

**Enhancement of biogas production by integrated solar heating system: A pilot study
using tubular digester**

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ABSTRACT

In rural areas of China, household digesters play a significant role to improve the rural production and living conditions, leading to energy conservation and reduction of emissions. However, the cold temperature of digesters results in relatively low digestion efficiency and reduction of biogas yield. The present study aimed to investigate the potential of integrated solar heating techniques to raise the slurry temperature within a low-cost tubular digester and its impact on the biogas yield. Two similar digesters were used, the first one (D1) was heated by the solar greenhouse integrated with a solar water heating system and a capillary heat exchanger, while the second (D2) was heated by only solar greenhouse, and both digesters were above ground and were fed with cattle manure. The results showed average slurry temperature of 9.5 and 4.9 °C above the mean ambient temperature for D1 and D2, respectively. Furthermore, the mean specific biogas production of D1 and D2 were 247 and 181 L/kg VS, respectively, with no significant variations in the methane content ($\approx 62.7\%$). The study indicated that using of integrated solar energy is efficient to achieve the optimum temperature for the process of biogas production roughly the most of the year.

Keywords: Tubular digester, Greenhouses, Solar water heating, Capillary heat exchanger, Biogas production.

