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MODEL-BASED PROCESS DEVELOPMENT FOR COMPLEX VACCINE MIXTURES

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The regulations, safety and purity demands are extremely high for vaccine processes and likewise reflected in process development time and cost. Reducing time-to-market is key for pharmaceutical companies, hence saving lives and money, and therefore the need raised for systematic, general and efficient process development strategies (Hanke & Ottens, 2014). Despite the tremendous variation between vaccine purification processes, platform processes for similar types of vaccines could aid to generally accelerate the process development and would be beneficial in terms of knowledge, resources, costs and regulatory aspect. High throughput process development (HTPD) approaches can be used to establish platform processes. HTPD combines high throughput technologies and statistical or mechanistic modeling in an efficient manner. In particular mechanistic models, that aim to describe the real process based upon physical processes occurring, can be of great merit to extend the level of process understanding and thereby support in making decision regarding the process design (Pirrung et al., 2019). Moreover, calibrated mechanistic models decrease the experimental effort by simulating virtual experiments instead and allowing to perform processes on different scales *in-silico*. The vaccine downstream process consists of several purification steps and besides the sequential order and type of purification techniques, the conditions, costs and other performance measurements should also be determined. Most processes are developed and optimized sequentially, however this could lead to a suboptimal process design. Calibrated mechanistic models of each unit operations would enable to change the order of purification steps, adapt the conditions accordingly and hence enable to find the optimal process design. In this poster mechanistic models for a filtration, membrane chromatography and packed bed chromatography are shown.

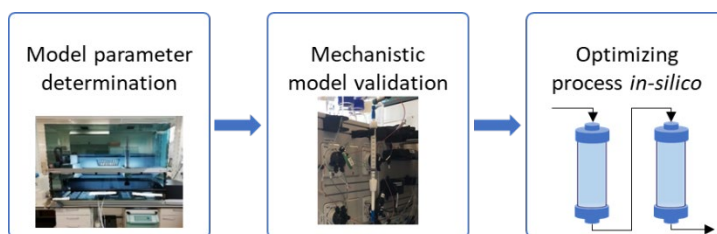


Figure 1. Overview of the model-based HTPD approach in which high throughput methods to determine model parameters are efficiently combined with mechanistic models that can be used to optimize the process *in-silico*.

Hanke, A. T., & Ottens, M. (2014). Purifying biopharmaceuticals: knowledge-based chromatographic process development. *Trends in Biotechnology*, 32(4), 210-220. doi:10.1016/j.tibtech.2014.02.001

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