On-line prediction of ABS quality parameters fusing NIR and process sensors data using different multiblock approaches

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One of the key issues in petrochemical industry is the high amount of time-consuming laboratory (off-line) analyses performed every day. However, these analyses are crucial for the control of the final product quality over time and for the detection of possible plant faults. In this context, to reduce operators’ effort and chemical wastes and to perform a quick detection of deviations from normal operation conditions, models able to predict in real time the quality parameters of the final products are needed. The main objective of the current study was to apply different multiblock regression approaches, fusing NIR and process sensors data, to compute real time monitoring models for the prediction of two Acrylonitrile-Butadiene-Styrene (ABS) properties. Along the ABS production plant, operating in continuous, four NIR probes were installed on-line in the key areas of the process, in addition to standard process sensors. The data coming from these two types of sensors were arranged in different blocks, one for each area of the process, and fused in a single dataset. Both Multiblock-PLS (MB-PLS) and Response-Oriented Sequential Alternation (ROSA) (Liland et al., 2016) methods were explored to evaluate which were the most important sensors and plant areas for the prediction of the two quality parameters. Multiple prediction models were computed considering data acquired by sensors present in different process areas. Good prediction performance was obtained by means of both multiblock methods that allowed to identifying the most relevant blocks of data for the prediction of ABS quality. Furthermore, prediction yielded by errors models constructed without involving data blocks belonging to the final stage of the process were comparable to those obtained considering all the available data blocks. Hence, a good real time estimation of the ABS quality can be achieved before the product is completed, drastically reducing the off-line laboratory analysis.

**Keywords:** polymer quality prediction; low-level data fusion; multiblock-partial least squares, (MB-PLS); response-oriented sequential alternation (ROSA); multivariate statistical process control; real-time monitoring.

REFERENCES

Liland, K.H., Næs, T., Indahl, U.G., 2016. ROSA—A fast extension of partial least squares regression for multiblock data analysis. J. Chemom., 30, 651–662.