

# Applied SmartFactory<sup>®</sup> Rx Analytics & Control (SFA)

Case Study: Predictive Control to circumvent exhaust filter clogs in 30 & 300 L bioreactors

## SCENARIO

**Client:** Large molecule manufacturer  
**Process:** Batch fermentation for protein production

## CHALLENGE

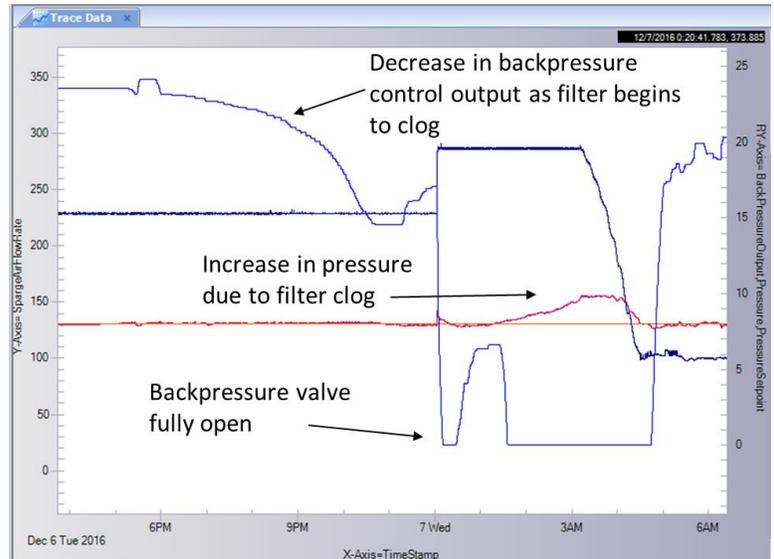
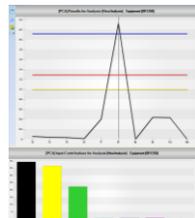
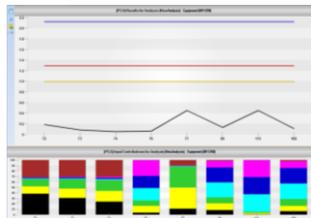


Bioreactor failures during regular operation lead to a significant loss in product and profit. Routine monitoring and PID control do not provide predictive control functionality and there is an essential need to have the capability of predicting what might occur within a batch and then act upon it. A common failure mode in bioreactors is the clogging of exhaust filters which results in over pressurization and lost batches. The goal was to identify parameters and build models that would indicate an exhaust filter was going to clog and take preemptive action. In many bioreactor configurations, redundant exhaust filters are incorporated for such an eventuality but over pressurization occurs before an operator can switch to the secondary filter or effect changes to reduce pressure. The ideal solution must predict the failure and then take action to maintain process parameters within limits.

Bioreactor failures during regular operation lead to a significant loss in product and profit. Routine monitoring and PID control do not provide predictive control functionality and there is an essential need to have the capability of predicting what might occur within a batch and then act upon it. A common failure mode in bioreactors is the clogging of exhaust filters which results in over pressurization and lost batches. The goal was to identify parameters and build models that would indicate an exhaust filter was going to clog and take preemptive action. In many bioreactor configurations, redundant exhaust filters are incorporated for such an eventuality but over pressurization occurs before an operator can switch to the secondary filter or effect changes to reduce pressure. The ideal solution must predict the failure and then take action to maintain process parameters within limits.

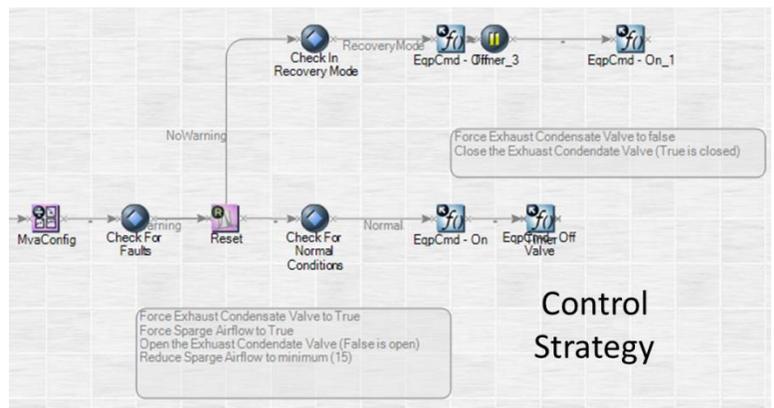
## SOLUTION

Analytics & Control was implemented to generate an MVA model using standard bioreactor parameters monitored during batch processing. The model identified abnormal output to the backpressure control valve based on controller settings, airflow and overlay flow rates.



Analytics & Control interface showing a failed run due to a clogged filter

This model was integrated into a dual fault detection control strategy that identified when an out of limit event occurred and notified operations of a filter issue as well as fed-back into the bioreactor controls to close the loop and automatically effect changes that would save the batch



Analytics & Control drag and drop strategy designer closing the loop

## OUTCOMES

- Triggers alerts for suspect filters with high success rate
- Advanced warning allows for operator involvement to correct for failures before they occur
- Advanced control made possible to maintain parameters within specified limits
- Less lost batches