XPURE
innovative continuous chromatography

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Techno-economic Evaluation of Adsorption Based Processes in Food and Biochemical Industries

Techno-economic evaluation (TEE) is an approach that helps holistic decision-making during development and optimization of manufacturing processes in food, pharma, chemical, and bio-based industries. In this article, we will present three major overviews, which can help in structuring the development path for **translating optimal technological outcomes into economically viable industrial processes**. The three overviews presented below include:

1. Feedstock and Product overview
2. Process overview
3. Economic overview

Each of these overviews present some fundamental blocks that allow to analyze the requirements and enable the technological outcomes to address the demands.

Feedstock and Product Overview

The primary overview for conceptualizing a feasible process is a feedstock and product overview. Such an overview presents the basic elements to be understood when deriving a product(s) from feedstock. The overview can involve five generic blocks, which include the type of industry, feedstock used by the particular industry, physical properties of the feedstock, required production process, and the final product. In Figure 1 below, an example is presented for the food industry, where the feedstock can be either plant-based or animal-based, where the plant-based feedstock then can involve both solid and liquid streams. Therefore, a process required must enable purification of liquid streams or extraction of valuable components from the solid stream into a liquid stream and further purification. A purification/separation process with suitable technologies will, therefore, define the product quality and resulting value. Like mentioned in Figure 1, a purification process can result in plant-based nutraceuticals, sugars, proteins etc. of different market values and economic potential.

