SUPERVISORY CONTROL OF INTEGRATED CONTINUOUS DOWNSTREAM PROCESSES

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Smart downstream processing can be performed with a sequence of integrated purification steps, which minimize the number of storage tanks and reduce hold-up time. The result is an integrated unit operation sequence that performs straight through processing of the target protein, with minimal time from expression to formulation. This downstream processing technique is well suited to be connected to a continuous upstream process based on perfusion. To develop these kinds of processes it is important to do studies in small-scale in a convenient way. This paper presents a methodology for supervisory control of integrated continuous downstream processes in lab-scale.

A general platform in lab-scale for sequential processing of integrated downstream processes is developed using ÄKTA/UNICORN-systems. The modification of the physical setup to handle multiple processing steps in sequence on one single machine makes it possible to study advanced and complex process configurations without a lot of resources. To make it easy to program and run the complicated setup a new supervisory controller is developed on top of UNICORN. The new controller, called **orbit**, is extendable and flexible to handle very different configurations and processes. To facilitate the usage even further the actual controller code is automatically generated from a high level presentation of the separation problem. Tools for design, control and verification makes it possible to virtual test the concept before making the actual experiment. The power of this concept is illustrated by some case studies.

An industrial case study, with ion exchange step, virus deactivation hold-up and hydrophobic interaction step is operated completely integrated, is seen below. The first gray part is the pool from IEX to hold-up, the second from hold-up to HIC and the third is the product pool from HIC.

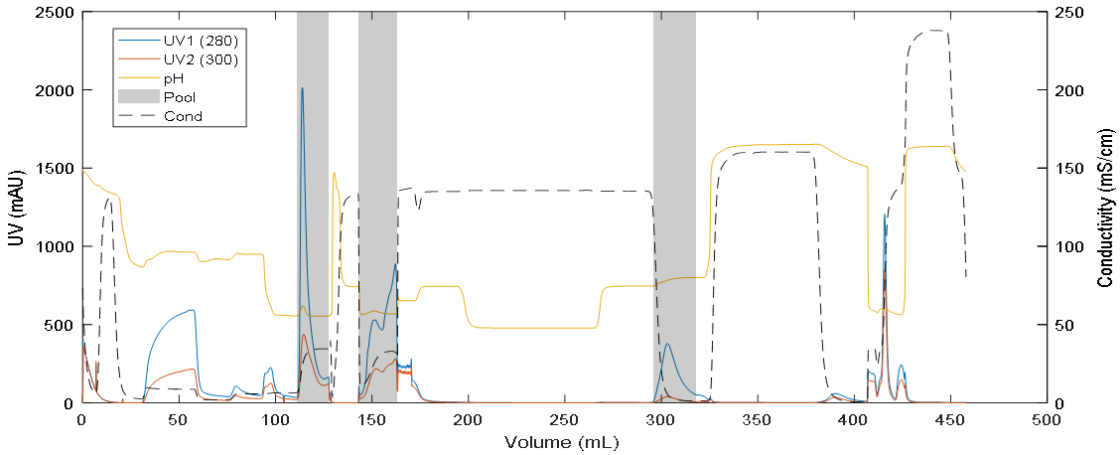

Figure 1 – the chromatogram of an integrated process with IEX-virus deactivation-HIC sequence.