Mirota, K., Grubel, K., Machnicka, A. Design and Assessment of Cavitational Device for Enhancement of Sewage Sludge Fermentation. ***Ochrona Srodowiska*** **2011, Vol. 33, No. 1, pp. 47–52.**

Abstract: Hydrodynamic cavitation is amongst the most promising methods of sewage sludge pretreatment. With this method, strong destruction and disruption of the sewage sludge microorganisms, and consequently an increment in the quantity of organic matter in the supernatant can be achieved. The aim of this study was to find the optimal design of the cavitational device for disintegrating the sewage sludge intended for fermentation. Making use of the CFD (Computational Fluid Dynamics) simulation methods, a variety of configurations with a constant cavitation number was considered and evaluated. Turbulent fluid flow was described in terms of the RANS (Reynolds Averaged Navier Stokes) model. With the pressure field distributions obtained in this way it was possible to choose three very promising geometries of the cavitational device, which were then made subject to experimental verification. The efficiency of sewage sludge disruption was established in terms of the increment in the COD value of the supernatant. The investigated process was additionally assessed using the coefficient DD_M (Degree of Disintegration) calculated by Müller's method. It has been demonstrated that after 30-minute disintegration the COD value increased 3.65fold, and the calculated value of DD_M was 42%. Mesophilic digestion tests conducted in the cavitational device with sewage sludge samples disintegrated by the hydrodynamic method brought about a significant (approximately twofold) increase in biogas production. These findings substantiate the applicability of the proposed sewage sludge pretreatment method on a technical scale.

Keywords: Recirculated activated sludge, disintegration, computational modeling, k–∈ model, hydrodynamic cavitation, degree of disintegration.