

Mathematical Model of Biofilm Induced Calcite Precipitation

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Abstract

Microbially modulated carbonate precipitation is a fundamentally important phenomenon of natural and engineered environments which involves the interaction of biological, chemical, geological, and hydrological processes, and is important in controlling atmospheric and aqueous levels of carbon dioxide on a number of spatial and temporal scales. We consider the following biomineralization problem. Urea hydrolysis catalyzed by biofilm increases the pH value and produces carbonate ions. In the presence of soluble calcium ions, calcite (CaCO_3) will precipitate and form crystal once its saturation index exceeds certain critical value. We propose a multiphase mixture model including the important chemical, physical and biological processes (Ureolysis and pH value change, advection, diffusion and crystal precipitation, biofilm growth and deformation) involved in the problem. Numerical results and discussion will also be presented.