

Preliminary study of anaerobic digestion process of biomass waste sludge in a Conical Spouted Bed reactor

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Topic: Innovative technologies and processes (wastewater, sludge & odours)

As industry generates annually great amount of waste sludge, sludge removal is an environmental problem worldwide, which represents a significant cost for industry. A proper management of sludge requires ways of biomass waste valorization. Moreover, the high water content of biomass wastes (up to 100 wt% in dry basis) increases transport costs for valorization and makes difficult a possible later energy valorization.

The contact method in spouted bed regime is especially useful for applications which require a vigorous solid movement as in the handling of sticky solids, of irregular texture and with a wide particle size distribution. The Spouted Bed technology has been successfully applied in biomass wastes treatment by drying (San José et al., 2010a, 2010b, 2013a); and by thermal treatment (San José et al., 2013b, 2014a, 2014b).

The operating regime of conical spouted bed has advantages over fixed beds and fluidized beds such as: spouted bed: easy construction without plate or any gas distributor, lower pressure drop, better gas-solid contact, possibility of process difficult materials (sticky, with particle size distribution, thermally sensible), such as sludge. As technical constraint it is noteworthy the difficulty in handling particles with diameter smaller than 500 μm .

Waste sludge of biomass has mean Sauter diameter between 500 μm and 10 mm, density from 500 to 1500 kg/m^3 and high water content up to 100 wt% (dry basis). Anaerobic digestion process of biomass waste sludge has been carried out at laboratory scale. Likewise, the time necessary for the process of obtaining of biogas has been determined. A conical spouted bed reactor with base angle of $\gamma= 28^\circ$ has been designed at purpose at pilot plant scale for anaerobic digestion of biomass waste sludge. The experimental unit basically consists of the conical contactor, an air blower, an electrical resistance for heating the air, thermocouples to monitor bed temperature, and two high-efficiency cyclones. In addition, the operativeness of the conical spouted bed unit has been proven for anaerobic digestion of waste sludge of biomass. The air flow rate is measured by two rotameters and two mass flowmeters being these latter controlled by a computer with an accuracy of $\pm 0.5\%$ of the measured flow rate.

The feasibility of a conical spouted bed contactor for anaerobic treatment of beds consisting of industrial sludge waste of biomass of different particle size has been proven.

Keywords: anaerobic digestion, conical spouted beds, biomass sludge, spouted beds, wastes

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