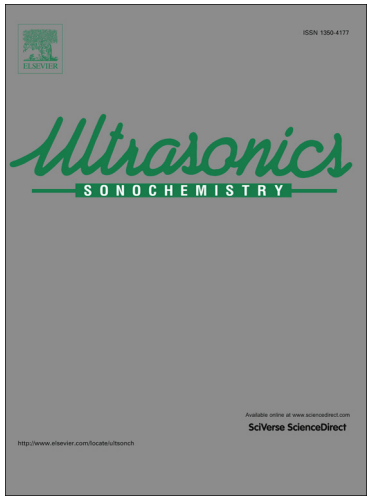

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A swirling jet-induced cavitation to increase activated sludge solubilisation and aerobic sludge biodegradability

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Abstract

In this work, a modified swirling jet induced hydrodynamic cavitation (HC) has been used for the pre-treatment of excess sludge. In order to both improve the HC treatment efficiencies and reduce the energy consumption, the effectiveness of the HC reactor on sludge disintegration and on aerobic biodegradability has been investigated at different operating conditions and parameters, such as temperature, inlet pressure, sludge total solid (TS) content and reactor geometry. The inlet pressure was related to the flow velocity and pressure drop. The best results in terms of sludge solubilisation were achieved after 2 h of HC treatment, treating a 50.0 gTS L^{-1} and using the three heads Ecowirl system, at 35.0°C and 4.0 bar. Chemical and respirometric tests proved that sludge solubilisation and aerobic biodegradability can be efficiently enhanced through HC pre-treatment technique.

At the optimum operating conditions, the specific supplied energy has been varied from 3,276 to 12,780 kJ kg TS^{-1} in the HC treatment, by increasing the treatment time from 2 to 8 hours, respectively. Low endogenous decay rates (b_H) were measured on the excess sludge at low specific supplied energy, revealing that only an alteration in floc structure was responsible for the sludge solubilisation. On the contrary, higher b_H values were measured at higher specific supplied energy, indicating that the sludge solubilisation was related to a decreasing biomass viability, as consequence of dead cells and/or disrupted cells (cell lysis).