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Process analytical technologies: Application to biological batch processes

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Process analytical technologies (PAT) have been gaining lot of significance in recent years from modern bioprocess industry as they provide scientific approach for process design & optimization, appropriate sensor & control technologies and chemometric monitoring resulting economic optimality, operational safety and sustainability. Modern bioprocess technology needs more sophisticated techniques and refined instrumentation to monitor its status. Any abnormal deviation in process may result in lower product yields, batch to batch quality variation, thus leading to suboptimal process operation. There can also be a risk of contamination by foreign microorganisms. Hence there is a great need for the development of on-line monitoring and control systems for bioprocess application.

Present paper gives a brief overview on various components of PAT and their importance with relevance to bioprocess application. Further, one of the major components of PAT namely chemometrics has been explored for on-line monitoring of batch bioprocesses. Chemometric analysis provides efficient means of extracting valuable information from the historical process data by using multivariate statistical techniques. An improved chemometric methodology based on local multiway PCA (LMPCA) has been proposed in this work. LMPCA considers the historical database of past successful batches and builds local off-line principal component (PC) models at each sampling instant of batch. On-line process monitoring is done by developing simple statistical process control charts, which are capable of tracking the progress of new batch runs and detecting the occurrence of observable upsets. Simulation results reveal the efficacy of the proposed chemmometric technique for on-line monitoring of a biological batch penicillin production process in resulting improved performance.

Biography

Sumana Chenna has obtained her doctorate degree in chemical engineering from IIT, Bombay. She has been working as scientist at Indian Institute of Chemical Technology, Hyderabad for the past 12 years. She has been serving process industry by providing consultancy for process design, scale-up and technology development. She has published more than 15 papers in reputed international journals and conference proceedings. Her research areas of interest include process systems engineering, mathematical modeling, optimization, monitoring and control of chemical and biochemical processes.

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