Reactivity of different cement minerals in presence of Fe(II) for reducing trichloroethylene

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ABSTRACT

Ferrous iron Fe(II) in combination with Portland cement is effective in dechlorinating trichloroethylene (TCE). However, there is no clear evidence about the component in cement responsible for TCE dechlorination. In present study different cement hydration minerals, such as ettringite (AFt) and monosulfate (AFm) were synthesized separately in laboratory. The TCE dechlorination ability of these minerals in combination with Fe(II) was investigated. It was found that these minerals in pure form do not have TCE dechlorination capacity. Further α-hematite (α-Fe₂O₃) that is suspected reactive mineral in cement/Fe(II) was investigated. It was found that when extra pure α-Fe₂O₃ along with CaO/Fe(II) was used for TCE did not show any reduction potential. This result was contradictory to earlier researchers, who used α-Fe₂O₃/CaO/Fe(II) for dechlorination of TCE. Thus, the α-Fe₂O₃ (Bayferrox-110M) used by earlier researchers was investigated and it was found that it had some other impurities present in it. These impurities were suspected to play significant role in dechlorination of TCE. Further detailed studies were carried out and α-Fe₂O₃ was synthesized by following manufacturing procedure given for α-Fe₂O₃ (Bayferrox-110M). When such α-Fe₂O₃ was used for TCE reduction, it showed improved reactivity. Detailed investigations showed that the α-Fe₂O₃ not in pure form but in combination with other impurities has reduction capacity for TCE.

Keywords: TCE; Ettringite; Monosulfate; α-Fe₂O₃; Reduction

1. Introduction

Chlorinated ethylene and their adverse effects on environment have been studied by many researchers [1–3]. The iron based solidification and stabilization technology is one of the most popular technologies to remediate the ground water polluted with chlorinated solvents. This technology helps not only in immobilizing the organic and inorganic contaminants and prevent their spreading in surrounding environment, but also can degrade chlorinated hydrocarbons by reductive dechlorination [4,5].

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