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Modèles biocinétiques de boues activées de type ASM : Analyse théorique et fonctionnelle, vers un jeu de paramètres par défaut

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Abstract

Mathematical modelling of activated sludge systems has become a widely accepted tool and is used in particular for optimization and upgrading of existing plants and for new facilities design, either by engineering and consulting companies, or university and research centers. Ensuring the adequate quality of modelling results is therefore essential. However, an international survey conducted among 96 potential users of activated sludge models (ASM) pointing to two main obstacles to the use of modelling: the selection of the model to use among the available models and the model calibration. The objective of this work was to provide elements to overcome these obstacles and to promote the wider use of biokinetic models for activated sludge systems. It focused on seven published models: (1) ASM1, (2) ASM2d, (3) ASM3, (4) ASM3+BioP, (5) ASM2d+TUD, (6) Barker & Dold and (7) UCTPHO+.

First, an analysis **of practical knowledge** on the models was performed to improve the transfer of modelling knowledge. A database of practical modelling applications from published case studies and from the answers of a questionnaire sent to model users was created. This database enables to establish ranges of parameter values commonly used for the ASM1 and ASM2d.

Then the theoretical knowledge on ASMs was analysed to help users to better understand the seven studied models and to select the model most appropriate to their project. The studied models were first verified and typing errors and inconsistencies have been corrected. The modelling concepts were compared to each other through a new graphical representation, and confronted with knowledge about the biology of activated sludge, in order to highlight the theoretical limits of each model.

Finally, a methodology has been developed to obtain default parameter values that could be used as initial values for model calibration. To this end, an automated calibration procedure that allows calibration on multiple data sets was proposed. Then, the quality criteria used in environmental sciences have been synthesised. These criteria are required to determine the best set of parameters based on the goodness-of-fit of the model and to compare results from different models.