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Calibration and validation of an activated sludge model for a pilot-scale anoxic/anaerobic/aerobic/post-anoxic process

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Process design

Process flow

Modified A^2/O process

Step-feed strategy

Two internal recycles

Post-anoxic zone

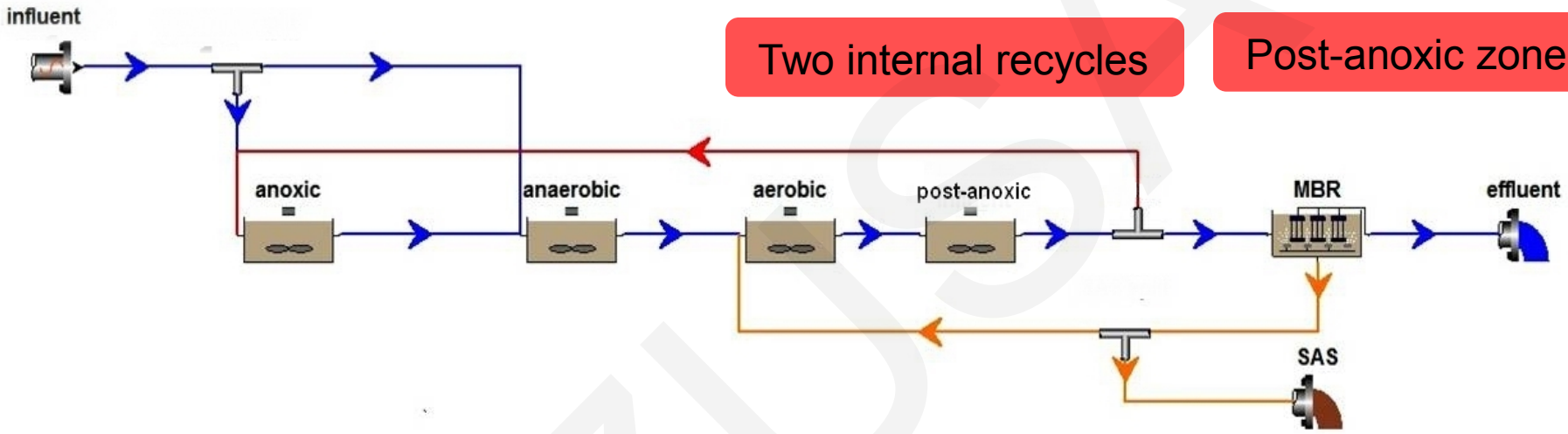


Fig.2 The model configuration of the modified AAO plant in the BioWin simulator







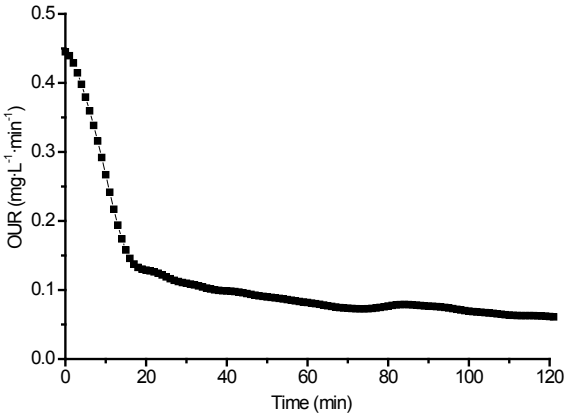
Model calibration

Table 6 Comparison of the default, calibrated, and literature values of the selected parameters

Parameter	Unit	Default value	Calibrated value (steady-state)	Calibrated value (dynamic)	Literature value (Henze et al., 2000; Bizukojc et al., 2011)
AOB					
$b_{aerob,A}$	d^{-1}	0.17	0.74	0.75	0.05~0.15
OHOs					
$\mu_{max,H}$	d^{-1}	3.2	6	5	4~8
b_H	d^{-1}	0.62	0.275	0.275	0.1~0.62
K_S	mg COD/l	5	2.1	2.1	4
Y_H	mgCOD/mgCOD	0.67	0.72	0.72	0.5~0.74
$Y_{H,anoxic}$	mgCOD/mgCOD	0.54	-	0.21	-
PAOs					
$Y_{PAO,aerob}$	mgCOD/mgCOD	0.64	-	0.50	0.5-0.625