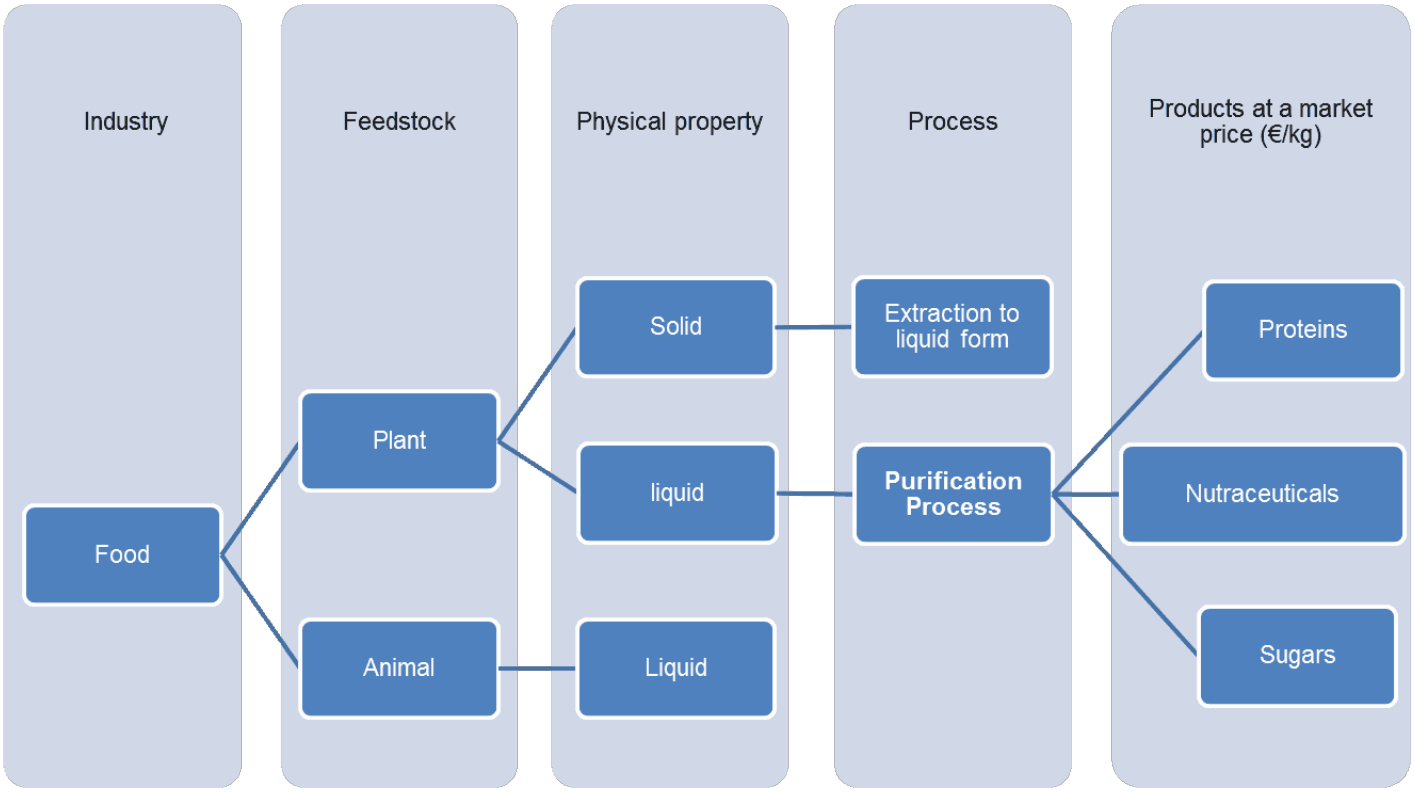

Figure 1. Feedstock and product overview

Process Overview

The feedstock and product overview presents the process targets depending on the specifications of feedstock and the product‘s market requirements. Based on the defined process targets, the process overview can be generated with five generic blocks as described in Figure 2 below. The primary block involves understanding a generic or existing process for manufacturing a specific product from a feedstock. Then, critical factors to be addressed by such a process when optimized are defined in a critical factors block. This is followed by identifying critical process steps, which can have a major impact on the critical factors. The critical factors can always depend on one or more critical process steps. In Figure 2, when the critical step is chromatography, the mode of operation and type of columns used will affect the resulting critical factors. Therefore, a preliminary process development plan needs to be generated to obtain an optimal operating window for the chromatography step to achieve the critical factors.

