Aerobic granular sludge with granular activated carbon for enhanced biological phosphate removal from domestic wastewater

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Aerobic granular sludge (AGS) is an emerging replacement for activated sludge for advanced and sustainable wastewater treatment. This study examined the beneficial effect of granular activated carbon (GAC) addition on AGS formation and sewage treatment in tropical climates. GAC shortened the start-up period for granulation by minimizing sludge washout. Ammonium was removed effectively through partial nitrification and denitritation. Enhanced biological phosphate removal was established with ~98% removal efficiencies. Improved granulation, enrichment of polyphosphate-accumulating organisms, and establishment of enhanced biological phosphate removal pathways in tropical climates recommend GAC addition as a simple and potential start-up strategy for AGS-based biological wastewater treatment.

Keywords: Aerobic granulation, biological nutrient removal, microbial community assembly, phosphate removal, sewage treatment.

AEROBIC granular sludge (AGS) is the

plants, possibly due to the concerns about the long start-up periods for cultivating AGS, disintegration of granules, and NO_x species accumulation because of inefficient denitrification[7–9].

For AGS development, it is crucial to have sufficient organic substrate as well as a high COD/biochemical oxygen demand (BOD) ratio in the wastewater. Previous research suggests that long start-up periods of up to several months are needed for cultivating AGS while treating low-strength domestic wastewater[7,10]. In regions with combined or open sewer systems in practice, mixing storm water with domestic wastewater can dilute and generate low-strength wastewater. For instance, COD values of 267 mg/l and 300–400 mg/l were reported respectively, in China and Malaysia, in sewage treatment plants[11]. The COD values ranging from 112 to 475 mg/l were observed at one of the sewage treatment plants in India[6]. Longer start-up periods of 3 months and 300 days respectively, were reported for AGS formation and establishment of biological nutrient removal (BNR) pathways in independ-