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Batch production processes pose specific challenges for process monitoring and control. This is due to many reasons including non-linear behaviour, and a relatively poor understanding of the system dynamics [1]. It is therefore challenging for the process engineer to optimise the operation conditions, due to a lack of available process models, and complex interactions between variables which are not easy to define, especially across scales and equipment. There is however a vast amount of batch process data generated, which can be investigated with the aim of identifying desirable process operating conditions, and therefore areas of focus for optimising the process operation. This requires multivariate methods which can utilise the complex datasets which are routinely collected, containing online measured variables and offline sample data.

Fermentation processes are highly sensitive to operational changes, as well as between batch variations, and are therefore an interesting application of multivariate methods. The process dynamics are governed by the combination of process variables, and cannot be fully characterised by individual variables alone [2]. There is also a lack of sensors for key variables which are considered to define the operation [3], which makes traditional modelling a challenge.

Although multivariate techniques are routinely used for chemometric applications, their application to batch processes is less common due to the additional challenges associated with uneven batch lengths and less reproducible data, which has naturally greater variability, as well as high measurement noise. This requires additional preprocessing stages in order to extract the information within such a dataset.

A 30 batch dataset from a production process operating at Novozymes A/S is analysed by multivariate analysis with the aim of predicting the final product concentration, which is measured offline at the end of each batch. By creating a model for product concentration, it is possible to analyse the model results and interpret this to guide process optimisation efforts towards achieving a greater product concentration.

References
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