

## A Study on State Estimation of Acetone-Butanol-Ethanol Fermentation Process using Off-gas Measurement

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In bioprocesses, there exist batch-to-batch variations due to unknown disturbances and cell variability, resulting in unpredictable performance change and decreased process reproducibility. For effectively monitoring these disturbances and controlling the process accordingly, a reliable on-line state measurement is required. However, bioprocesses generally lack on-line sensors which can measure key state variables such as biomass, substrate, and product concentrations. Therefore, they should be estimated using on-line measurable variables. This study investigates estimation of major components' concentrations in continuous acetone-butanol-ethanol (ABE) fermentation with evolved CO<sub>2</sub> gas data which can be easily measured on-line. Based on the previously developed ABE co-fermentation model, an extended Kalman filter (EKF) is employed for the state estimation. The effect of uncertainty in biomass condition or other disturbances (e.g., maximum capacity of adsorbents) is taken into account as a stochastic model in this study.