

Biodegradation of lignite under conditions of acidic molasses fermentation

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In this study a packed bed reactor was filled with lignite samples collected from the Konin region (central Poland) and continuously supplied with M9 medium supplemented with molasses (a by-product of sugar industry) to stimulate autochthonic microflora of lignite for 124 days. In the bioreactor acidic fermentations of molasses and release of hydrogen-rich fermentation gas were observed. Our results show intensive decay of free (non-bounded) organic compounds during experiment of anaerobic lignite biodegradation. Concentrations of *n*-alkanes, *n*-alkanols, *n*-fatty acids, diterpenoids, triterpenoids and steroids present in non-biodegraded samples significantly decreased during biodegradation. Interestingly, some compound classes like phenols and ketons and certain organic compounds increase their concentration after lignite decay. We interpret this phenomenon as gradual decomposition of polymers present in lignite including lignin and cellulose. These changes resulted from microbial activity since they were not observed in pure solutions of short-chain fatty acids. The 16S rRNA profiling of microbial community in the bioreactor revealed that the dominant bacteria belonged to the Firmicutes, Actinobacteria, Proteobacteria and Bacteroidetes, furthermore representatives of 16 other phyla were also found. All the recognized taxa of lignocellulolytic bacteria were represented in the microbial community. Synergistic relations between bacteria fermenting molasses and bacteria degrading lignite is assumed. The results confirm extensive lignin degradation in acidic conditions by bacteria under anaerobic conditions.