Liang Zou

Thesis

Arsenic Removal from Industrial Wastewater by Photo-oxidation

Abstract

Arsenic is a naturally occurring chemical found in the earth's crust, which when released into drinking water supplies can be hazardous to humans and must be removed. Most arsenic removal or remediation technologies require that the arsenic be in the oxidized form as arsenate when it is much easier to remove by many of the technologies currently available. Hence this investigation was directed towards developing a process for the efficient oxidation of arsenite to arsenate. The photochemical oxidation is one such process that had not been adequately investigated in the past and it is the objective of this work to evaluate this.

A detailed study was conducted on the Direct Photolysis (DP) and the Advanced Oxidation Processes (AOP) employing hydrogen peroxide (H2O2) as the homogeneous photo-oxidizer for the oxidation of arsenite to arsenate. The effects of many operating parameters were evaluated for both these photochemical processes. The AOP is found to be much more effective than DP for the economic and effective conversion of arsenite to arsenate and the process can be developed for further use as a preoxidation step for many of the established arsenate removal technologies such as Ion Exchange, Membrane Separation etc. It is found that Dissolved Oxygen (DO) in the case of DP and the H2¬O2/Arsenic ration in the case of AOP are the most important parameters that dictate the feasibility and efficiency of arsenite oxidation.

The kinetic studies were conducted in a batch reactor and in a custom-modified recirculating batch reactor and the results were analyzed to establish the probable reaction order and rate constants. Reaction schemes are postulated to indicate the most probable mechanism for the overall photo-oxidation reactions.

Degree

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Completion

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