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Microbially Induced Calcium Carbonate Precipitation on Surface or in the Bulk of Soil

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Microbial precipitation of calcium carbonate takes place in nature by different mechanisms. One of them is microbially induced carbonate precipitation (MICP), which is performed due to bacterial hydrolysis of urea in soil in the presence of calcium ions. The MICP process can be adopted to reduce the permeability and/or increase the shear strength of soil. In this paper, a study on the use of *Bacillus sp.*, which was isolated from tropical beach sand, to perform MICP either on the surface or in the bulk of sand is presented. If the level of calcium salt solution was below the sand surface, MICP took place in the bulk of sand. On the other hand, if the level of calcium salt solution was above the sand surface, MICP was performed on the sand surface and formed a thin layer of crust of calcium carbonate. After six sequential batch treatments with suspension of urease-producing bacteria and solutions of urea and calcium salt, the permeability of sand was reduced to 14 mm/day (or 1.6×10^{-7} m/s) in both cases of bulk and surface MICP. Quantities of precipitated calcium after six treatments were 0.15 and 0.60 g of Ca per cm² of treated sand surface for the cases of bulk or surface MICP, respectively. The stiffness of the MICP treated sand also increased considerably. The modulus of rupture of the thin layer of crust was 35.9 MPa which is comparable with limestone.

Keywords microbially induced calcium carbonate precipitation, soil bioclogging, soil biocementation

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