

Abstract

Gas and liquid phase rapid analysis with near infrared spectroscopy - application in a petrochemical process

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Introduction

A near infrared analyser can measure both liquid and gas samples and is applicable in various petrochemical processes including ethylene plants. Gas chromatography has been commonly used for those processes but measurement time is from 5 to 10 minutes and faster measurement is required to improve the process operation. This report introduces an application of a near infrared analyser for liquid and gas measurement that enables more stable operation with its measurement time of about 1 minute.

Materials and Methods

A NIR analyser (NR800, Yokogawa Electric Corp.) with the sampling unit was installed in the analyser house of the ethylene plant; the analyser measures both liquid and gas phases in the plant. A liquid sample requires a pathlength from 1 to 10 mm whereas the gas sample requires one from 100 to 500 mm. Pre-treatment is done by the sampling unit. For liquid, removing dust and bubbles is important in order to measure stable spectra. For gas, removing oil-mist and stabilising pressure are important. Temperature control is also important for both measurements. 9000-4500 cm⁻¹ was used for PLS modeling and the models can measure hydrocarbons from C1 (methane) to C8 (xylene), respectively. The results from the NIR analyser are sent to a DCS (Distributed Control System) to optimise the industrial process.

Results and Discussion

The models were made with the reference method of a process gas chromatograph (PGC) which was installed at the same point as a NIR analyser. The correlation between NIR and PGC was high enough and the correlation coefficient higher than 0.99. Comparing the online monitoring results, the NIR could detect a concentration change earlier than the PGC.

Conclusion

NIR speed will enable the achievement of better process optimisation than PGC.