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Raman spectroscopy as a tool for simultaneous determination of diesel fuel additives

Various alternative sources are being explored as potential substitutes for conventional diesel fuel in the name of environment and circular economy. However, substitutes that are added to diesel fuel must comply with fuel quality regulations. Therefore, fuel additivation in form of diesel additives is required to maintain high quality fuel properties and its performance [1].
Raman spectroscopy in a combination with multivariate statistical analysis, partial least square algorithm (PLS) [2] was used as a promising tool to determine simultaneously the concentration of three types of diesel additives that improve the cetane number of diesel, the cold-flow properties and the conductivity-lubricating properties of diesel. Used cooking oil, waste tire oil and waste plastic oil was used as a replacement of 20% by volume of conventional diesel fuel. The root mean square error of calibration (RMSEC), root mean square error of cross-validation (RMSECV) and correlation coeffiecient was applied as a basic chemometric diagnostic tools to optimize the PLS models predictions. The calibration samples were equally distributed along the line of the PLS models with significant correlation >0.99.
Thus, Raman spectroscopy could be very promising technique in refinery/industrial applications, especially for online analysis, which could serve as quality control in production, prevent overdoses with diesel additives and save not only money but also time.

References

[1] Fayyazbakhsh, A.; Pirouzfar, V. Comprehensive overview on diesel additives to reduce emissions, enhance fuel properties and improve engine performance. Renewable and Sustainable Energy Reviews 74, (2017), 891-901.

[2] Marinović, S., Krištović, M., Špehar, B. et al. Prediction of diesel fuel properties by vibrational spectroscopy using multivariate analysis. J Anal Chem 67, (2012), 939–949.

Figures

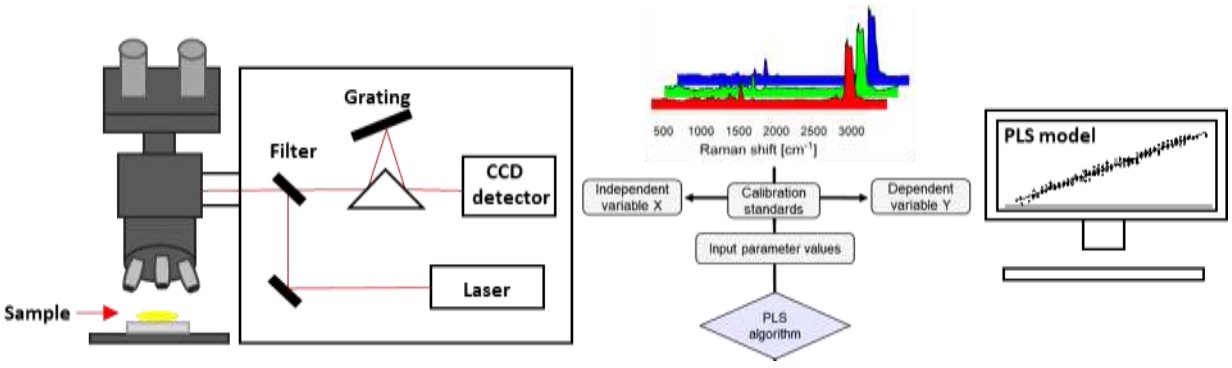

Figure 1: Raman spectroscopy scheme for PLS modelling