

Improving Biogas Production by Integrated Solar Greenhouse Technique: A Pilot Study Using Semi-buried Tubular Digester in Cold Climate Regions

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Abstract

Household biogas-digesters are a prospective technique that can help minimal-income rural families to meet their basic energy requirements and enhance their living standards. Nevertheless, due to the cold temperature of the digesters, the biogas generation is decreased and the digestion efficiency is generally low. The current work proposes a solar-greenhouse (SGH) heating technique united with a north wall to heat a semi-buried tubular digester, as a solution. Two similar semi-buried digesters were used in this experiment; one (DA) was heated by a SGH attached to a north wall, while the other (DB) was heated by direct sunlight (without a greenhouse), which used as a control, and both digesters were fed with cattle manure. The average slurry temperature for DA and DB was 24.9 °C and 23.45 °C, respectively, and both digesters were warmer than the outside air temperature of 22 °C. Moreover, there were no appreciable differences in the methane concentration (62.2–62.76%) between the mean specific biogas production of DA and DB, which were 173 and 155.3 L/kg VS, individually. The study showed that using combined SGH technique is enhanced the process of biogas output more than control.

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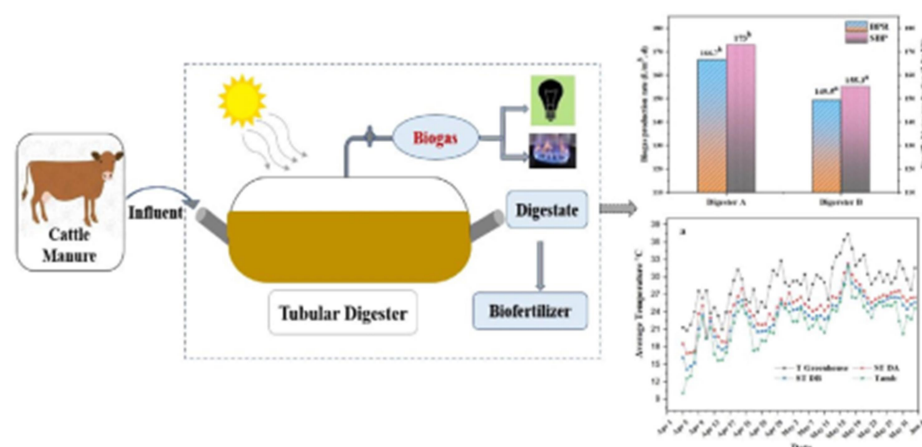
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Graphical Abstract



Keywords Tubular digester · Greenhouses · Cattle manure · Biogas production

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