Editorial: Innovative Anaerobic Processes for Wastewater Treatment

For over a century, anaerobic digestion has become a key technology in removing organic contents from waste streams, while at the same time enabling the recovery of energy and resources (Guo *et al.* 2017; Martins *et al.* 2018). In both industrial and scientific communities in this field, great efforts have been devoted to technical innovation, resulting in the development of many cutting-edge and emerging strategies for the management of waste streams, nutrients circulation, biogas production and removal of hazardous and persistent micro-pollutants, and insights into digestion microbiome (Arora *et al.* 2018; Gonzalez *et al.* 2018; Hassa *et al.* 2018). Therefore, the aim of this special issue is to bring together papers from multiple disciplines on the state-of-the-art emerging/innovative anaerobic processes and associated principles. This issue contains 11 selected research articles, covers research frontiers from the development, optimization and application of novel processes, as well as the functional microbiome in anaerobic digesters.

Engineering bioreactor/bioprocess design basing on advantages of established design science theory and knowledges on the targeting anaerobic microbiome could fundamentally and significantly improve digestion performance (Arora *et al.* 2018). In this issue, two novel bioreactors/processes were developed and applied for the wastewater treatment and resource recovery, respectively, i.e., an anaerobic filter membrane bioreactor (Diez *et al.* 2018) and anaerobic-based water resource recovery facility (WRRF) (Seco *et al.* 2018), providing interesting insights into the impacts of reactor configuration and operation condition on the digestion performance. For specific applications of bioreactors/processes, many puzzles await to be disentangled, including the effects of seeding microbiome (Kocamemi *et al.* 2018; Zhao *et al.* 2018), volatile fatty acids (VFAs) (Vargas-Morales *et al.* 2018), redox conditions (Pokorná-Krayzelová *et al.* 2018), temperature (Awad *et al.* 2018), organic loading rates and digestion substrate pre-treatments (Diamantis & Aivasidis 2018), which have been comprehensively tested and discussed in articles in this issue. These results genuinely provide invaluable to anyone involved in anaerobic digestion.

We would like to thank the organizing committee of the 15th IWA World Conference on Anaerobic Digestion (AD-15) for providing an excellent platform gathering international researchers, practitioners, designers, public officials and industry representatives and decision makers in the field of anaerobic digestion. This special issue is evidence of their great efforts and the great success of the conference.

doi: 10.2166/wst.2018.506

Guest Editors
Shanquan Wang
Sun Yat-sen University, China

Guojin Xie
Harbin Institute of Technology, China

Wenzong Liu
Chinese Academy of Sciences, China

Hongbo Liu
Jiangnan University, China

Yanping Liu
Beijing University of Chemical Technology, China

REFERENCES

Arora, S., Rani, R. & Ghosh, S. 2018 Bioreactors in solid state fermentation technology: design, applications and engineering aspects. *J. Biotechnol.* **269**, 16–34.

Awad, M., Tian, Z., Gao, Y., Yang, M. & Zhang, Y. 2018 Pretreatment of spiramycin fermentation residue using hyperthermophilic digestion: quick startup and performance. *Water Science and Technology* **78** (9), 1823–1832.

Diamantis, V. & Aivasidis, A. 2018 Performance of an ECSB reactor for high-rate anaerobic treatment of cheese industry wastewater: effect of pre-acidification on process efficiency and calcium precipitation. *Water Science and Technology* **78** (9), 1893–1900.

Diez, V., Iglesias, A., Cámara, J. M., Ruiz, M. O. & Ramos, C. 2018 A novel anaerobic filter membrane bioreactor: prototype start-up and filtration assays. *Water Science and Technology* **78** (9), 1833–1842.

Gonzalez, A., Hendriks, A. T. W. M., van Lier, J. B. & de Kreuk, M. 2018 Pre-treatments to enhance the biodegradability of waste activated sludge: elucidating the rate limiting step. *Biotechnol. Adv.* **36** (5), 1434–1469.

Guo, Z., Liu, W., Yang, C., Gao, L., Thangavel, S., Wang, L., He, Z., Cai, W. & Wang, A. 2017 Computational and experimental analysis of organic degradation positively regulated by bioelectrochemistry in an anaerobic bioreactor system. *Water Res.* **125**, 170–179.

Hassa, J., Maus, I., Off, S., Pühler, A., Scherer, P., Klocke, M. & Schlüter, A. 2018 Metagenome, metatranscriptome, and metaproteome approaches unraveled compositions and functional relationships of microbial communities residing in biogas plants. *Appl. Microbiol. Biotechnol.* **102** (12), 5045–5063.

Kocamemi, B. A., Dityapak, D., Semerci, N., Keklik, E., Akarsubası, A., Kumru, M. & Kurt, H. 2018 Anammox start-up strategies: the use of local mixed activated sludge seed versus Anammox seed. *Water Science and Technology* **78** (9), 1901–1915.

Martins, G., Salvador, A. F., Pereira, L. & Alves, M. M. 2018 Methane production and conductive materials: a critical review. *Environ. Sci. Technol.* **52** (18), 10241–10253.

Pokorna-Krayzelova, L., Vejmelková, D., Selan, L., Jenicek, P., Volcke, E. I. P. & Bartacek, J. 2018 Final products and kinetics of biochemical and chemical sulfide oxidation under microaerobic conditions. *Water Science and Technology* **78** (9), 1916–1924.

Seco, A., Aparicio, S., González-Camejo, J., Jiménez-Benítez, A., Mateo, O., Mora, J. F., Noriega-Hevia, G., Sanchis-Perucho, P., Serna-García, R., Zamorano-López, N., Giménez, J. B., Ruiz-Martínez, A., Aguado, D., Barat, R., Borrás, L., Bouzas, A., Martí, N., Pachés, M., Ribes, J., Robles, A., Ruano, M. V., Serralta, J. & Ferrer, J. 2018 Resource recovery from sulphate-rich sewage through an innovative anaerobic-based water resource recovery facility (WRRF). *Water Science and Technology* **78** (9), 1925–1936.

Vargas-Morales, G., Chamy, R. & García-Gen, S. 2018 A VFA-based controller for anaerobic digestion of industrial winery wastewater. *Water Science and Technology* **78** (9), 1871–1878.

Zhao, X., Li, X., Qi, N., Fu, Z., Chen, M., Jiang, B. & Hu, X. 2018 Enhancement of COD, ammonia, phosphate and sulphide simultaneous removal by the anaerobic photosynthetic bacterium of *Ectothiorhodospira magna* in batch and sequencing batch culture. *Water Science and Technology* **78** (9), 1852–1860.