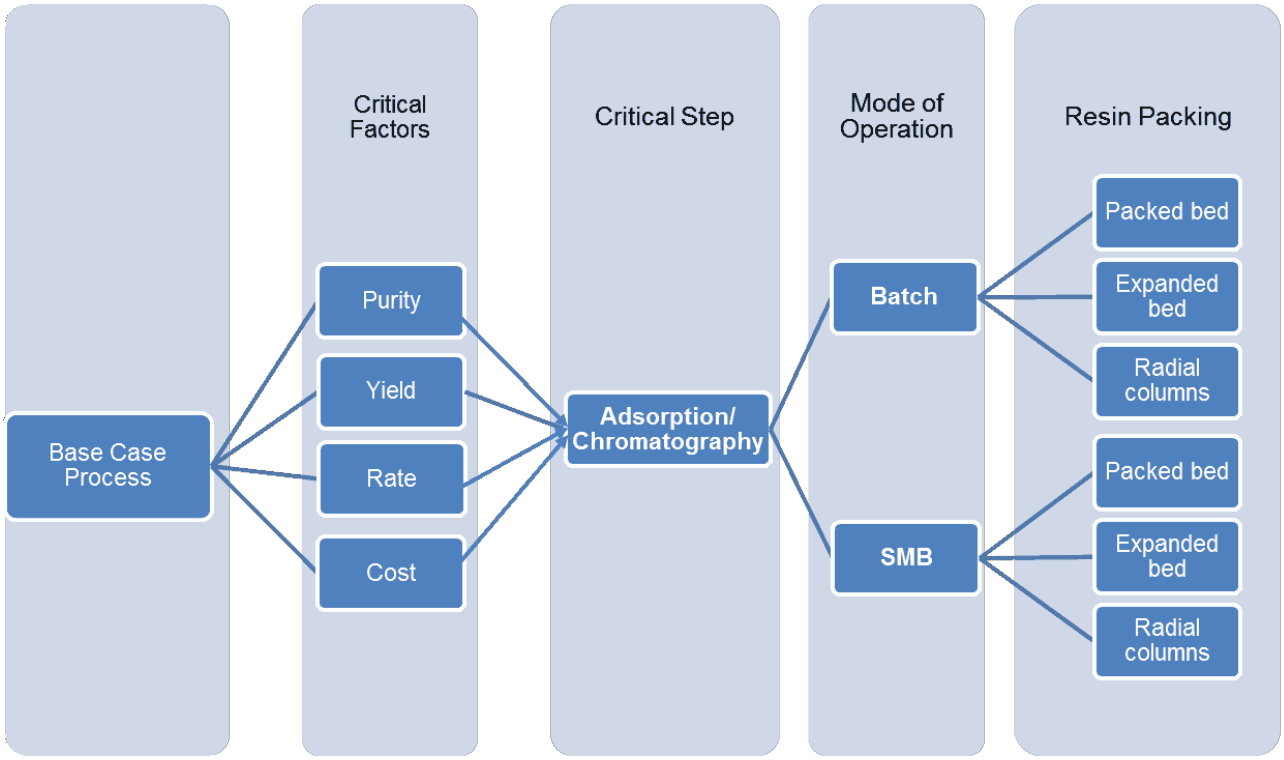

Figure 2. Process Overview (SMB: simulated moving bed)

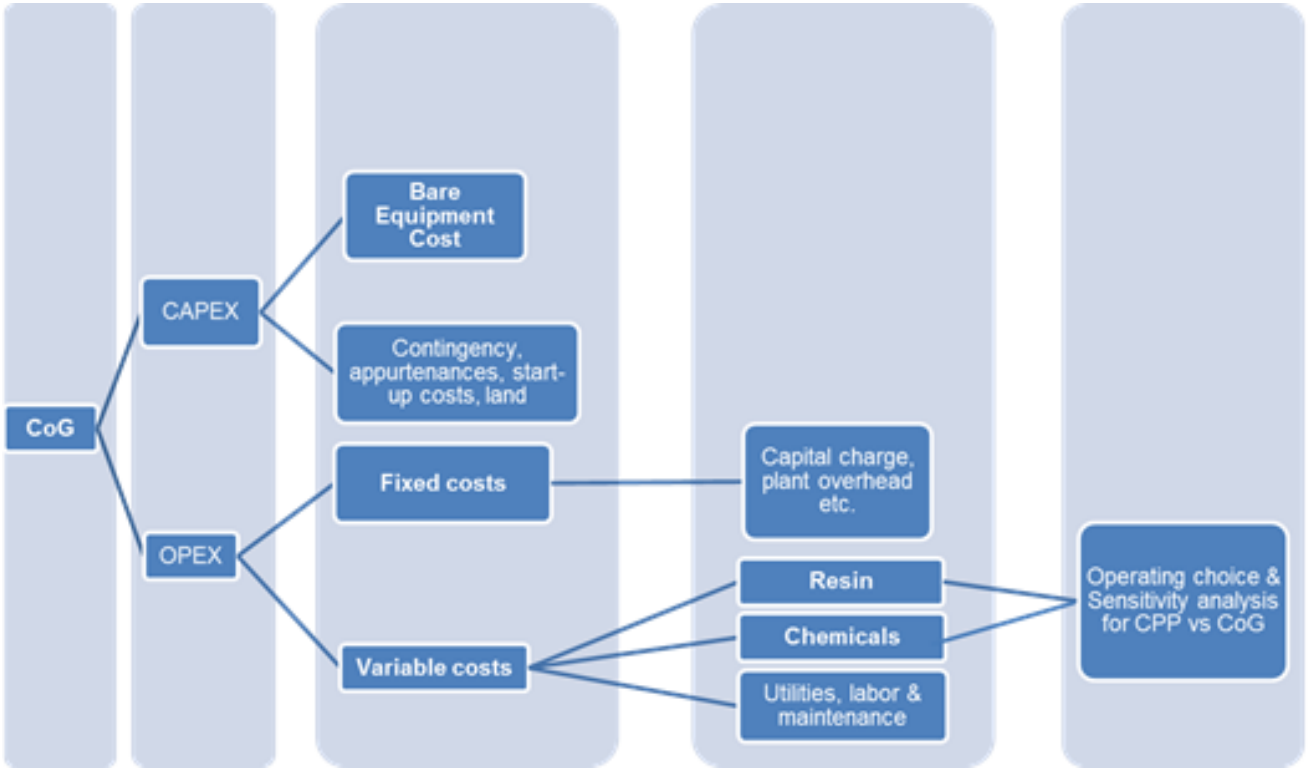

Figure 3. Economic overview (CAPEX: capital expenditure; OPEX: operating expenditure; CPP: critical process parameters; CoG: cost of goods)

Economic Overview

The process development outcome is then incorporated into an economic overview described in Figure 3. Economic overview can then be used to understand the critical cost contributors and further optimize the process to achieve the desired process

economics. As an outcome of the product, process, and economic overviews, a techno-economic optimization strategy can be derived according to Figure 4, further leading to a techno-economically viable manufacturing process.

