Strategies for the Production of Magnetite from Groundwater

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Groundwater is an important source of drinking water. However, groundwater worldwide contains up to 50 mg/L of iron, while WHO recommends a concentration < 0.3 mg/L for drinking water. Currently, chemical removal of iron is the most utilized method. This results in a voluminous sludge waste stream of low value. We propose a different approach, in which the dissolved iron will be precipitated to form the more compact and more valuable magnetite ($Fe^{2+}Fe^{3+}{}_2O_4$). Several chemical routes to synthesize magnetite exist. However, these routes are not environmentally friendly due to the employment of elevated temperatures and toxic chemicals to meet the product demands. We strive to find a more sustainable route to magnetite crystallization. The three main routes that are explored in this research are; partial oxidation of Fe^{2+} coupled to 1) biological denitrification and 2) chemical reduction of oxygen, and 3) partial *biological* reduction of Fe^{3+} with an organic electron donor.

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