APPLY CHAR-BASED ADDITIVES TO ANAEROBIC BIOPROCESSES: THE KNOWN AND THE UNKNOWN

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ABSTRACT

The initiatives of supplementing additives into anaerobic digestion for improving the process performance are never ending. The additives vary from conductive iron oxides, semiconductive iron-oxide minerals, nanoparticles, nano-graphene, micrometer-size magnetite Fe_3O_4, zeolite, humic acid to activated carbon, whereas the application of biochar in anaerobic digestion gains intensive interest in recent year. The use of biochar in the treatment of high-solid content waste is environmental friendly and economically favourable, since biochar is cost-effective and eco-compatible with soil system and then it can be remained in solid digestate for the subsequent composting land application without further separation (Zhang et al., 2014). Biochar is a carbon-rich material prepared from the thermal pyrolysis of biomass or biowaste (Zhang et al., 2015). The present presentation reviewed the recent works reporting the incorporation of various biochars in anaerobic digestion process from batch to continuous operation for wastewater or complex waste stream (Cai et al., 2016). It was found that the effectiveness of biochar seemed to be inconclusive. Therefore, the potential mechanism relating to biochar was dissected, i.e. to increase alkalinity (Shen et al., 2016), to increase buffering capacity (Wang et al., 2017), to adsorb inhibitory compounds (Fagbohungbe et al., 2016), to supply mineral nutrients (Linville et al., 2017), to supply supporting surface for microbial colonization (Cooney et al., 2016), to enrich functional microorganisms (Lü et al., 2016; Luo et al., 2015), or to promote direct interspecies electron transfer between microorganism (Chen et al., 2014). The microbial ecology affected by the biochar addition was emphasized.

It then comes to the questions what kind of biochar should be used in anaerobic bioprocess and how to prepare a biochar with the targeted property. We will present in the conference our recent studies about the association of biochar's diverse physio-chemical characteristics and the effectiveness for process enhancement, the application of biochar in other anaerobic bio-refinery processes (e.g. chain elongation (Liu et al., 2017), carbon monoxide fermentation) besides anaerobic digestion, and the application of other types of char-based materials (Xu et al., 2015).

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