

Nitrate remediation using silica supported iron nanoparticles

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Excess nitrate:



Lake Horowhenua, www.mfe.govt.nz

- Nitrate (NO_3^-) from dairy farms causes eutrophication in waterways
- Nitrates high solubility limits removal methods
- Riparian strips, chemical precipitation methods do not work

Zero-valent iron nanoparticles (nZVI):

- Highly reactive
- Cheap!
- Removes nitrates as well other pollutants (ie As, PO_4^{2-} , Pb, Cd etc)



The side effects: bioaccumulation of nZVI

Medaka fish



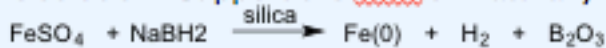
Intestinal wall of Larvae (control)



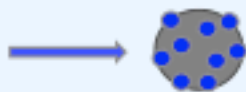
After 7 days of 100 mg/L Fe^0



The solution: Support the nZVI on naturally occurring silica and silicates



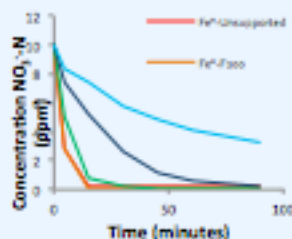
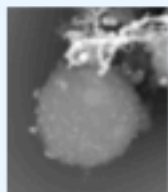
10-20 nm



100-250 nm

- Maintain reactivity of nZVI
- Minimise the risk of bioaccumulation
- Easier to manipulate → no need for extra chemical coating require for nZVI storage

Initial results: naturally occurring silicates



- Reduces nitrate
- Uneven nZVI-coating
- Is activity due to free nZVI???

Current work: focus on silica

- Working with the 'known' chemistry of silica to determine optimum coating conditions
- pH/zeta-potential optimisation
- Other ligands on silica (ie - NH_2) to attract Fe

