

生物质废物中温联合厌氧消化的动力学研究

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近年, 随着城市化进程的加快, 我国城市生活垃圾 (MSW) 的产生量逐年增加。2009年, MSW清运量达到约1.6亿吨, 同时MSW的成分也发生很大的变化。2006年, 生活垃圾中餐厨垃圾含量达到60%以上。我国MSW具有含水率高、可降解有机物含量高的特点, 为生物质废物的厌氧消化处理提供了有利的条件。本研究对餐厨垃圾、果蔬垃圾和污泥的混合物料进行了连续搅拌式反应器 (CSTR) 小试和中试规模的中温联合厌氧消化, 并对厌氧消化动力学进行了研究。实验结果表明, 在负荷为4.4以及5.5 kgVS/m³·d的条件下, 甲烷产率分为**76%, 74%** (小试) 和**78%, 78%** (中试), 有机转化率大于70%, 当反应器的负荷提升至8 kgVS/m³·d时, 系统仍然能够正常稳定运行。最后, 针对本系统对ADM1动力学模型进行了修正, 构建了适合本联合消化系统的动力学模型, 结果显示碳水化合物、蛋白质和脂肪的水解反应速率参数是ADM1模型中相应参数的10倍, 脂肪发酵分解过程在负荷为4.4以及5.5kgVS/m³·d时的反应速率参数分别为1和1.25 kgCOD·kgCOD⁻¹h⁻¹。

关键词: 中温联合厌氧消化; ADM1动力学模型; 生物质废物; 单相CSTR反应器。

参考文献

- [1] Angelidaki I.; Sanders W. *Reviews in Environmental Science and Bio/Technology*. **2004**,**3**:117-129.
- [2] Mata-Alvarez. *IWA Publishing*. **2003**.
- [3] 左剑恶, 凌雪峰, 顾夏声. *环境科学研究*. **2003**,**16**(1):57-61.
- [4] IWA Task Group for Mathematical Modeling of Anaerobic Digestion Processes. *IWA Publishing*. **2002**.

Kinetics on Mesophilic Anaerobic Co-digestion of Biomass Wastes

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In this study, bench-scale and pilot-scale single-phase continuous stirred tank reactors (CSTR) were used as the experimental systems under mesophilic temperature. During feeding cycle period, variation of biogas production, biogas composition, pH, volatile fatty acids (VFAs), dissolved organic matter were analyzed. The results showed that methane yields were **76%, 74%** in bench-scale tests and **78 % , 78 %** in pilot-scale experiments at different organic loading rates (OLR). The reactors run well when upgrading the OLR from 4.4 kg VS/m³·d to 5.5 kg VS/m³·d. The ADM1 model was modified and applied to simulate the mesophilic anaerobic co-digestion of kitchen garbage, fruit /vegetable waste and primary sludge. Theoretical methane yield fitted well with the experimental data. This model established theoretical basis for the amplification of anaerobic digestion process.

Keywords: mesophilic anaerobic co-digestion; ADM1 kinetic model; biomass waste; single-phase CSTR reactor