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# Stochastic evolutionary-based optimization for rapid diagnosis and energy-saving in pilot- and full-scale Carrousel oxidation ditches

Li, L



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## Supporting Information

# Real-time simulation and stochastic evolutionary-based optimization in pilot-scale and full-scale Carrousel oxidation ditches

Li Li[a], Li Lei[a], Jinren Ni[a]*, Maosheng Zheng[a], Alistair G. L. Borthwick[b]

[a] Department of Environmental Engineering, Peking University; Key Laboratory of Water and Sediment Sciences, Ministry of Education, Beijing 100871, China

[b] Institute of Energy Systems, School of Engineering, The University of Edinburgh, The King's Buildings, Edinburgh EH9 3JL, United Kingdom.

*Corresponding author:

Jinren Ni;

Ying Jie Communication Center 417N, Peking University, Beijing 100871, China;

Tel.: +86-10-62751185;

E-mail address: jinrenni@pku.edu.cn

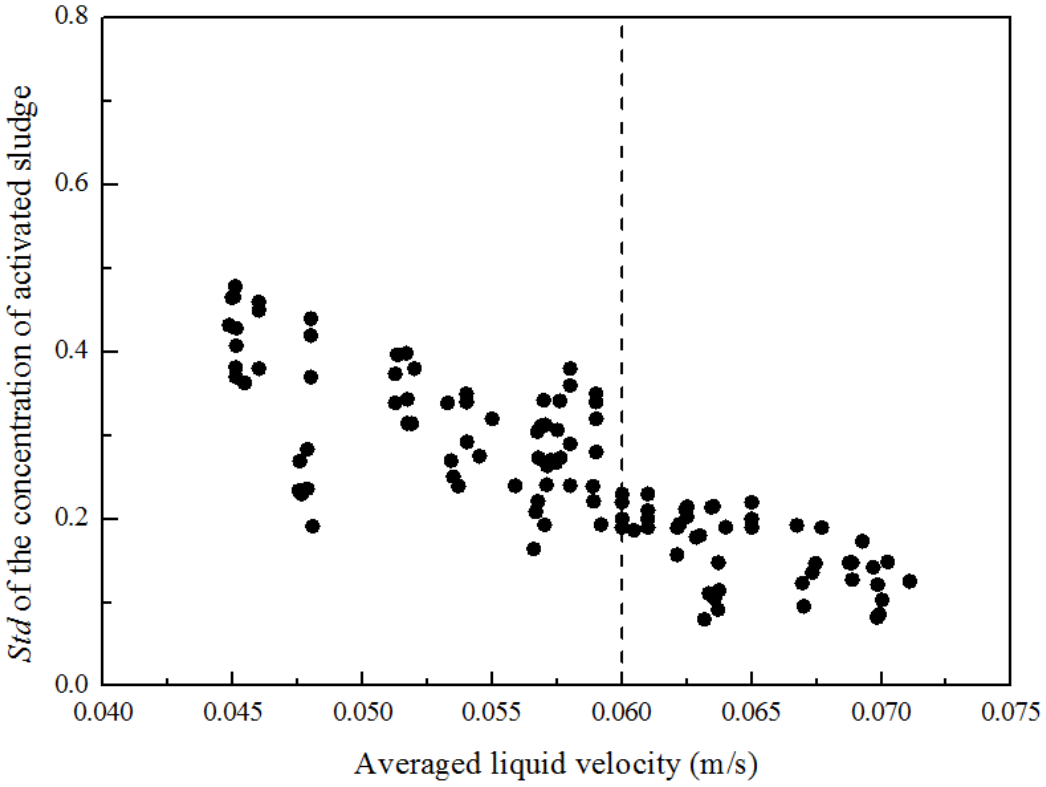


**Fig. S1 Correlation between averaged liquid velocity and standard deviation of MLSS concentration over a range of operational modes in a pilot-scale oxidation ditch.**

