Preface

Special Issue on Recent Advancements in Sustainable Management of Livestock Waste and Rural Environment (LSW-2020)

According to the UN Food and Agriculture Organization (FAO), the global meat production was about 341 million tonnes in 2018, which is continuously increasing along with the rapid population growth and living standard improvement worldwide. The continuous increase of livestock numbers generates a large amount of livestock wastewater and manure waste, which has inevitably brought about global environmental issues relating to water, soil, and air pollutions in addition to food security concerns. As estimated, livestock and fishery industries and crop production in 2018 contributed to 31% and 27% of global greenhouse gases (GHGs) emission from the global food systems, respectively. Most recently, much attention has been paid to emerging contaminants (such as antibiotics and antibiotic resistance genes) and heavy metals in livestock wastewater/manure and synthetic insecticides in agriculture, which may pose high risks to human health. Still, few reports are available on efficient control and sustainable management of these emerging contaminants in the context of ever-increasing production of livestock waste and in rural environment.

To cope with these challenges in sustainable management of livestock waste and rural environment, recently many attempts and innovations have been made to find out efficient solutions. Livestock waste or wastewater contains high levels of organics, nitrogen(N), phosphorus (P) and other macro/micro-nutrients, which possesses high potentials for resources and energy recovery. Up to now, composting and anaerobic digestion (AD) are still the two main processes in practice for resources and energy recovery from agricultural wastes. More specifically, co-composting or anaerobic co-digestion (AcoD) of manure with other organic solid wastes like crop straw, waste activated sludge (WAS) and/or food waste can greatly enhance process stability, promote process progress and achieve high economic benefits. As for

composting, nutrients-rich compost production with less gaseous pollutants (NH_3 and N_2O) emission from livestock manure can be realized by using epigeic earthworms, inoculating nitrifying and denitrifying bacteria, or adding lactic acid; while the compost may have enriched antibiotic resistance when exposed to multiple antibiotics. As for AcoD, high solids or solid-state AD of different agricultural wastes with combined heat and power (CHP) unit can achieve high efficiency of investment with high economic viability. Use of nanobubble water (NBW) or some additives like granular activated carbon (GAC) can enhance methane production from AD process of manure waste or rural wastewater by 20-30% with shortened AD duration, even at a low temperature of 25°C. Hydrothermal pretreatment and biogas recirculation can further improve both methane yield and methane content by > 10%, resulting in a significant increase in biogas heating value and easy handling of solid digestate. Microbial fuel cell (MFC), membrane bioreactor (MBR), moving bed biofilm reactor (MBBR), and constructed wetlands (CWs) possess high potentials to resist the inhibition effect of antibiotics on pollutants removal from livestock wastewater, achieving desirable removals of refractory organics and N with reduced exposure risk of antibiotics to humans. On the other hand, a full-scale efficient N removal from liquid digestate via anaerobic ammonium oxidation (ANAMMOX) system can be rapidly established by regulating the operation strategy for nitrite dosing and dissolved oxygen (DO) control. Among the above biosystems, CWs in combination with oxic/anoxic process and Fe/C micro-electrolysis can be practically applied to treat the decentralized low-carbon wastewater at ambient temperature in rural area. Bioremediation is also possible to achieve an effective degradation of insecticides like allethrin. Besides pollutants removal, high-quality compost production and energy recovery, other high value-added products such as polysaccharides, lipids, proteins, and polyhydroxyalkanoates (PAHs) from wastewater treatment through specific microalgae cultivation or operation under proper salinity condition can add more environmental and economic benefits to the whole treatment system, targeting sustainable management of livestock waste and rural environment.

All the above recent research advancements can be found in this special issue (LSW-2020). This issue consists of 4 review articles and 20 research papers, which can be grouped into 4 themes as follows: (1) Current management and future perspectives of livestock manure/wastewater and agriculture wastes; (2) Energy and resources recovery from organic solid waste and wastewater; (3) Efficient biological wastewater treatment systems in rural area; and (4) Fate of emerging contaminants involved in biological processes for livestock manure and wastewater treatment. All the selected articles in this special issue passed through the regular peer-review process.

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