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江苏省大中型沼气工程调查及沼液生物学特性研究

Investigation on large and medium scale biogas plants and biological properties of digestate in Jiangsu province

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中文摘要:

近年来,中国大中型沼气工程发展迅速,然而有关沼气工程运行情况的研究甚少。为探索沼气工程运行中存在的问题,该文对江苏省21家畜禽养殖场大中型沼气工程进行了实地调查,并采集发酵料液以及出料样品,分析了进出料液COD(化学需氧量)质量浓度、沼液产气潜力、粪大肠菌群数等指标。结果表明:江苏省沼气工程设计施工规范,配套设施较完备,但运行效率低,沼液、沼液处理或利用能力低。大多数沼气工程以处理养殖废水为主,发酵料液固体质量分数<3%,62%的出料沼液的COD质量浓度达到5 000 mg/L以上;沼液残余产气潜力较大,在35℃条件下,有12家沼气工程的沼液残余产甲烷量达100 mL/L以上。沼气发酵处理可以显著降低粪大肠菌群含量,平均可减少92.9%,但厌氧消化后的沼液中仍含有较高浓度粪大肠菌群,不能达到无害化要求。该调查结果可为畜禽养殖场沼气工程的健康稳定运行与管理提供科学依据。

英文摘要:

Biogas plant construction has rapid development in recent years. However, studies on its operation and management were few, especially for large and medium-sized ones. To explore the problems existing in operation and management, a field investigation on 21 plants of large and medium-sized biogas was carried out in intensive pig and dairy farms in Jiangsu province. The investigation included the operation status of the plants and the raw materials and digestion slurry was sampled to analyze the content of COD, residual biogas production and the count of fecal coliform. Results showed that the design and construction of all the biogas plants was performed by professional company with well-appointed facilities, whereas the biogas volume produced and the utilization of biogas and digestion slurry were low. The main raw materials for anaerobic digestion were waste water from pig and dairy farms, with low content of total solid (i.e., TS < 3%). Most raw materials could not be digested completely. COD contents from 62% digestion slurry samples were more than 5 000 mg/L, which caused appreciable quantities of methane produced from digestion slurry. Twelve digestion slurry samples could produce methane more than 100 mL/L at 35°C. Anaerobic digestion could significantly reduce the survival of fecal coliform, reaching 92.9% on average. However, the digestion slurry still contained high concentrations of fecal coliform, which could not reach the requirement of sanitary. These results could provide a theoretical reference for the stable and healthy operation and management of large and medium-sized biogas plants.

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