

Modelling of activated sludge process kinetics using a combination of hybrid respirometric and titrimetric data

**Authors:** Britta Petersen, Krist Gernaey and Peter Vanrolleghem

Biomath Department, University Gent, Coupure Links 653, B-9000 Gent (Belgium). Tel +32 9 264 59 32 - Fax +32 9 223 49 41 - E-mail: Peter.Vanrolleghem@rug.ac.be

**Keywords:** Activated sludge, kinetics, modelling, respirometry, titration

### **Summary**

Knowledge of activated sludge biokinetic parameters is important to simulate the behaviour of an activated sludge plant with the commonly used IAWQ models (e.g. Henze *et al.*, 1987). Batch experiments using pulse substrate additions in a small bioreactor are often applied to collect data about activated sludge behaviour. However, many of the experiments that were designed in the past suffer from poor data quality. In this paper the development of a combined hybrid respirometric - titrimetric set-up is presented. Performing experiments in this set-up allows to get high quality data of the biological processes under study as will be shown with several examples. Model based interpretation of these data results in estimates of the kinetic parameters of the different groups of activated sludge bacteria.

### **Materials and Methods**

In the experimental set-up used to collect the data the theoretical hybrid respirometer concept (Vanrolleghem and Spanjers, 1998) was combined with the titrimetric sensor concept proposed by Gernaey *et al.* (1998). Experiments were performed with activated sludge collected on a municipal wastewater treatment plant (Zelee, Belgium). Experiments consisted of monitoring the response of the activated sludge following pulse substrate additions (acetate, ammonium, mixtures of acetate and ammonium, ...). Based on the collected data sets kinetic parameters of heterotrophic and autotrophic (nitrifying) bacteria were estimated using the WEST++ modelling and simulation environment.

### **Overview and discussion of results**

A first series of experiments was performed with single substrate additions of ammonium and acetate. Aim of these tests was to validate the sensor concept: i.e. show that similar results are obtained as with conventional sensors. Based on these experiments kinetics of nitrifying and heterotrophic bacteria were estimated. The results showed that a titration experiment could also give useful information about heterotrophic degradation processes, since a good correlation was obtained between the amount of acetate dosed to the sludge and the amount of acid added to keep the pH in the reactor vessel of the sensor constant. In a second series of experiments mixtures of acetate and ammonium were dosed to activated sludge. Model based interpretation of these data sets resulted in the kinetic parameters of both heterotrophic and autotrophic bacteria based on a single experiment.

### **Conclusions**

A combination of a hybrid respirometric technique and a titration method can be used to perform high quality experiments with activated sludge samples. Titrimetric data are also useful to monitor heterotrophic degradation processes.

### **References**

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