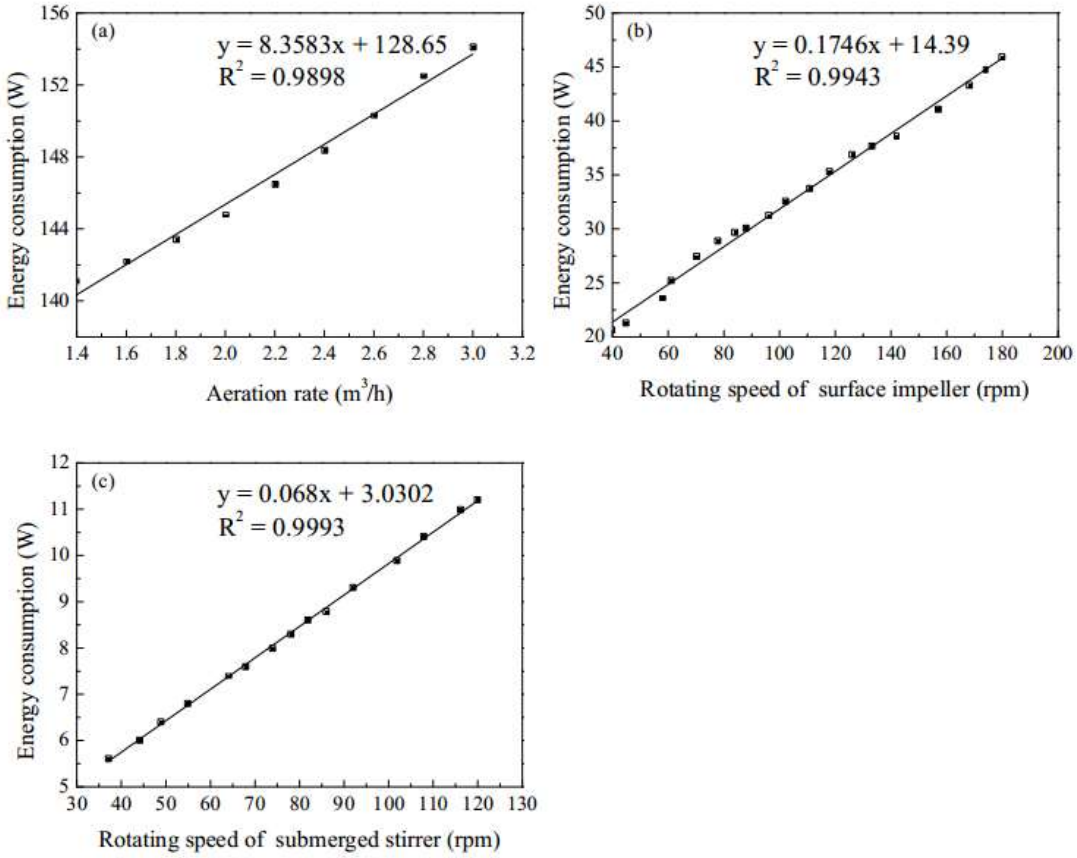


**Fig. S2 Energy consumption of: (a) aeration device, (b) surface impeller, and (c) submerged stirrer over the operational range of the pilot-scale OD.**

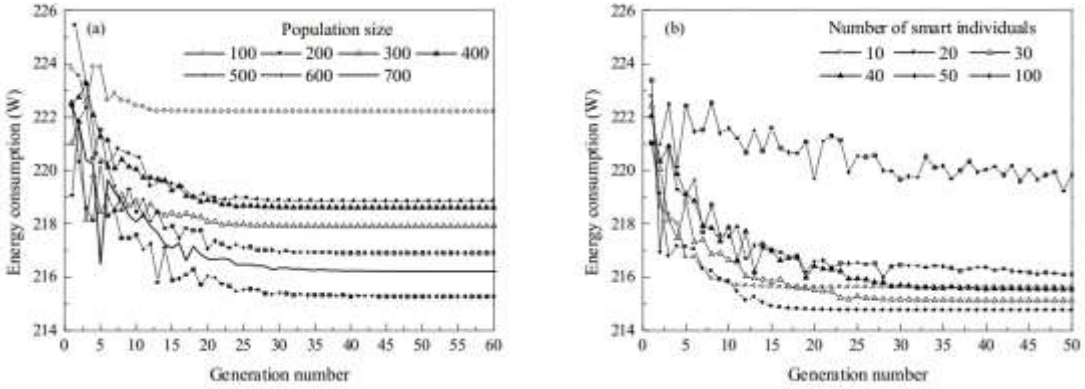


**Fig. S3 Effect of (a) population size and (b) number of smart individuals on the optimization results obtained by the AGA module for the pilot-scale OD.**

