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Removal of Polycyclic Aromatic Hydrocarbons (PAHS) and the Response of Indigenous Bacteria in Highly Contaminated Aged Soil after Persulfate Oxidation

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Abstract : Integrated chemical-biological treatment is an attractive alternative to remove polycyclic aromatic hydrocarbons (PAHs) from contaminated soil; wherein indigenous bacteria is the key factor for the biodegradation of residual PAHs concentrations after the application of chemical oxidation. However, the systematical study on the impact of persulfate (PS) oxidation on indigenous bacteria as well as PAHs removal is still scarce. In this study, the influences of different PS dosages (1%, 3%, 6%, and 10% [w/w]), as well as various activation methods (native iron, H2O2, alkaline, ferrous iron, and heat) on PAHs removal and indigenous bacteria in highly contaminated aged soil were investigated. Apparent degradation of PAHs in the soil treated with PS oxidation was observed, and the removal efficiency of total PAHs in the soil ranged from 38.28% to 79.97%. The removal efficiency of total PAHs in the soil increased with increasing consumption of PS. However, the bacterial abundance in soil was negatively affected following oxidation for all of the treatments added with PS, with bacterial abundance in the soil decreased by 0.89~2.88 orders of magnitude compared to the untreated soil. Moreover, the number of total bacteria in the soil decreased as PS consumption increased. Different PS activation methods and PS dosages exhibited different influences on the bacterial community composition. Bacteria capable of degrading PAHs under anoxic conditions were composed predominantly by Proteobacteria and Firmicutes. The total amount of Proteobacteria and Firmicutes also decreased with increasing consumption of PS. The results of this study provide important insight into the design of PAHs contaminated soil remediation projects.

Keywords : activation method, chemical oxidation, indigenous bacteria, polycyclic aromatic hydrocarbon
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