Flux of poly(hydroxyalkanoates) in photosynthetic benthic microbial mats

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Abstract

The *in situ* concentrations and repeating unit characterization of poly(hydroxyalkanoates) (PHAs) were examined in stratified photosynthetic microbial mats from Great Sippewissett Salt Marsh, Massachusetts and the Ebro Delta, Spain. In the cyanobacteria-dominated green layer material the mole % ratio of hydroxybutyrate (HB) repeating units to hydroxyvalerate (HV) units was generally 1HB:1HV. In the purple sulfur bacteria-dominated pink material the relationship was typically 1HB:2HV. When total PHA content was normalized to organic carbon content there was little seasonal variation in the PHA levels. However, a diel cycle of varying PHA levels was evident at all sites. Overnight, PHA accumulated to about 1 1/2 to 2 times the amount that had been present the previous evening. Over the course of the next daylight period, those levels declined to what they had been the previous evening. Exogenous acetate, lactate, and propionate induced 2 to 5-fold increases in PHA content when applied in the daylight, but had no effect on PHA content when applied at night. ^ Intact microbial mat slabs, incubated in the light for 6 h in H $^{14}CO_3^-$ amended seawater, incorporated 58% of the initial radiolabel. The cyano/green material incorporated 4 times more H$^{14}CO_3^-$ than did the PSB/pink material. The mats were fractionated into the major molecular pools of (1) low molecular weight (lmw) material, (2) proteins/nucleic acids, (3) PRA, and (4) glycogen. After the initial labeling period in the light, the ^{14}C incorporated into the green layer material was partitioned as follows: 61% in lmw material, 20% in proteins/nucleic acids, 20% in glycogen, and less than 1% in PHA. After the initial labeling period in light the ^{14}C incorporated into pink layer material was partitioned as follows: 61% in lmw material, 14% in proteins/nucleic acids, 25% in glycogen, and less than 1% in PHA. When mat that was labeled in the light was transferred to darkness, there was a marked now of ^{14}C from the glycogen fraction to the PHA fraction, particularly in pink material where 13% of the incorporated ^{14}C was detected after 20 h of darkness. There was no incorporation of label into the PHA of mats that were continuously incubated in the light. ^

Subject Area

Microbiology|Environmental science

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