SLUDGE REDUCTION IN ATTACHED GROWTH WASTEWATER SYSTEM ASSUMING FOOD CHAIN REACTOR

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Abstract

Reduction of dry mass in wastewater sludge management is crucial to reduce the operational cost of a sewage treatment plant (STP). Sludge reduction processes could be based on the enhanced endogenous metabolism, cell lysis and cryptic growth or by predation and biodegradability of inert solids. The latter one requires long sludge residence time (SRT) and a cascaded biological treatment system. This could be achieved by applying attached growth biomass, where the microorganisms are fixed to a carrier. In a cascaded system due to the presence of higher order organisms (protozoae and flagellae) less sludge is produced compared to a single compartment biological basin. The reason is that these organisms require DO level of 1-3 mg/L, and BOD_5 concentration lower than 30 mg/L. Sludge reduction is achieved by creating a food chain and part of the inert solids is transformed to biodegradable solid.

Our aim was to predict the sludge reduction rate by numerical analysis in order to determine the magnitude of the possible optimisation by taking advantage of cascaded reactors. The performance of a 1,000 m^3/d capacity STP was calculated by mass balance modelling. ASM2d wastewater model was applied introducing a fraction rate describing the utilisable inert solid fraction.

As a result of the analysis it can be stated that sludge reduction is approximately 0-6% if the inert fraction rate is between 0-0.4, and 15% of total mass reduction could have been achieved if the reactor with single compartment was cascaded and at least 5 reactor zones were separated in a biofilm system. As a continuation of the analysis, full scale treatment plant measurements and verification are projected.

Key words: biofilm, food chain, sludge, wastewater

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