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Degradation of phthalic acid esters by zero-valent iron and persulfate using bacth experiments at different temperatures

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ABSTRACT

Phthalic acid esters (PAEs) are often detected in groundwater. Degradation of PAEs in groundwaters is more difficult than in surface waters because of their lower temperatures. Degradation of three PAEs (di(2-ethylhexyl) phthalate (DEHP), dibutyl phthalate (DBP), and dimethyl phthalate (DMP)) were investigated in ZVI-persulfate system at 15°C, 20°C, 25°C, and 30°C. Degradation rates of these PAEs were much faster when persulfate was activated by ZVI in comparison with the persulfate activated by heat only. PAEs degradation slowed down as temperature decreased. Degradation of DEHP, DBP, and DMP at 15°C in 180 min was 32%, 47%, and 5%, respectively. PAEs with longer carbon chains degraded more than PAEs with shorter carbon chains at 25°C–30°C. Conversion of persulfate into sulfate, release of iron ions, and variation in pH values in the solutions were also investigated. Persulfate ions consumption and dissolution of iron ions increased as temperature increased. About 47–57 mg/L of sulfate ions formed from 60 mg/L of persulfate. pH values remained in the 3.5–4. range. Our work provides basic and guidance knowledge for in situ PAEs remediation from groundwaters.

Keywords: PAEs; Zero-valent iron; Persulfate; Temperature; Batch test

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