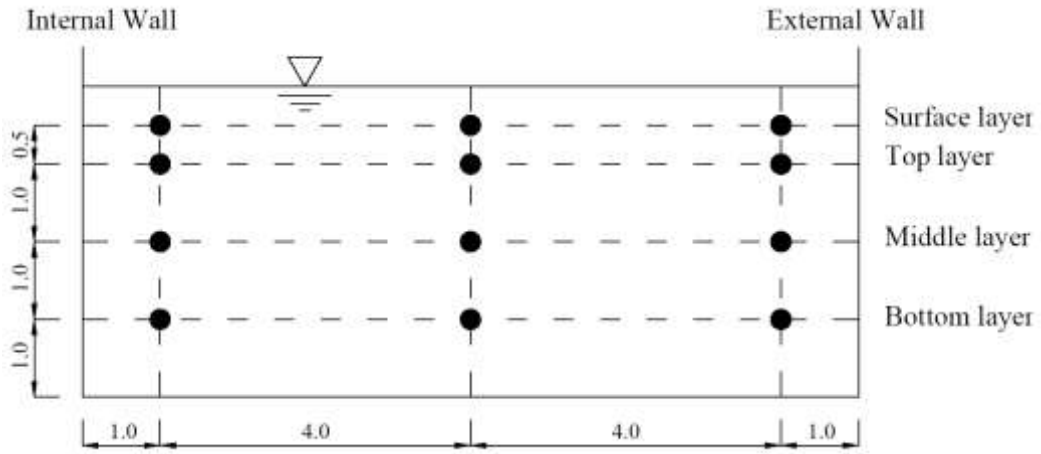


**Fig. S4 Sketch indicating sampling locations in the full-scale oxidation ditch at Ping Dngshan, Henan Province, China (Unit: m).**

