

Abstract

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Effect of Thermal Pretreatment on the Solubilization of Organic Matters in a Mixture of Primary and Waste Activated Sludge

The increased demand for advanced techniques in anaerobic digestion over the last few years has led to the employment of various pre-treatment methods prior to anaerobic digestion to increase gas production. These pre-treatment methods alter the physical and chemical properties of sludge in order to make it more readily degradable by anaerobic digestion. Although the thermal pre-treatment presents high energy consumption, the main part of this energy to heat can be recovered from the biogas produced in the anaerobic process. In this research a mixture of primary and waste activated sludge was thermally pretreated at 100, 125, 150, 175 and 200 oC in order to determine the reaction kinetics for the increase of soluble organic fraction (expressed as CODs and VFAs). Experimental results proved that the solubilization of sludge is a 1st order reaction with respect to both CODs and VFAs, KCODs (reaction rate constant of CODs solubilization) increased from $4.59 \cdot 10^{-3}$ (min⁻¹) to $7.55 \cdot 10^{-3}$ (min⁻¹) as the temperature increased from 100 to 200 oC, with a reaction activation energy of 7447.21 (J/mole) and frequency factor of 0.051 (min⁻¹), While KVFA (reaction rate constant of VFAs solubilization) increased from $5.33 \cdot 10^{-3}$ (min⁻¹) to $7.97 \cdot 10^{-3}$ (min⁻¹) for the same increase in temperature, with a reaction activation energy of 5947.22 (J/mole) and frequency factor of 0.0364 (min⁻¹).