Evaluating Varying Bacterias' Capacity to Desalinate Water via Precipitating Calcium, Magnesium, Phosphate, and Sodium Chloride Ions

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The issue of freshwater scarcity needs a solution, as the world is already undergoing effects. Humans explore desalination processes to continue to supply freshwater for ourselves and ecosystems. The National Aeronautics and Space Administration outlined strategic goals to "expand human knowledge through scientific discoveries" and to "drive innovation to address national challenges" (NASA). The experiment refines a method of desalination utilizing microbes to remove ions from saline water, improving habitat quality and providing larger supplies of freshwater to those experiencing scarcity. The objective examines if microbially-induced biomineralization results in removing calcium, magnesium, and sodium chloride from water. The question is asked, "Can bacteria effectively desalinate water through biomineralization?" It's hypothesized that microbes remove ions from water and reduce salinity levels.

A microfluidic experimental observation is performed. A microfluidic cell was constructed using a 3D printer with a porosity mimicking sand. Four species of bacteria are utilized for this experiment: e. Coli, r. Rubrum, b. Subtilis, and m. Luteus. Presently, e. Coli has been tested for halotolerance by examining survival over an hour in varying concentrations of salt. Once each bacteria has been tested for halotolerance, they will grow throughout the model over a period of time. Nutrients will be injected into the cell with bacteria. A saline solution will be injected. The solution will be injected using a syringe pump, releasing the fluid into the micromodel. An inverted Leica camera records a time-lapse.

The results of this study are visualized via video. It's been found that e. Coli is capable of surviving saline conditions as high as 10g/L NaCl. Mineral precipitation rates and temporal changes in porosity will be measured using ImageJ, an image analysis software for microfluidic experimental analysis. The data collected will be set up in a table. Then, results are analyzed and further conclusions are drawn.