3P-173 Effect of hydrothermal pretreatment on solubilization and subsequent volatile fatty acids fermentation of waste activated sludge

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Hydrothermal (HT) technology has been proven to be a promising approach to enhance sludge solubilization and thus accelerate the hydrolysis step during anaerobic digestion. Volatile fatty acids (VFAs) as the dominant intermediate product of anaerobic digestion are also expected to be increased after waste activated sludge (WAS) being pretreated by HT. In this study, HT pretreatment from 100 °C to 275 °C with holding time of 0 min was employed to treat WAS. After HT pretreatment at different temperatures, mesoporous VFAs fermentation assessment was carried out on the HT pretreated WAS.

During HT pretreatment, sludge solubilization was improved with the increase in HT temperature. HT pretreatment at 175 °C to 200 °C was found to be the most suitable condition for protein and carbohydrate dissolution. Higher temperatures resulted in decreased soluble proteins and carbohydrates possibly via non-enzymatic browning process. In addition, partial organics were detected to be lost as CO2 and CH4 under higher temperature conditions.

During the subsequent VFAs fermentation, the highest VFA yield (483.0 mg COD/g-VSS) was obtained from the HT pretreated WAS at 175 °C, about 2.2-fold of the raw WAS (216.6 mg COD/g-VSS). Meanwhile, probably due to the high soluble proteins produced, the proportions of HPr and HAc exceeded HP; about 27.7% and 19.9%, respectively. The products generated during HT pretreatment might inhibit the activities of anaerobic microorganisms when the temperature higher than 200 °C.

3P-174 雯アルカリ環境におけるバイオガスの生物的脱硫法の研究

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Ammonia has attracted increasing attention in recent years, due to its negative impacts on water quality and inhibitory effects on methane fermentation when the concentration of ammonium-nitrogen (NH4+-N) reached 3000 mg/L in the bioreactor. Many methods including air stripping at high pH value, chemical precipitation and adsorption have been adopted to remove ammonia from wastewater or avoid its inhibitory effect on methane fermentation. Among these methods, adsorption has recently attracted great research interest because of its easy operation, high efficiency and low cost. Nowadays, zeolite has demonstrated to be a more efficient adsorbent for removing ammonia from wastewater or fermentation liquor, compared to other natural clay minerals. The objective of this study is to determine the optimum conditions for removal of ammonia from synthetic solution by investigating the effects of temperature (25 and 35°C), initial pH (5-9) and initial ammonia concentration (500-2000 mg/L) at fixed zeolite dosage of 10.0 g/L.

The results showed that the highest ammonia adsorption capacity (4.12 mg/g and 5.85 mg/g) was obtained at pH 7, when the temperature was 25°C and 35°C, respectively. Further increasing the pH level to pH 8 and pH 9 resulted in a decrease in ammonia adsorption capacity. In addition, the ammonia adsorption capacity increased with the increase in initial ammonia concentration, which reached the maximum value (10.35 mg/g) at initial NH4+-N concentration of 2000 mg/L.

3P-175 Volatile fatty acids (VFAs) accumulation from waste activate sludge under alkaline anaerobic fermentation

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Volatile fatty acids (VFAs) are very important intermediate products from anaerobic digestion, which can be used as a readily biodegradable carbon source for biological nutrients removal, especially for phosphorus removal. In addition, previous works point out that the ratio of HPr/HAc can influence the effect of biological phosphorus removal. It was reported that VFAs yield from waste active sludge and its compositions were significantly affected under alkaline condition. The objective of this study is to investigate the VFAs yield and its compositions during mesophiles (35°C) alkaline anaerobic fermentation.

Seven 500ml glass reactors loaded with 300ml WAS were used for VFAs production from anaerobic fermentation. The initial pH values were respectively adjusted to 12, 11, 10, 9, 8, 7 by using 3M NaOH or 3M HCl solutions. After sludge dosage and pH adjustment, the headspace of the reactor was flushed by nitrogen gas for 2 min, and then sealed and placed in a temperature-controlled water bath (35°C). Sampling from the reactors was performed once every two day. Biogas production and its components, VFAs and its composition, pH, proteins, polysaccharides, ammonia, total solids, total volatile solids, and ATP were measured accordingly.

The largest amount of total VFAs was achieved at initial pH10 and pH11 after anaerobic fermentation for 144h, about 125mg C/g-VS. Moreover, anaerobic fermentation at initial pH9 produced VFAs with the highest HPr/HAc ratio, 43.59% in comparison to 20.35%, 15.43%, and 15.74% obtained at initial pH10, pH11, and pH12, respectively.

3P-176 Removal of ammonia from ammonium-rich wastewater by zeolite adsorption

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Removal of ammonia from ammonium-rich wastewater by zeolite adsorption

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