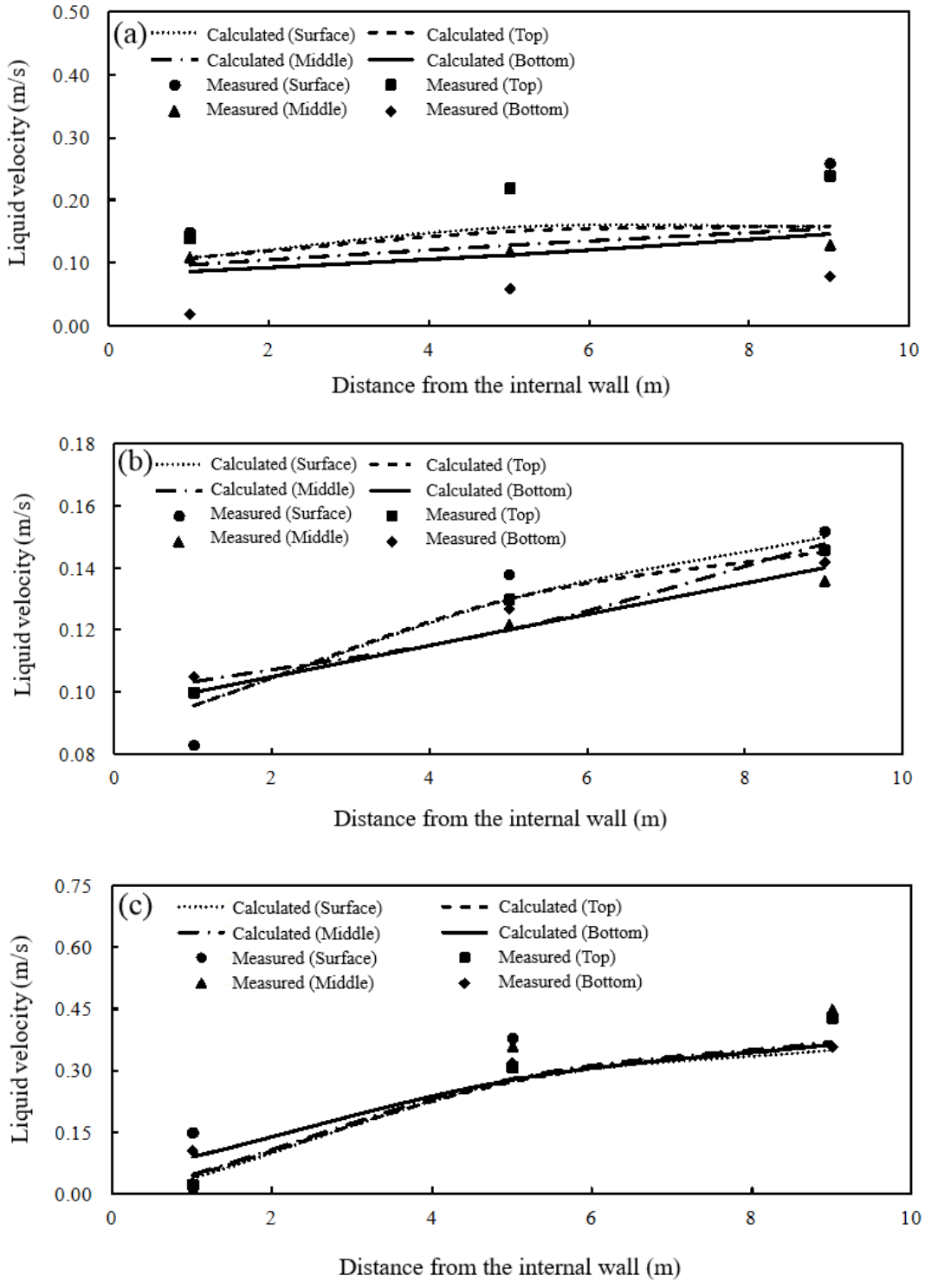


**Fig. S5 Predicted and measured transverse profiles under existing operating conditions of horizontal liquid speed across: (a) Section 1-1, (b) Section 2-2, and (c) Section 3-3 of the full-scale OD at Ping Dingshan, Henan Province, China.**

