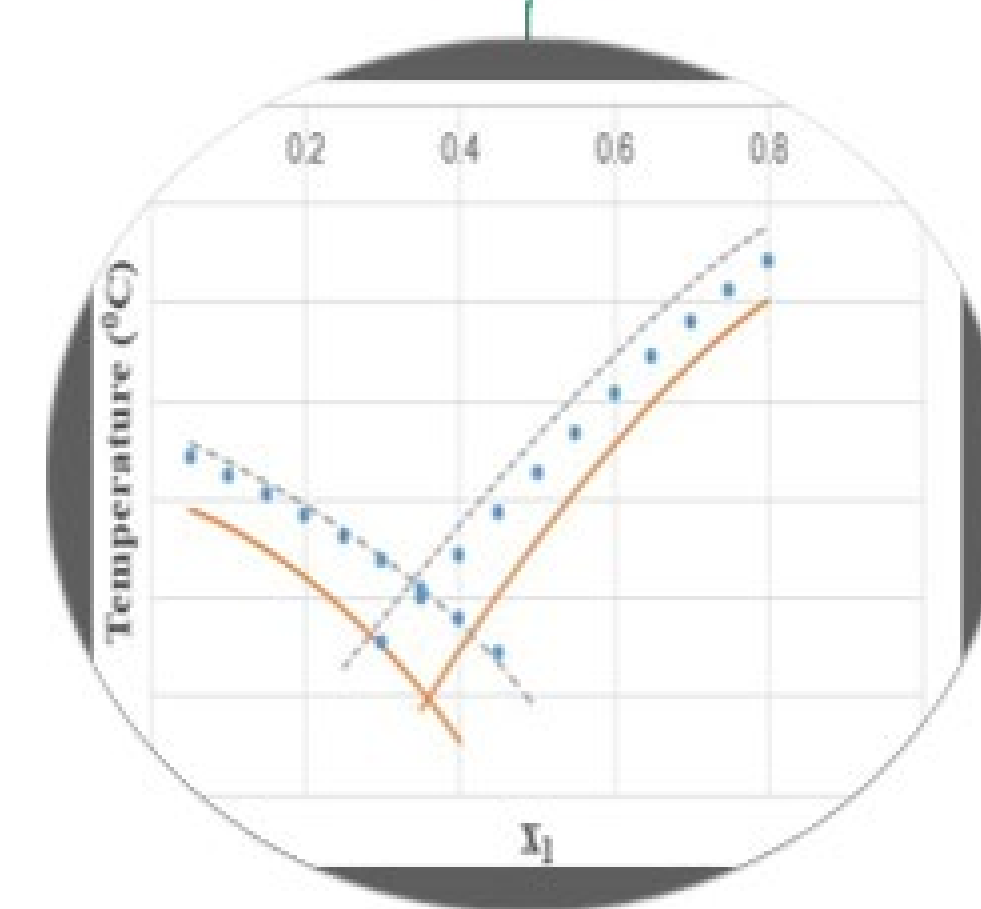
- SEM** and laser diffraction-based crystal size distribution analysis were used for studying **crystal size** and shape whereas **X-ray** powder diffraction was used for crystal structure studies.
- FBRM** was used to provide precise and highly sensitive chord length data collection to capture real-time changes in crystallization.



