Sewage Sludge Rheological Properties Variability in Dependence of Drawing Sludge Samples at Different Times – Beata Malczewska

Summary

Sewage sludge is a two-phase mixture, generated during the treatment of domestic sewage in waste water treatment plants. It consists of 90–99% water and an accumulation of settleable solids, mainly organic that are removed during primary, secondary or advanced wastewater treatment processes. The hydration of the sludge is one of its main properties which determines sludge management and waste disposal cost. The flow properties of the sewage sludge, such as settling properties and concentration of solids, may affect its hydraulics. Application of rheology in wastewater treatment is determined by the flow character of the sludge. The basic purpose of the investigation was to define the rheological properties of sludge taken from secondary settling tanks in a typical municipal wastewater treatment plant. A laboratory investigation was conducted using a coaxial cylinder with a rotating torque and gravimetric concentration of the investigated sludge ranged from 2.21 to 6.56%. Approximation was made after transforming the pseudo-curve obtained from the measurements into the true flow curve, which was made according to the equation provided by Krieger, Elrod, Maron and Švec. In order to describe rheological characteristics the 3-parameter Herschel-Bulkley model was applied. The correlation between rheological parameters τ_o, k, n and concentration C_s was calculated as well as between periods of time when the samples of sludge were taken. The research has allowed calculating the dimension of the main transport installation pumping sludge and optimizing the pump discharge pressure, when transporting viscous sludge in pipelines. Determination of rheological parameters, especially yield stress (τ_o), is important in sludge management, for instance in designing parameters transporting, storing, spreading.