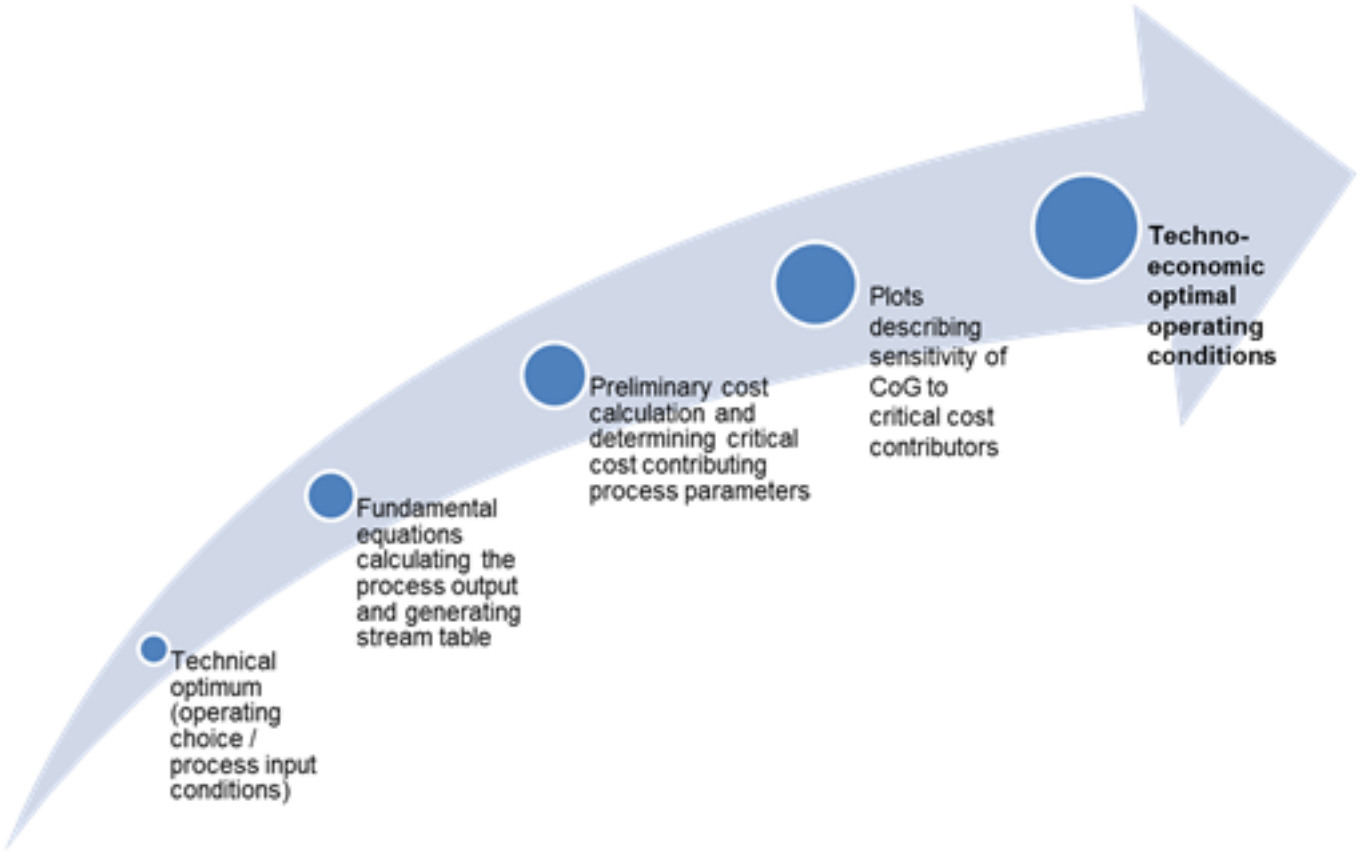

Figure 4. Strategy for techno-economic optimization

For more information on techno-economics and our technologies, please contact us.