BUSINESS CASE FOR CONTINUOUS MAB PRODUCTION WITH NOVEL DESIGN STRATEGIES AND ENHANCED CONTROL

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The biopharmaceutical industry has been gearing up to implement continuous production strategies, aiming to boost productivity and flexibility, while reducing risk of failure, costs and environmental burden. Also, there is a renewed interest in the potential of column-free capture alternatives operated in continuous mAb production, with the purpose of eliminating the high costs associated with protein A resins. On top of these new design opportunities, enhanced quality control, better process performance and, hence, reduced costs can be expected by having automated continuous bioprocesses with higher levels of real-time data collection due to advanced analytical technologies established in-process.

This presentation will showcase the several competencies of UCL's Decisional Tools through two cases studies that evaluate different production flowsheets from economic, environmental and robustness perspectives.
The first case study will address the question "Can column-free alternatives compete with protein A for continuous mAb capture in end-to-end continuous processes?". The major trade-offs will be quantified for integrating continuous precipitation (PP) or aqueous two-phase extraction (ATPE) in integrated continuous bioprocessing (ICB) as alternatives to mAb processes employing continuous protein A chromatography (ProA) as the capture step. The different strategies will be compared based on the cost of goods (COG) and environmental factors in terms of process mass intensity (PMI) for water and consumables as well as lifecycle analysis (LCA) to determine carbon footprint metrics. The major elements influencing each metric will be analysed. Monte Carlo simulations will be shown to compare ProA, PP and ATPE in the face of process variability and give insights on the robustness of different ICB schemes. A target analysis will highlight the process changes required for column-free options to become more cost-effective and sustainable. This helps drive future process development priorities onto the biggest levers of impact.

The second case study will address the question of "How will PAT and enhanced control affect the business case for end-to-end continuous processes of the future?". The current state-of-the-art and biopharma's vision for PAT implementation were investigated by conducting a survey and a series of interviews with worldwide industrial experts (e.g., Amgen, Eli Lilly, GSK and Sanofi) and the answers and key inputs from these contacts will be shared to provide context to the project. The results from an advanced process economics analysis will demonstrate the potential impact of PAT on decreasing production variability and manufacturing costs and reveal the sweet spot in terms of cost-benefit considering technology investment versus COG savings.
The in-depth evaluation of different technologies, flowsheets and scenarios will demonstrate the added value of such a simulation framework for streamlining ICB's route to readiness and industrialisation, while addressing the major challenges and opportunities for new facility designs in biomanufacturing.