陈兴春,郑颖,刘宏波,符波,刘和.基于pH调控的城市污泥厌氧发酵产酸小试研究[J].环境科学学报,2015,35(4):1067-1073

基于pH调控的城市污泥厌氧发酵产酸小试研究

A lab scale volatile fatty acids production process study based on pH regulation from sewage sludge by anaerobic fermentation

关键词：污泥 挥发性脂肪酸(VFA) 热碱预处理 pH调控 强化脱氮除磷

基金项目：江苏省太湖水环境综合治理科研课题(No.JSZC-G2013-191);江苏省环保厅科研课题(No.2012035);国家自然科学青年基金项目(No.51208231)

作 者 单位

陈兴春 江南大学 环境与土木工程学院, 无锡 214122

郑 颖 江南大学 环境与土木工程学院, 无锡 214122

刘宏波 江南大学 环境与土木工程学院, 无锡 214122

符 波 江南大学 环境与土木工程学院, 无锡 214122

刘 和 江南大学 环境与土木工程学院, 无锡 214122

摘要：本研究设计了热碱预处理-半连续流厌氧发酵污泥处理工艺,探究了pH对热碱预处理污泥产酸性能的影响,同时对发酵液作为碳源回用于污水厂强化脱氮除磷进行了质量衡算.在30 L厌氧发酵罐中考察了偏中性(pH=6.5)和碱性(pH=10.0)条件下热碱预处理污泥发酵的挥发性脂肪酸(VFA)产生及分布、蛋白质及碳水化合物的消耗和氮磷释放情况.结果表明,污泥热碱预处理-半连续流厌氧发酵工艺的VFA产量稳定,在pH为6.5和10.0的条件下,发酵罐中平均VFA产率分别为333.29 mg · g^{-1}(以每g VS产生的COD(mg)计,下同)和250.64 mg · g^{-1},pH为6.5时产酸更稳定,且产量较高,但碱性条件更适合产乙酸.两种pH条件下的SCOD、溶解性蛋白质、溶解性多糖、氮和磷的释放都无较大差异.质量衡算结果表明,以处理量为50000 m^3 · d^{-1}的城市污水处理厂为例,其产生的污泥经过热碱预处理-半连续流厌氧发酵产酸工艺,产生的VFA能够满足该污水处理厂脱氮除磷提标改造的碳源需求.

Abstract：Thermo-alkaline pretreatment combined with semi-continuous flow fermentation process was used to assess the performance of volatile fatty acids (VFA) production from sewage sludge under different pH conditions. Meanwhile, mass balance was also conducted to evaluate the feasibility with VFA fermentation liquid as carbon source to enhance biological nutrients removal. The VFA production and composition, consumption of protein and carbohydrate, and nitrogen and phosphorus release from sludge were investigated under neutral (pH=6.5) and alkaline (pH=10) conditions in a lab scale anaerobic fermentor with a volume of 30 L. The results showed that the process maintained a stable VFA yield for sludge fermentation. Under the conditions of pH at 6.5 and 10.0, the VFAs yields were 333.29 and 250.64 mg · g^{-1}, respectively. The average VFA yield of pH 6.5 was higher than that of pH 10.0 and with a higher stability, although the alkaline fermentation was favorable for acetic acid production. There is no difference between the two pH conditions in terms of the soluble chemical oxygen demand(SCOD), soluble protein, soluble polysaccharide, nitrogen and phosphorous release during the whole fermentation process. Mass balance results demonstrated that the VFA from the sludge fermentation in a wastewater treatment plant with a capacity of 50000 m^3 · d^{-1} could meet the upgrading requirement of carbon source for the biological nutrients removal.

Key words：sewage sludge volatile fatty acids (VFA) thermo-alkaline pretreatment pH regulation enhanced phosphorus and nitrogen biological removal

单位地址：北京市海淀区双清路18号 邮编：100085
服务热线：010-62941073 传真：010-62941073 Email：hjkxxb@rcees.ac.cn