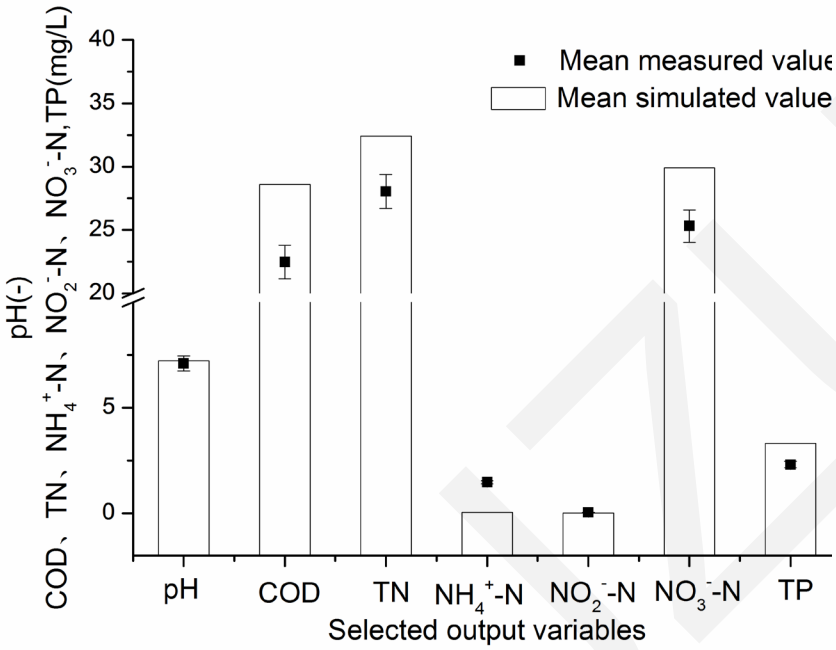
The calibration of Y_H and b_H for the heterotrophic biomass was carried out based on the respirometric measurements.

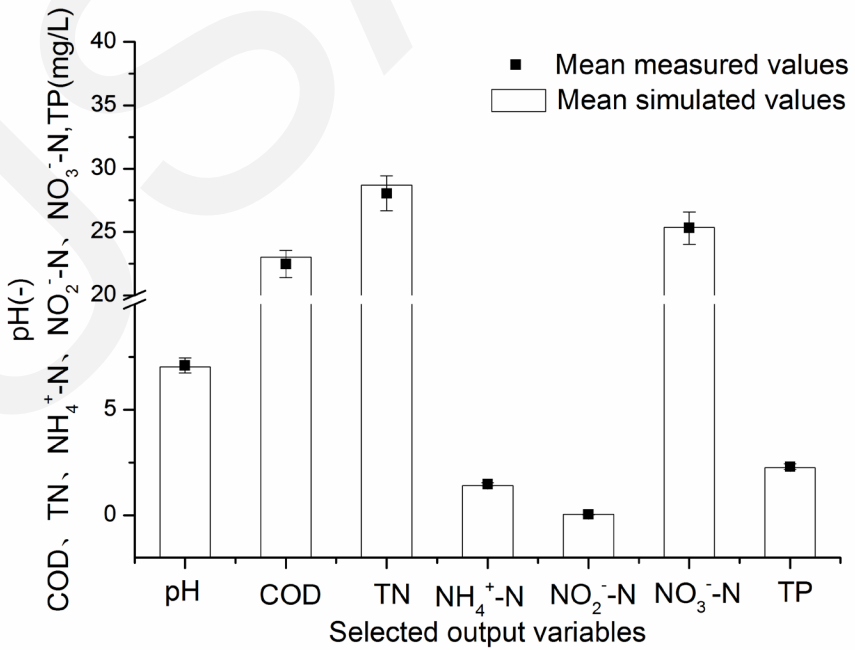
The other four parameters ($b_{aerob,A}$ for AOB, μ_{maxH}, $Y_{H,anoxic}$ for OHOs and $Y_{PAO,aerob}$ for PAOs) were calibrated directly through modification of the default values.



