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# Process Raman as a PAT tool for Industrial Process Monitoring

Raman spectroscopy is increasingly used as a Process Analytical Technology (PAT) due to its ability to provide rapid, non-destructive, and reagent-free chemical information. However, industrial environments present several challenges, including complex sample matrices, fluorescence, process variability, and changing operating conditions, which can affect measurement robustness and sensitivity.

This work evaluates the performance of a Raman spectroscopy system for industrial process monitoring under representative operating conditions. The influence of sample composition, measurement configuration, and process-related variability on spectral quality and chemical information extraction is investigated. Raman measurements are combined with chemometric methods to assess the capability of the technique to detect compositional changes and monitor key process parameters. Where available, Raman results are compared with reference analytical methods to evaluate model performance and sensitivity.

The results demonstrate that Raman spectroscopy, coupled with appropriate spectral preprocessing and multivariate analysis, provides robust and sensitive monitoring of industrial processes, highlighting its potential for real-time process control and quality assurance across a wide range of applications.

## Online Process Raman

### Real-Time Monitoring: General Workflow

