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GRANULAR SLUDGE TECHNOLOGY FOR VALORIZATION OF WATER USE – FROM HIGH TO LOW STRENGTH EFFLUENTS IN AQUACULTURE

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Abstract

Aerobic granular sludge (AGS) is a relatively new compact and energy-efficient technology for wastewater treatment, with over 60 full-scale plants in operation worldwide. AGS is a special case of biofilms in which microorganisms are embedded in a self-produced extracellular polymeric substances (EPS) matrix, forming round-shape microbial aggregates with excellent sedimentation capacity [1]. Due to AGS richness in EPS, surplus biomass is a valuable source for resource recovery, in line with a circular economy approach [2]. AGS applicabilty for the treatment of high-strengh wastewater has been largely reported, demonstrating its robustness to withstand with pollutants commonly found in wastewater e.g. pharmaceuticals [3, 4]. More recently, AGS performance with low-strengh wastewater (< 200 mg COD L^{-1}) has been researched [5, 6]. However, water streams from freshwater aquaculture are characterised by extremely low concentrations of carbon and nutrients and high flows which represent a major challenge for the treatment.

Two different granular based technologies, one operated in sequencing batch and other in continuous mode, were applied for the treatment of extremely low-strength wastewater mimicking aquaculture trout farm effluents. Operation in sequencing mode allowed for a high ammonium removal efficiency which was close to 100 %, whereas the continuos flow reactor allowed for 10-20 % removal. However, the ammonium removal rate was ca. 90 mg NH_4^+-N/(L·d) in the continuos reactor compared to ca. 15 mg NH_4^+-N/(L·d) in the sequencing batch one, due to the different hydraulic retention time. Overall, the sequencing batch reactor generated an effluent with high quality while the continuous flow reactor was able to treat larger flows, and applications may be directed to different stages of the trout production process.

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