

Monitoring an activated sludge reactor using IR spectroscopy

A. M. A. Dias¹, A. Paulo¹, D. Mesquita¹, M. M. Alves¹, J. A. Lopes², E. C. Ferreira¹

¹IBB-Institute for Biotechnology and Bioengineering,
Centre of Biological Engineering, Universidade do Minho,
Campus de Gualtar, 4710-057, Braga, Portugal

Email: {adias, ana_paulo, daniela, madalena.alves, ecferreira}@deb.uminho.pt

²REQUIMTE, Faculdade de Farmácia,
Universidade do Porto, 4099-030, Porto, Portugal

Email: joaolopes@ff.up.pt

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The advantages of using spectroscopy to monitor biological systems are being increasingly claimed in the open literature. In fact, it is a fast, non-destructive technique that avoids the use of solvents and extra care sampling. Moreover, the development and cost reduction of modern spectrometers also permits the online surveying of the system to be monitored using fiber optics based immersion probes. This can be very important to detect changes as fast as possible helping to optimize the control of a given process. The use of the near and mid-infrared spectroscopic range working in transmission, diffuse reflectance, transmittance or attenuated total reflectance modes, is nowadays found in many applications in agriculture and industry for detection, classification and identification. However, the technique is being far less used for monitoring in wastewater treatment biological systems.

In this work an activated sludge system fed with a high nitrogen content influent was monitored using a compact and portable dispersive near infrared (NIR) spectrometer with an immersion probe system and a Fourier Transform NIR (FTNIR) in order to compare the amount and the quality of the information that is possible to obtain from both methods. The system was monitored during pseudo steady-state conditions and also during perturbations that were induced to the process as instantaneous increases in the inlet charge loads and aeration failures. Due to the large amount of information obtained in both cases, the acquired spectra were treated using chemometric tools that already proved to be efficient for monitoring purposes. Principal Component Analysis (PCA) was used to identify changes in the process while Partial Least Square (PLS) regression was used to correlate the organic matter concentration with the measured spectra. The promising results obtained in this work may encourage the use of these environmentally friendlier methods to monitor and control wastewater treatment systems.

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2