

Two-Stage Anaerobic Digester for Biogas Production from Sewage Sludge: A Case Study in One of Kuwait's Wastewater Treatment Plant

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Abstract : Due to the high demand for energy from unsustainable resources in Kuwait, the Kuwaiti government has focused recently on using sustainable resources for energy, such as solar and wind energy. In addition, sludge which is generated as a by-product of physical, chemical, and biological processes during wastewater treatment, can be used as a substrate to generate energy through anaerobic digestion. Kuwait's wastewater treatment plants produce more than 1.7 million m³ of sludge per year, and this volume is accumulated in the treatment plants without any treatment. Therefore, a pilot-scale (3 m³) two-stage anaerobic digester was constructed in one of the largest treatment plants in Kuwait. The reactor was operated in batch mode, and the hydraulic retention time varied between 14 - 27 days. The main of this study is to evaluate the technical feasibility of a two-stage anaerobic digester for sludge treatability and energy generation in Kuwait. The anaerobic digester achieved a total biogas production of 37 m³, and the highest value of daily biogas production was 0.4 m³/day. The methane content ranged between 50 % and 66 %, and the other gases were as follows: CO₂ 20 %, H₂S 13 %, and 1 % O₂. The generated biogas was used on-site for cooking and lighting. In some batches, low C/N was noticed, and that lead to maintaining the concentration of CH₄ between 50%-55%. In conclusion, an anaerobic digester is an environmentally friendly technology that can be applied in Kuwait, and the obtained results support the scale-up of the process in all the treatment plants.

Keywords : wastewater, methane, biogas production potential, anaerobic digestion

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