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Substrate utilization kinetics and microbial community dynamics in solid-phase denitrification processes acclimated to different copolymers of polyhydroxyalkanoates

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Solid-phase denitrification (SPD) processes using biodegradable polymers as the solid substrate have great promise in wastewater treatment technology for nitrogen removal. A copolymer group of polyhydroxyalkanoates (PHAs) has been most widely used as the substrate for this purpose because of their excellent biodegradability. This study was undertaken to characterize poly(3-hydroxybutyrate-*co*-3-hydroxyhexanoate) (PHBH)- and poly(3-hydroxybutyrate-*co*-3-hydroxyvalerate) (PHBV)-acclimated SPD processes with respect to substrate specificity for nitrate removal and microbial community dynamics. **Methods**. Sequencing-batch SPD reactors were constructed using screw-capped glass bottles seeded with activated sludge and cultivated semi-anaerobically with nitrate-containing mineral medium and PHBH and PHBV flakes (1%, w/v). Nitrate removal activity was determined in vial tests with different concentrations of lower fatty acids as the substrate. Changes in microbial community structure was studied by quinone profiling and 16S rRNA gene amplicon analysis using the Illumina MiSeq platform. **Results and Discussion**. The PHBH- and PHBV-acclimated SPD reactors constructed exhibited good performance of nitrate removal in every batch cycle. Vial tests with different lower fatty acids showed that the PHBH- and PHBV-acclimated cultures had the highest V_{max} with acetate and butyrate for nitrate removal but differed in substrate specificity in K_s. Quinone profiling showed that the PHBH- and PHBV-acclimated reactors contained Q-8 as the most abundant component but differed from one another in proportions of Q-9 and Q-10. Amplicon analyses showed that members of *Betaproteobacteria* predominated in both the reactors. These results suggest that microbial community structure and activity in PHA-acclimated SPD processes are relatively stable; nevertheless, small but significant changes take place depending upon the kind of copolymers used for acclimation.