

PREFACE

The world is constantly facing the problems associated with waste minimisation and energy supply. Waste to the energy sector is developing to accomplish the above-mentioned goals, simultaneously. Biogas production from a variety of substrates through anaerobic digestion is an attractive approach to energy production and waste minimisation. The limitations of biogas technology are low yield and less amount of methane concentration in biogas. The low yield is associated with the complexity of the substrate and climatic variation across the country that hampers the process. Taking this into consideration present work was decided.

The objective of this research was to investigate the potential of sawdust and OFMSW for improved biogas production. The production yield was improved by introducing different pretreatment methods. The statistical optimisation of the pretreatment process was done by using RSM. The co-digestion, optimisation of process parameters of anaerobic digestion and physicochemical properties of digestate were also studied. OFMSW was found better substrate for biogas production as compared to sawdust. NaOH-autoclave treatment was the best pretreatment method among all carried on sawdust that significantly reduced the lignin by 58.6 %. Biogas production from treated sawdust was 289 NmL/gVS. The anaerobic digestion of chemically and thermochemically treated OFMSW resulted in the biogas yield of 465.67 and 529 NmL/gVS, respectively at the optimised condition of pretreatment. The biogas production from the co-digestion of OFMSW with SS was 626 NmL/gVS at the optimised condition of process parameters of anaerobic digestion. The work incorporated in the present thesis has been arranged in five chapters.

Chapter one is the general introduction of biofuels and biogas. It described the generations of biofuel, the process of anaerobic digestion and associated benefits of the technology. It also provided an idea of the presence of different biomass in Varanasi, India that can be utilized for biogas production.

Chapter two is associated with the exhaustive literature survey of the background of biogas production. It described the development of biogas technology in India, criteria for selection of feedstocks and the methods employed to increase the production from different feedstocks. It also described the potential of lignocellulosic residue and OFMSW to produce biogas and associated pretreatment technologies for increased production. The effect of process parameters and benefits of co-digestion of different biomass were also explained in this chapter. The research gap was identified and the objectives of the present work were drawn based on the research gap.

The materials and methods employed to produce biogas from sawdust and OFMSW are discussed in chapter three. The chapter explained the procedures for media and reagent formulation, substrate and product characterization. The procedures of different pretreatment strategies on sawdust and OFMSW were also discussed.

The fourth chapter deals with the results obtained during the experiments carried out in chapter three followed by detailed discussions on them.

Chapter five summarizes the main findings of the whole study and overall conclusions that were obtained. The recommendations for future work were also appended in the chapter.

In the end, the thesis has been appended by an up-to-date list of references. References have been arranged alphabetically according to the surname of the first author. The list of the publications that arose out of this research work has been attached at the end of the thesis.