Use of the ferrates (Fe$^{IV-VI}$) in combination with hydrogen peroxide for rapid and effective remediation of water – laboratory and pilot study

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ABSTRACT

In recent years, particles of iron in higher oxidation states (Fe$^{IV-VI}$), commonly called ferrates, have been presented theoretically as very effective oxidants. They can potentially be used for elimination of a wide range of organic and inorganic contaminants. However, so far the majority of applications have been carried out only as laboratory tests using model samples in many cases. The application of ferrates in remediation programs has so far proved to be more complicated with results failing to meet expectations. Therefore there is a necessity to consider the suitability of their use or consider their possible combination with other agents in order to reach required removal efficiencies in remediation. This study is focused on laboratory experiments using industrial groundwater leading to the proposal of a pilot field application realized as an ex-situ remediation. The combination of ferrates with hydrogen peroxide was used in this study in order to enhance the removal efficiency during pilot remediation of groundwater strongly contaminated by a wide range of organic contaminants. This combination has been shown to be very effective. During the 24-hour reaction time the majority of detected contaminants were removed by approximately 60–80%. Moreover, the unpleasant odor of the water was suppressed and suspended particles were removed by the flocculation effect of ferric sludge.

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