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OPERATION OF HYBRID FLUIDIZED BIOREACTORS FOR *ON SITE* BIOREMEDIATION OF WATER POLLUTED WITH HIGH CONCENTRATION OF PCE

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Abstract

Perchloroethylene (PCE) can be removed via biological processes like reductive dehalogenation and halorespiration, and by abiotic mechanisms such as zero-valent iron (ZVI) and zinc. Coupling these processes in bioreactors could be useful to treat effluents with high concentrations of PCE solubilized with Tween 80, for future applications to *on site* remediation of polluted groundwaters. Thus, the aim of this work was to evaluate the effect of increasing PCE concentrations (80, 165, 278 mg/L) on the performance of methanogenic and hybrid fluidized bed bioreactors.

Two factors were tested, *i.e*., the PCE loading rate π_v and coupling to ZVI filter. Four methanogenic fluidized bed bioreactors were implemented, two plain (MFBBR) and two bioreactors coupled to filters filled with particulate ZVI and sand (hybrid bioreactors or HFBBR). π_v was set at 80, 165, 278 mg PCE/(L*d) (Periods 1, 2, and 3, respectively). Performance of bioreactors was evaluated as described elsewhere.

Coupling to the ZVI filter in the HFBBR was associated to a higher PCE removal in Period 2 whereas in Period 3, PCE removal was poor for both types of bioreactors. There was either a negative effect of the increased π_v or PCE plus increased Tween 80 concentration. Cconcentration of metabolites in the effluents, gas trap (volatilized PCE and metabolites) and sorbed onto bed bioparticles were lower in the HFBBR than in MFBBR in all periods. The main metabolite of PCE degradation found in the effluent of Periods 2 and 3 was vinyl chloride (VC). PCE and VC sorbed onto bed bioparticles increased with π_v; this trend was consistent with the decrease of PCE removal at the highest π_v.

The HFBBR performance was satisfactory in the first two periods, highlighting the second period in which the PCE removal was significantly higher than that of MFBBR reactors, despite the high concentration of PCE (165 mg/L*d). These results are encouraging, since most research on bioreactors has been focused on lower concentrations of PCE. Performance of HFBBR deteriorated at the highest π_v (278 mg/(L*d), although there is preliminary evidence that the bioreactors could recover with prolonged operation at that level. It can be concluded that HFBBR is a promising alternative for the on site treatment of waters contaminated high concentrations of PCE (up to 165 mg/L PCE).

Key words: fluidized bed bioreactor, on site remediation, perchloroethylene, Tween 80