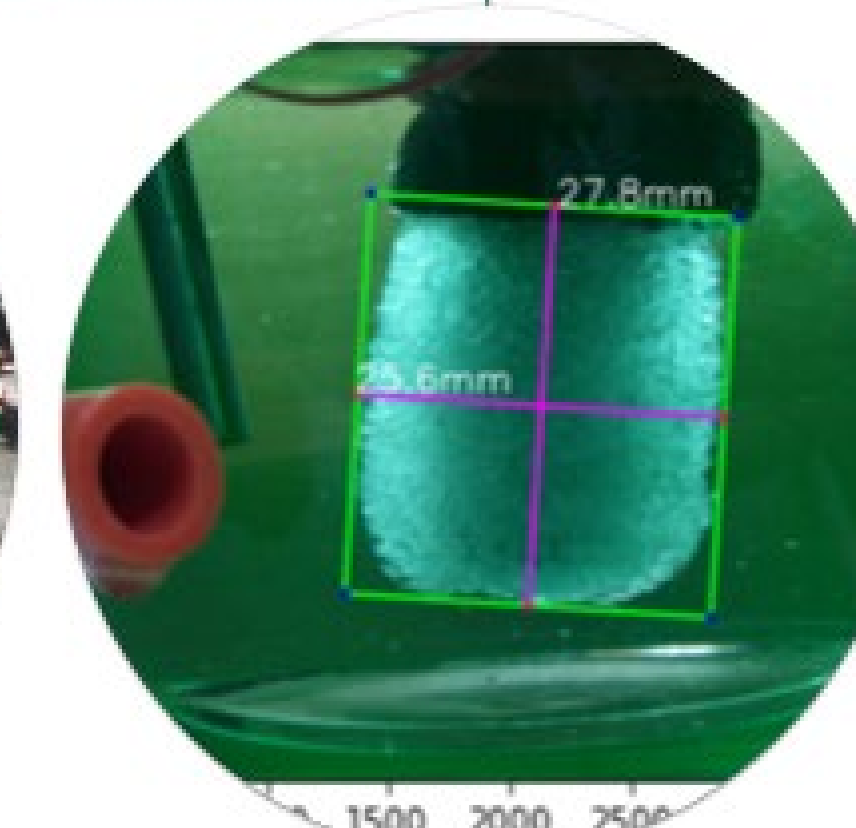
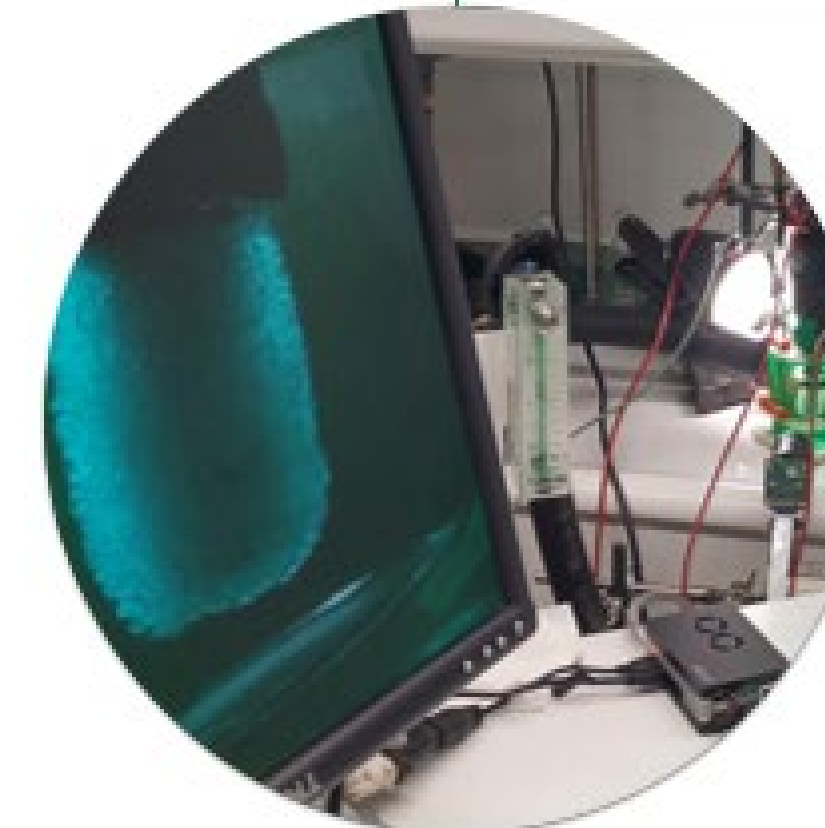
Crystallization from melt



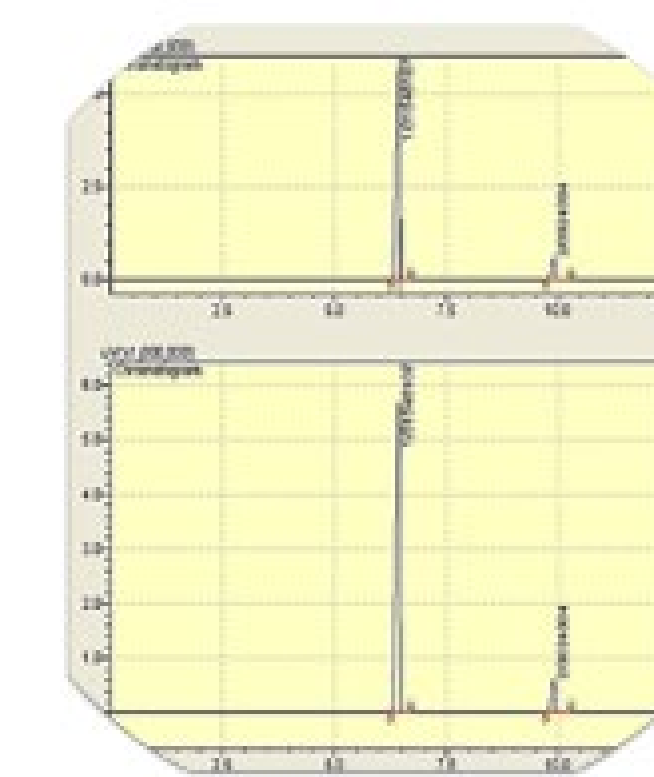
Thermodynamics of crystallization



Kinetics of crystal growth



Product quality



- Estimation of solid-liquid phase equilibria using predictive activity coefficient model (UNIFAC and UNIFAC-DMD model) or development of a semi-empirical model.
- In situ monitoring of melt crystallization process using a modular camera system
- Influence of operating condition on crystal growth rate via image analysis
- Evaluation of crystallization yield
- Impact of thermodynamics and kinetics of crystallization on purity of final product

Discussions

- Developing a promising process for production of chemicals of the desired quality that can replace fossil-based products requires the identification of a suitable crystallization technique, making necessary modifications such as addition of agents and modifier as well as selection of appropriate pre/post-crystallization treatments.
- A comprehensive study on thermodynamics, kinetics of crystallization and analysis of final products under different operating conditions has been done in order to determine the optimum conditions for the intended systems.

Future direction

- Purification of highly impure materials by crystallization
- Influence of impurities on crystal growth rate
- In-depth study of crystallization kinetics by MSMPR model
- Investigation on the role of transport phenomena on growth kinetics of crystals and purification efficiency.

Acknowledgements

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