Advance Biopharma Tech Transfer Using Process Modeling and Simulation

Frequently Asked Questions (FAQs)

FAQs from the webinar, "Advance Biopharma Tech Transfer Using Process Modeling and Simulation"

Q: Does modeling include best practices within its design? How are assumptions and biases avoided?

A: Modeling is a combination of practices and tools. Mechanistic simulators include models for physical properties and unit operations. These models encompass scientific knowledge developed and validated over decades. All models are based on a set of assumptions, which are documented and available to users for review. Best practices for building and calibrating models are available in different forms for users to gain competence.

Q: Does Aspen Plus® leverage bioreactor kinetic models?

A: Yes, Aspen Plus provides off-the-shelf modeling and simulation for bioreactors, including cell culture systems used in biopharma.

Q: Does AspenTech have any use cases for small molecule manufacturing simulators?

A: Yes. Aspen Plus is used by many small molecule pharmaceutical companies to design and optimize processes including common unit operations such as synthesis, distillation, liquid-liquid extraction, crystallization, filtration and others. Aspen Plus is also supported by Aspen Properties™, the industry-leading physical properties system.

Q: How does computation and modeling address instances where first principles models and data driven information do not agree? Does one model take priority?

A: First principles models typically have tunable parameters (i.e., reaction rate coefficient, heat transfer coefficient, etc.) that are calibrated against experimental data. Once calibrated, a goodness of fit check to the data can be used to determine if the first principles model fits the data well. If there is a mismatch, additional mechanisms can be added to the model to make it more complete and flexible—or if you prefer, hybrid modeling can be used where the additional mechanisms are discovered from the data via machine learning.

Q: What have been your observations on how organizations navigate between the two extremes of modeling: Accurate but specific vs. general but flexible?

A: There is no one-size-fits-all solution. We recommend organizations invest in understanding practices, benefits and costs of the different approaches. The teams involved should choose the best approach to a certain problem given a set of decision criteria (i.e., amount of data available, amount of prior knowledge available, project timeline, etc.). Identifying and using the simplest possible model that provides the desired level of accuracy to solve a business problem should always be the goal.

Q: How do we get enough data to train the simulator for new products?

A: We can use an efficient design of experiments (DoE) to obtain experimental data across the design space with very few physical experiments. We then calibrate the first principles model to this data. The calibrated model is used to simulate conditions across the design space for optimization—for instance, to discover the operating conditions that maximize product yield while achieving target value for critical quality attributes (CQAs).

Q: What AspenTech products are typically used for computational modeling and simulation (CM&S) in biopharma?

A: Aspen Plus is the primary product used for computational modeling and simulation in biopharma. It supports unit operations such as bioreactors, separation and purification processes. The first principles models can also be augmented with machine learning via hybrid modeling. This enables complex unit operations to be modeled through a combination of first principles and machine learning. Aspen Batch Process Developer™ is a complementary solution to enable scale-up and tech transfer of processes using the batch recipe as the basis for the model.

Q: Are there training courses available to learn how to apply AspenTech products to biopharma processes?

A: For a quick overview of the Aspen Plus solutions for biopharma, we encourage you to watch the on-demand webinar: "Advance Biopharma Tech Transfer Using Process Modeling and Simulation". To learn more about mechanistic modeling, we suggest you explore the e-learning modules and flowsheet templates that are available to help users get started.

Q: Do you perform uncertainty analysis to validate your mechanistic models, especially when using an unstructured approach?

A: Uncertainty analysis can be performed by users with embedded capabilities in the simulators or via connected applications.

Q: Models are usually simplifications of reality, for example unstructured models, linear models, etc. Is there a way to quantify the errors in model outputs, especially when it's used for regulatory compliance?

A: Modeling solutions allow predictions to be compared to experimental data for validation or calibration purposes. Sensitivity analysis can be conducted to assess model predictions based on variations of inputs.

Q: From a regulatory standpoint what has been the reception to including models in the filing, from your experience?

A: Our customers tell us that regulators such as the FDA are very favorable to filings that include models in the documentation to demonstrate the pharma company's deep understanding of how to operate and control the process within the design space.

About Aspen Technology

Aspen Technology, Inc. (NASDAQ: AZPN) is a global software leader helping industries at the forefront of the world's dual challenge meet the increasing demand for resources from a rapidly growing population in a profitable and sustainable manner. AspenTech solutions address complex environments where it is critical to optimize the asset design, operation and maintenance lifecycle. Through our unique combination of deep domain expertise and innovation, customers in capital-intensive industries can run their assets safer, greener, longer and faster to improve their operational excellence.

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