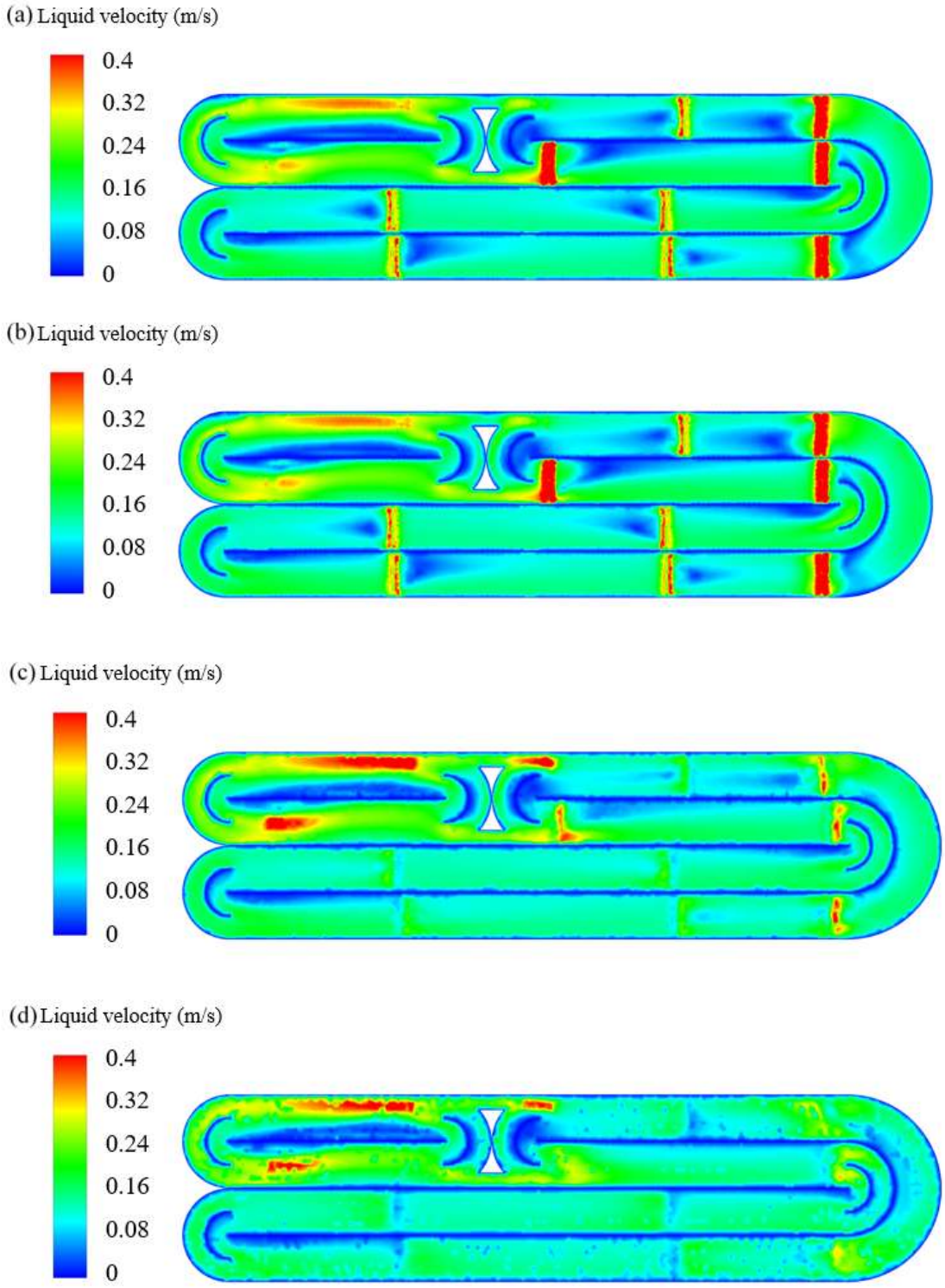


**Fig. S6 Predicted horizontal flow speeds in four horizontal slices through the depth: (a) surface layer, (b) top layer, (c) middle layer, and (d) bottom layer of the full-scale OD at Ping Dingshan, Henan Province, China.**

