Office of Technology Transfer

Auburn University

Destruction of Perchlorate and Nitrate in Spent Ion-Exchange Brine

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Reference: Perchlorate/ Nitrate Treatment

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Overview

Auburn University seeks a licensee or development partner for an improved remediation technology for the *ex situ* destruction of perchlorate and nitrate in spent, ion-exchange regenerant brine. A new class of zero-valent iron nanoparticles stabilized with starch or cellulose can degrade perchlorate or nitrate in hypersaline or fresh water in an environmentally safe manner, something not possible by current techniques. The stabilization prevents nanoparticle agglomeration, thereby maintaining a high surface area and reactivity of the nanoparticles. This innovative process is fast and highly cost-competitive for *ex situ* destruction of perchlorate and nitrate in brine.

Advantages

- Destroys perchlorate and nitrate completely and rapidly in spent, ion-exchange brine and fresh water. Current technologies are limited to fresh water treatment only
- Degrades perchlorate and nitrate at a much faster rate than existing biological processes; 100% reduction of both achievable in 2 hours or less under certain conditions
- Reduces costs of ion exchange by converting costly waste brine to reusable regenerant and by eliminating need for routine replacement of expensive adsorbent resins
- Keeps operating costs low through simple operations and maintenance
- Nanoparticles can be regenerated *in situ* and reused
- Produces no detectable undesirable intermediates

Visual comparison of nanoparticle stability after five days: stabilized (left) vs. unstabilized (right)

Description

Rocket fuel, fireworks, explosives and road flares are all major sources of perchlorate contamination in water. Perchlorate is highly soluble in water and can cause harmful effects to the human metabolism processes. Nitrate contamination occurs through fertilizer runoff, farm animal wastes and septic tank discharge that percolate into groundwater aquifers and ultimately into water supplies. High nitrate levels in drinking water are the main cause of "blue-baby" syndrome and also increases the risk of cancer and other birth defects. Among the Best Available Technologies (BAT) to control perchlorate/nitrate contamination is the Ion Exchange process. However, the ion-exchange technology often produces large volumes of spent brine containing highly concentrated perchlorate or nitrate. The spent brine requires additional treatment to comply with environmental regulations, making the treatment process cost prohibitive.

The Auburn invention uses a new class of starch- or cellulose-stabilized, zero-valent iron nanoparticles to effectively destroy perchlorate/nitrate in fresh water or in brine resulting from the ion exchange process. The addition of starch or cellulose prevents the agglomeration of iron nanoparticles and ensures maximum reactivity of the nanoparticles.

Status

- Subject of US Patent 7,635,236
- This process has been experimentally verified

Licensing Opportunities

- This technology is available for exclusive or non-exclusive licensing
- Joint development opportunities include funded research or joint venture