

Life Cycle Assessment (LCA) in Development of Biorefinery Processes for a Sustainable Development

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In chemical engineering process simulation tools are used to develop and optimize processes in regard to technical and economic aspects, to yield the highest efficiencies or the highest profits. However, to meet the rising urgency for a sustainable development, conventional simulation tools are quickly reaching their limits.

While small, concentrated frameworks are often sufficient in process design and optimization, it is imperative to expand the scope and to take the entire process life time chain, from cradle to grave, into account to analyse the influence on the environment.

Many decisions are yet to be made when a process is just being developed. The “degree of freedom” in this stage is high and switching to alternative process routes is inherently easier. But one has to be aware that naturally more uncertainties are present in this stage of a technology.

To increase independence from fossil resources, biomass based refineries are the centre of interest for many research groups. This innovative technology also is intended to reach a sustainable development and to reduce the environmental burdens like CO₂. There are already different concepts for biomass based refineries and even within one concept there is a selection of process paths to obtain the botanical ingredients in a certain quality.

This study investigates how LCA can help to find the most ecological respectively the sustainable process paths in an early stage of process design using a case study on Biorefinery plant, since the use of renewable materials does not necessarily represent a sustainable development. A hotspot or trend analysis, as well as various life cycle assessment scenarios, can give valuable insights provided that the aspects of the methodology, used in the life cycle assessment, are examined in detail.