

Abstract Title	<p>title</p> <p>Oxidation of native-Fe(II) in anaerobic groundwater with H₂O₂ for enhanced As(III) co-removal- A field study in Assam (India).</p>
Topic	<ul style="list-style-type: none"> <input checked="" type="radio"/> Improving water quality <input type="radio"/> Resilient water systems <input type="radio"/> Circular solutions: Reuse, Recover and Recycle <input type="radio"/> Transitions in water, agro/food and energy
Challenges and Solutions	Challenges and solutions
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Abstract	<p>Arsenic (As), present mainly as arsenite (As(III)), in anaerobic groundwater is a toxic element and should be removed before drinking. Conventional aeration-filtration applied to anaerobic groundwater to remove native-iron (Fe(II)) can co-remove As, where Fe(II) oxidation through aeration (or O₂) generates Fe(III) (oxyhydr)oxides (or Fe solids) that can adsorb As. However, the technique is not very efficient for As(III) removal since Fe solids have high affinity to adsorb the oxidized arsenate (As(V)) than As(III), and As(III) oxidation with O₂ is extremely slow and partial. In this study, a novel approach is investigated to enhance As co-removal with the native-Fe(II) by oxidizing the Fe(II) with hydrogen peroxide (H₂O₂) before aeration. Although H₂O₂ is a strong oxidant but its oxidation rate for As(III) is also slow. However, Fe(II) oxidation by H₂O₂ generates higher stoichiometric amounts of reactive oxidizing species (ROS) (*OH, Fe(IV)) compared to O₂, which rapidly oxidizes As(III). H₂O₂ also oxidizes Fe(II) at a rate four orders of magnitude higher than O₂. This results in formation of poorly-ordered Fe solids, which have higher adsorption surface area compared to moderately crystalline Fe solids generated with O₂, thus causing higher As adsorption. Experiments were performed using anaerobic groundwater from four different locations (L1-L4 (Fig. 1(A) and (B)) in Assam (India), where the groundwater's</p>

are contaminated with As. The groundwater at the four locations contained varying concentration of As (>90% As(III)) and Fe(II) (Fig. 1(A) and (B)), where the native-Fe(II) was oxidized completely by dosing either 400 μM H_2O_2 or aeration (8.0-9.0 mg/L dissolved O_2) using an air-pump. Dissolved As measurement after the reaction showed that oxidizing the native-Fe(II) completely by H_2O_2 was advantageous compared to O_2 , where the As removal with H_2O_2 in L1, L2, L3, L4 was 88%, 70%, 59%, 53% compared to 30%, 44%, 27%, 48% with O_2 (Fig. 1(A) and (B)). Therefore, this study clearly shows the benefits of oxidizing groundwater native-Fe(II) with H_2O_2 rather than with O_2 in terms of As(III) removal. In addition, H_2O_2 is considered as a green oxidant since its decomposition product is $\text{H}_2\text{O}/\text{O}_2$, and H_2O_2 can be generated *in-situ* through electrochemical reactions, thus eliminating the need for transportation, handling, and storage of H_2O_2 solutions.

Figures/diagrams/illustrations

Up to 2 (in abstract)

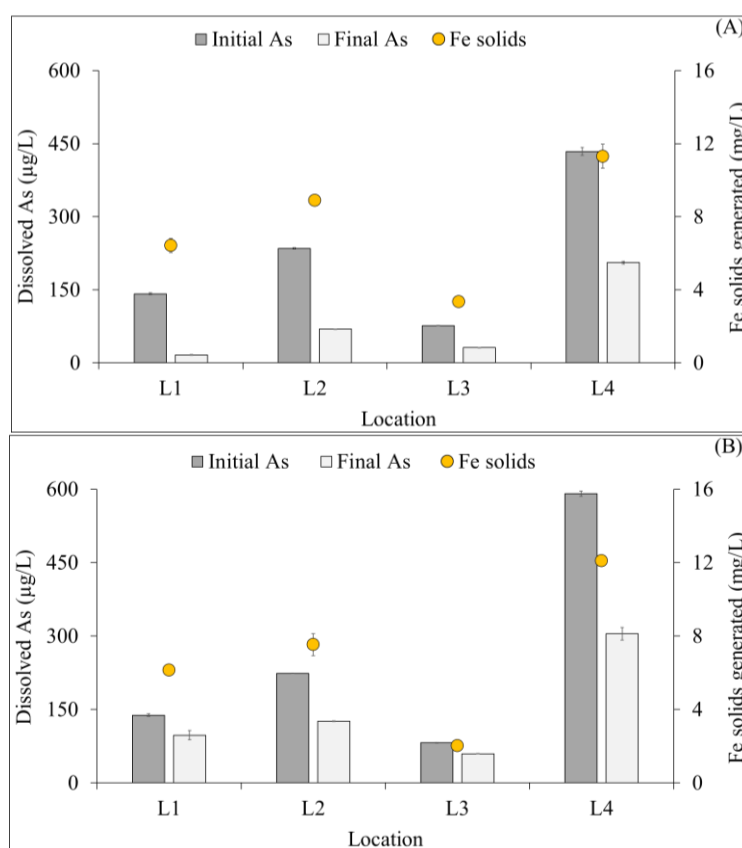


Fig. 1: Dissolved As concentration at the experiment beginning (initial) and end (final) and Fe solids concentration at experiment end when the native-Fe(II) at L1, L2, L3, L4 was completely oxidized by 400 μM H_2O_2 (A) and by 8.0-9.0 mg/L O_2 (B).