Successful design of Bioprocesses: an integrated approach

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**MOTIVATION**

Today, it is generally recognised that THE challenge for bio-based processes is upscaling from pilot or demo scale to commercial scale. Despite massive investments in research and development, many companies often fail to commercialize their innovative bioprocess. In particular, this goes for bioprocesses that often consider new and unproven technologies. The impact on process feasibility, energy consumption, and economics is often not well understood or properly evaluated leading often to commercialization failure.

An important aspect in this matter is that mostly technology, energy, economics, etc. are evaluated separately whilst an integrated approach will reveal changes in economics directly related to changes in the process.

**INTEGRATED APPROACH**

Integrated process design philosophy provides cost-effective development of industrial bioprocesses by combining sophisticated tools, methodologies, and expert knowledge to evaluate bioprocesses in the early research phases. Main characteristics of an integrated approach are:

1. **Early Phase Process Evaluation** (starting at technology readiness level TRL 1)
2. Technology, energy efficiency, and economics are key interconnected process evaluation factors
3. Impact beyond process boundaries is evaluated

The core of our approach is a sophisticated detailed model with the capacity to simulate (bio)processes at different technological and capacity levels. This allows R&D to evaluate their selected technology for feasibility at each moment in development AND understand the impact of different process parameters on energy efficiency, emissions, and the overall economics of the design.

Challenges when upscaling to demo or commercial scale are very often not visible at lab scale. Applying integrated model-based evaluation in early development stages as we propose will reveal these challenges and provide guidance to solve them. Part of this visualization lies the application of Monte Carlo based risk assessment tools.

Risk evaluation provides fact-based information about the nature and magnitude of identified challenges during process development. Our experience and expertise to combine all key parameters in terms of process, economics, energy, and logistics provides the basic needs for successful risk assessment and provide solutions when they most matter: before making the wrong decisions!

**SOLUTION**

The key to successful (bio) process development with respect to technology, sustainability, cost and time to market lies in identifying opportunities, risks and limitations related to technology selection, design and upscaling from day 1 of the process development.

Direct calculation and breakdown of energy demands and carbon emissions (of the ongoing design) is key for comparing different technologies. The integrated approach applies energy analysis tool to locate specific process parameters. Adjustment mostly lead to major energy efficiency improvement.

This is of great importance for the design of bioprocess since their energy demand often leads to economical infeasibility.

**TOOLS AND METHODOLOGIES**

Tools: Advanced process simulation and Economic modeling tools, Energy and Risk Analysis
Knowledge: Science, engineering, heat & process integration, cost estimating, finance & statistics

**CONTACT INFORMATION**

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