Model simulations

Preliminary steady-state simulations → **Calibrated simulations**

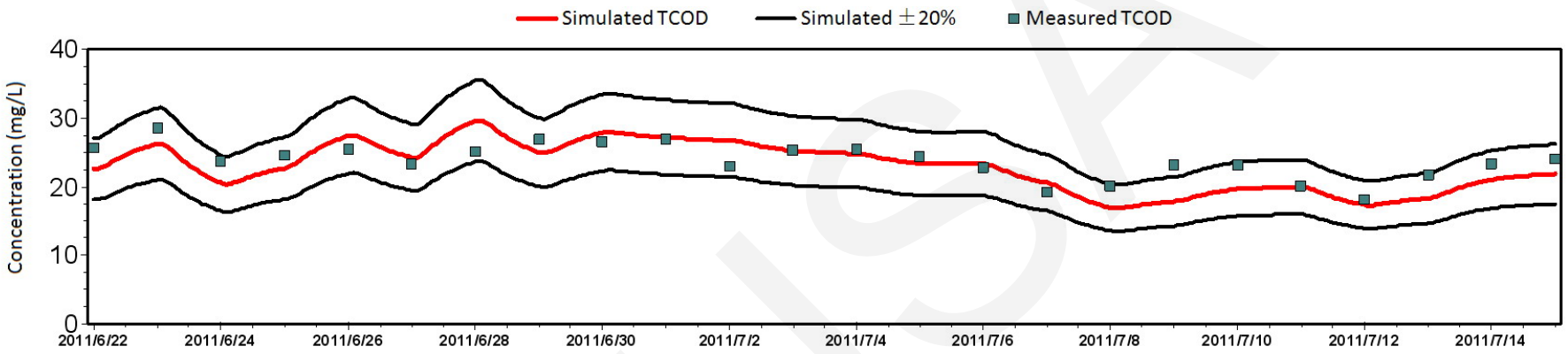




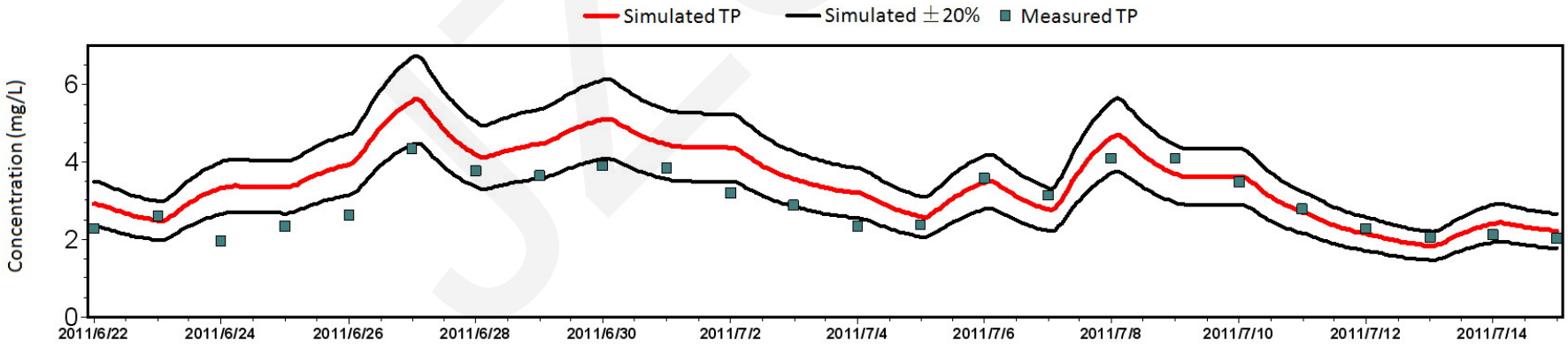
Measured data vs. simulated values of the selected output variables in the effluent using the default values (Fig. 4) and the calibrated values (Fig. 5)

Dynamic simulations (Fig. 6)

