Evaluation of Temperature Phased Anaerobic Digestion (TPAD)

Ferit Isik

ABSTRACT

Anaerobic digestion processes have been successfully applied for many years for the treatment of sewage sludge and livestock wastes. Mostly, single stage mesophilic completely mixed anaerobic digestion is the most applied technique for stabilization. The end products are digested sludge with a reduced volume content of organic matter, and the production of biogas. Over 20-day retention time is usually required for the mesophilic digestion, but it is not so efficient method in the reduction of volatile solids and the pathogenic organisms. To overcome these limitations, different configurations of anaerobic digestion systems have been studied for the treatment of the waste sludge.

Many high-temperature digestion systems have been developed to take advantage of thermophilic digestion while avoiding its drawbacks. Among these innovative digestion processes, the TPAD process is a new and efficient method for the treatment of wastewater which is capable of meeting the 40 CFR Part 503 Class A pathogen standards regulated by U.S.EPA to produce Class A biosolids which can be beneficially land applied with minimum restrictions. The TPAD process efficiently combines the advantages of each of the thermophilic and mesophilic anaerobic digestion process while avoiding the disadvantages of each. This process achieves higher VS removal and gas production compared with conventional single-stage mesophilic systems at the same HRT, therefore, the required digester volume for the same level of VS destruction is reduced.

KEYWORDS

Anaerobic digestion, TPAD process, volatile solids reduction, pathogen destruction, thermophilic/mesophilic digester, biogas.

INTRODUCTION

Anaerobic digestion processes have been successfully applied for many years for the treatment of sewage sludge and livestock wastes. Mostly, single stage mesophilic completely mixed anaerobic digestion is the most applied technique for stabilization. The end products are digested sludge with a reduced volume content of organic matter, and the production of biogas. Over 20-day retention time is usually required for the mesophilic digestion, but it is not so efficient method in the reduction of volatile solids and the pathogenic organisms, that is, these mesophilic digesters are not able to produce Class A biosolids (Song et al., 2004). To overcome these limitations, different configurations of anaerobic digestion systems have been studied for the treatment of the waste sludge. The majority of these anaerobic digestion systems operates at mesophilic temperatures (35-40 ºC). Though effective in reducing the organic content of wastes, studies have reported the survival of pathogenic bacteria at mesophilic temperatures (Sung and Santha, 2001).

The implementation of U.S. EPA`s 40 CFR Part 503 regulations established treatment requirements designed to control and reduce pathogens and attraction of disease vectors to land applied biosolids (U.S. EPA, 1994). The regulations have been aimed at encouraging treatment facilities to upgrade the treatment performance of conventional digestion processes to produce Class A or Class B biosolids while increasing quantities of biosolids being recycled every year. Besides, several counties including California`s Riverside, Kern, Fresno, and King Counties have passed local ordinances that ban Class B biosolids application. Under these circumstances, there has been widespread interest and experimentation in the US in upgrading the performance of conventional anaerobic digestion processes to meet Class A standards (Aitken and Mullenix, 1992).