Geophysical Research Abstracts
Vol. 15, EGU2013-1207, 2013
EGU General Assembly 2013

Use of bacterial ureolysis for improved gelation of colloidal silica in rock grouting

Erica MacLachlan
United Kingdom (erica.maclachlan@strath.ac.uk)

Low pH grouts that are capable of penetrating fine aperture fractures are increasingly being developed for use in engineering applications. One such grout is colloidal silica, which has an initial low viscosity and on destabilisation, typically using a saline solution, develops into a sol-gel. We propose here for the first time that bacterial ureolysis using Sporosarcina pasteurii can be used as an accelerator to destabilise colloidal silica in a much more controlled fashion than via saline solution alone. A number of different accelerators have been investigated in this study including sodium chloride, calcium chloride, ammonium chloride and bacterially-induced production of ammonium ions by ureolysis. For each accelerator, we experimentally determine the gel time and rate of gelation using viscosity measurements, and the shear strength of the grouts after 1 day and 7 days.
We demonstrate that using bacterial ureolysis as a means of destabilising colloidal silica, leads to longer gel times than for the direct addition of a traditional chemical accelerator at the same concentration. In addition, for grouts with similar gel times we have illustrated that the bacterial grout has a higher rate of gelation and a higher final shear strength than a grout destabilised by a chemical accelerator. These results suggest that bacterial ureolysis could potentially be used in rock grouting to achieve longer gel times and hence greater penetration, while also maintaining sufficiently rapid gelation to minimise issues related to fingering and erosion of the fresh grout.