TCOD

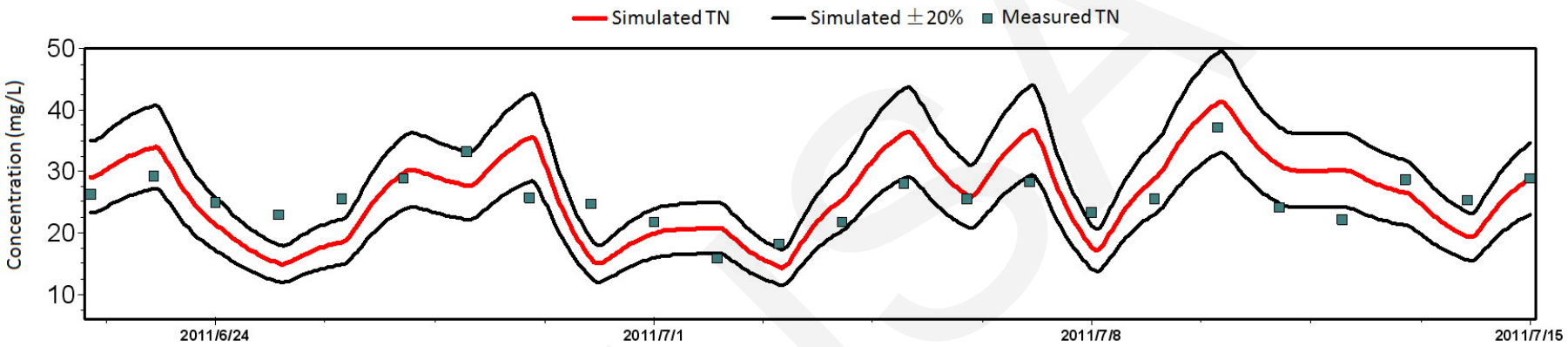


TP

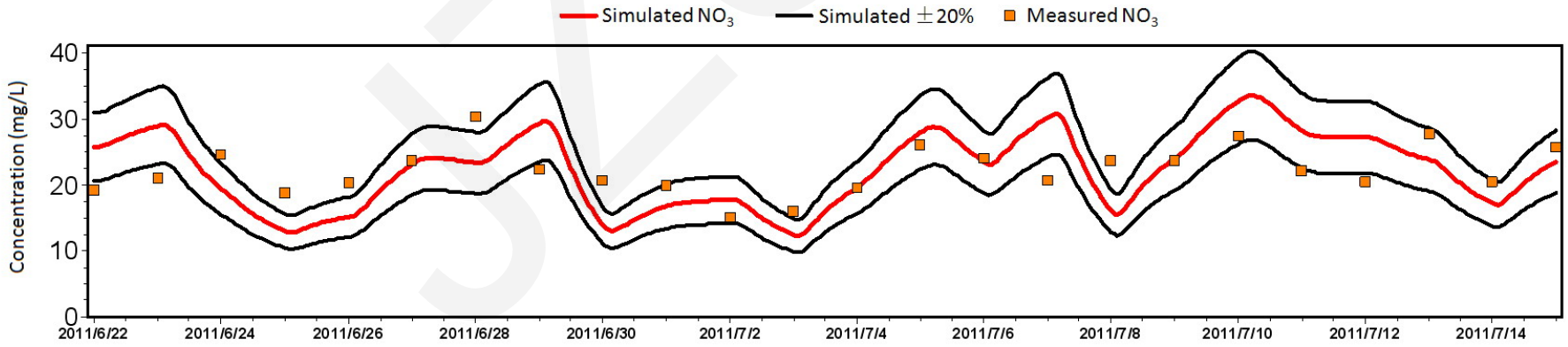


Dynamic simulations (Fig. 6)

TN



NO_3



Conclusions

Successful calibration was demonstrated by the fact that none of the simulated values exceeded the confidence intervals estimated for the effluent characteristics (pH, COD, TN, NH_4^+-N, NO_2^--N, NO_3^--N, and TP) in the steady-state simulation. In the dynamic simulations, the calibrated model was capable of generally tracking the effluent concentration, predicting the effluent quality (TCOD, NO_3^--N, TN and TP) within the range of 0-20%.

With the calibrated model, more scenarios can be tested to provide insight into the pilot-scale modified AAO process, as well as information needed to optimize the design and operation when applied at full-scale.

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