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Nanoparticles migration in fractured rocks and affects on contaminant migration

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In previous studies, the transport behavior of artificial (gold and latex) and natural (smectite clay) colloids, within a planar fracture in crystalline rock, was analyzed. In order to better understand the effects of colloid size, shape and surface charge on nanoparticle migration and especially on filtration processes on natural rock surfaces, different clay colloids and oxide nanoparticles were selected and their transport studied as a function of the residence time. In all the cases, (a fraction of) the nanoparticles travelled in the fracture as fast as or faster than water (with a retardation factor, Rf $\leq$ 1) and the observed Rf, was related to the Taylor dispersion coefficient, accounting for colloid size, water velocity and fracture width. However, under most of the cases, in contrast to the behavior of a conservative tracer, colloids recovery was much lower than 100 %. Differences in recovery between different nanoparticles, under similar residence times, were analyzed.
In order to evaluate the possible consequences, on contaminant migration, of the presence of nanoparticles in the system, transport tests were carried out with both colloids and sorbing radionuclides. The overall capacity for colloids of enhancing radionuclide migration in crystalline rock fractures is discussed.

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