

Experimental Studies on the Effect of Premixing Methods in Anaerobic Digester with Corn Stover

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Abstract : Agricultural residues are producing in large quantities in India and account for abundant but underutilized source of renewable biomass in agriculture. In India, the amount of crop residues available is estimated to be approximately 686 million tons. Anaerobic digestion is a promising option to utilize the surplus agricultural residues and can produce biogas and digestate. Biogas is mainly methane (CH₄), which can be utilized as an energy source in replacement for fossil fuels such as natural gas, oil, in other hand, digestate contains high amounts of nutrients, can be employed as fertilizer. Solid state anaerobic digestion (total solids \geq 15%) is suitable for agricultural residues, as it reduces the problems like stratification and floating issues that occur in liquid anaerobic digestion (total solids $<$ 15%). The major concern in solid-state anaerobic digestion is the low mass transfer of feedstock and inoculum that resulting in low performance. To resolve this low mass transfer issue, effective mixing of feedstock and inoculum is required. Mechanical mixing using stirrer at the time of digestion process can be done, but it is difficult to operate the stirring of feedstock with high solids percentage and high viscosity. Complete premixing of feedstock and inoculum is an alternative method, which is usual in lab scale studies but may not be affordable due to high energy demand in large-scale digesters. Developing partial premixing methods may reduce this problem. Current study is to improve the performance of solid-state anaerobic digestion of corn stover at feedstock to inoculum ratios 3 and 5, by applying partial premixing methods and to compare the complete premixing method with two partial premixing methods which are two alternative layers of feedstock and inoculum and three alternative layers of feedstock and inoculum where higher inoculum ratios in the top layers. From experimental studies it is observed that, partial premixing method with three alternative layers of feedstock and inoculum yielded good methane.

Keywords : anaerobic digestion, premixing methods, methane yield, corn stover, volatile solids

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