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Effect of Fenton's reagent on the intensification of the hydrolysis phase of methane fermentation of excess sludge and microbiological indicators

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ABSTRACT

Sludge oxidation with Fenton's reagent leads to the production of hydroxyl radicals, which are a strong oxidizing agent and thus reduce the time of final degradation of organic pollutants that are difficult to decompose. The aim of the study was to demonstrate the effect of in-depth oxidation with Fenton's reagent on the course of hydrolysis and the microbiological indicators of excess sludge subjected to methane fermentation compared to conventional fermentation. In the case of oxidation of excess sludge with Fenton's reagent, the iron ion dose of 0.08 g·Fe^{2+}/g total solids (TS) was considered the most favorable process condition, with a Fe^{2+}:H_2O_2 ratio of 1:5. A 28% degree of sludge disintegration, a 7-fold increase in the value of soluble chemical oxygen demand, and a 3-fold increase in the concentration of volatile fatty acids were observed compared to the initial values. The use of higher doses of Fe^{2+} ions, that is, 0.1 and 0.12 g·Fe^{2+}/g TS, and a proportion of Fe^{2+}:H_2O_2 greater than 1:5 did not increase the process efficiency. The disintegration of excess sludge with Fenton's reagent using a dose of 0.08 g of Fe^{2+} ions and hydrogen peroxide at a ratio of 1:5 resulted in the reduction of the number of microorganisms in individual groups. The highest decrease was recorded in the group of mesophilic microorganisms, from the initial value of 70 × 10^4 colony-forming units (CFU)/cm^3 before the process to 30 × 10^4 CFU/cm^3 after disintegration.

Keywords: Fenton's reagent; Excess sludge; Hydrolysis; Methane fermentation; Microbial indicator

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