Gasification of sewage sludge using different gasifying agents

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The management of sewage sludge is a big problem all over the world because of its large quantities and harmful impact on the environment (Kliopova e Makarskienė, 2015). According to European regulations, management methods involving dumping are now being replaced by methods leading to waste stabilization and safe recycling (Cieślik, Namieśnik e Konieczka, 2015). Gasification is a promising sewage sludge-to-energy method considering the increasing price of land for landfills (Samolada e Zabaniotou, 2014).

The aim of this work is to study gas quality, tar production, low heating value, gas yield, carbon conversion and efficiency in sewage sludge gasification using three different gasifying agents: air, air-steam, and oxygen enriched air.

The study has scientific innovation due to the utilization of different gasifying agents in sewage sludge gasification using a big scale plant in auto-thermal conditions, without the use of external heating. Limited studies about sewage sludge gasification in real auto-thermal conditions have been published and neither about oxygen enriched air utilization.

Air gasification tests of digested dry sewage sludge from a waste-water treatment plant have been performed in a 100 kWth bubbling fluidized bed gasifier in atmospheric pressure and auto-thermal operation, without the use of any external heating. Gasification test have been conducted in the temperature range of 750-830 ºC and in the equivalence ratio range of 0,14-0,35, using different gasifying agents.

The gas produced in the gasifier is composed of 4-8 % H_2, 5-8 % CO, 2.3-3.7 % CH_4, and 12-16 % CO_2. Its average Low Heating Value (LHV) is 2.2-3.5 MJ/Nm^3. The process has 3,1-4,3 Nm^3/kg of gas yield; 56-97 % of carbon conversion and 31-53 % of Cold Gas Efficiency.

Gasification of sewage sludge gasification produces a low heating value gas. Steam gasification reduces gas quality, whereas the employment of oxygen enriched air improves gas quality the most. The utilization of steam and oxygen enriched air increase the cost of the gasification process.

References

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