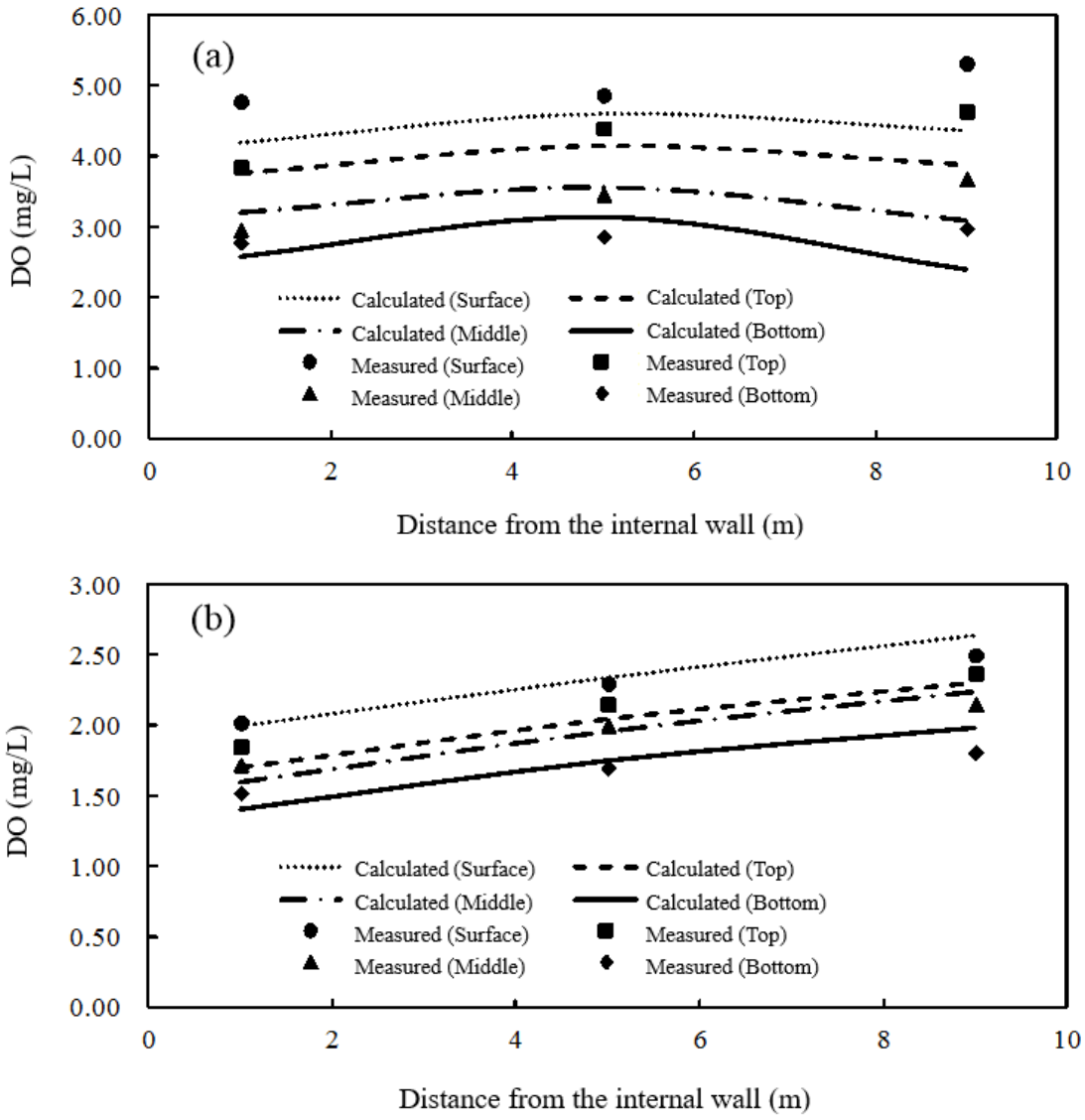


**Fig. S7 Simulated and measured dissolved oxygen concentration distributions at: (a) Section 2-2, and (b) Section 3-3 of the full-scale OD at Ping Dingshan, Henan Province, China.**

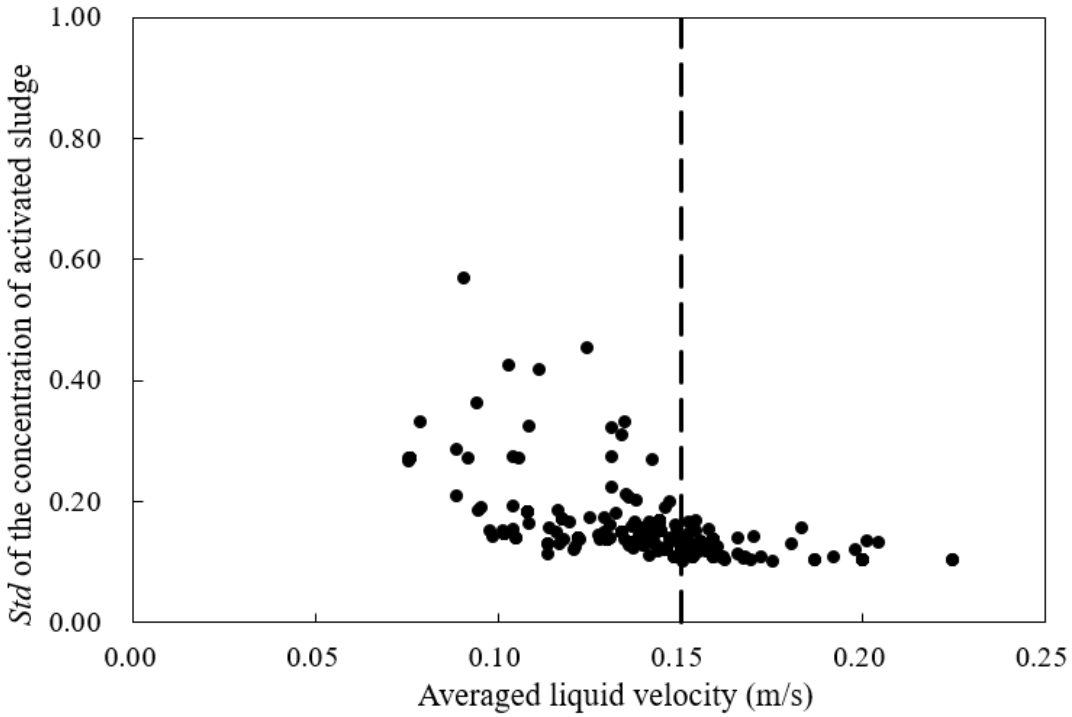


**Fig. S8 Correlation between average liquid velocity and standard deviation of MLSS concentration under different operation modes for the full-scale oxidation ditch at Ping Dingshan, Henan Province, China.**

**Tale S1 Characteristics of influent and effluent water quality of full-scale oxidation ditch at Pingdingshan, China, under existing operating condition.**

| Parameters | COD | $BOD_5$ | TN | Ammonia nitrogen |
|---|---|---|---|---|
| Influent (mg/L) | 333.1 | 92.2 | 35.1 | 24.7 |
| Effluent (mg/L) | 26.1 | 8.2 | 19.7 | 2.0 |

**Table S2 Measured and simulated effluent water quality parameters under existing operating condition for the full-scale oxidation ditch at Ping Dingshan, China.**

| Parameters | Measured | Calculated |
|---|---|---|
| COD (mg/L) | 26.1 | 28.5 |
| Ammonia nitrogen (mg/L) | 2.0 | 2.3 |
| TN (mg/L) | 19.7 | 18.0 |