EBP2R – An innovative enhanced biological nutrient recovery activated sludge system to produce growth medium for green microalgae cultivation

Current research considers wastewater as a source of energy, nutrients and water and not just a source of pollution. So far, mainly energy intensive physical and chemical unit processes have been developed to recover some of these resources, and less energy and resource demanding alternatives are needed. Here, we present a modified enhanced biological phosphorus removal and recovery system (referred to as EBP2R) that can produce optimal culture media for downstream micro-algal growth in terms of N and P content. Phosphorus is recovered as a P-stream by diversion of some of the effluent from the upstream anaerobic reactor. By operating the process at comparably low solids retention times (SRT), the nitrogen content of wastewater is retained as free and saline ammonia, the preferred form of nitrogen for most micro-algae. Scenario simulations were carried out to assess the capacity of the EBP2R system to produce nutrient rich organic-carbon depleted algal cultivation media of target composition. Via SRT control, the quality of the constructed cultivation media can be optimized to support a wide range of green micro-algal growth requirements. Up to 75% of the influent phosphorus can be recovered, by diverting 30% of the influent flow as a P-stream at an SRT of 5 days. Through global sensitivity analysis we find that the effluent N-to-P ratio and the P recovered are mainly dependent on the influent quality rather than on biokinetics or stoichiometry. Further research is needed to demonstrate that the system performance predicted through the model-based design can be achieved in reality.

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