Challenges encountered when expanding activated sludge models: a case study based on N2O production.

It is common practice in wastewater engineering to extend standard activated sludge models (ASMs) with extra process equations derived from batch experiments. However, such experiments have often been performed under conditions different from the ones normally found in wastewater treatment plants (WWTPs). As a consequence, these experiments might not be representative for full-scale performance, and unexpected behaviour may be observed when simulating WWTP models using the derived process equations. In this paper we want to highlight problems encountered using a simplified case study: a modified version of the Activated Sludge Model No. 1 (ASM1) is upgraded with nitrous oxide (N2O) formation by ammonia-oxidizing bacteria. Four different model structures have been implemented in the Benchmark Simulation Model No. 1 (BSM1). The results of the investigations revealed two typical difficulties: problems related to the overall mathematical model structure and problems related to the published set of parameter values. The paper describes the model implementation incompatibilities, the variability in parameter values and the difficulties of reaching similar conditions when simulating a full-scale activated sludge plant. Finally, the simulation results show large differences in oxygen uptake rates, nitritation rates and consequently the quantity of N2O emission (G(N2O)) using the different models.