

Insights into the current trends in the utilization of bacteria for microbially induced calcium carbonate precipitation

ABSTRACT

Nowadays, microbially induced calcium carbonate precipitation (MICP) has received great attention for its potential in construction and geotechnical applications. This technique has been used in biocementation of sand, consolidation of soil, production of self-healing concrete or mortar, and removal of heavy metal ions from water. The products of MICP often have enhanced strength, durability, and self-healing ability. Utilization of the MICP technique can also increase sustainability, especially in the construction industry where a huge portion of the materials used is not sustainable. The presence of bacteria is essential for MICP to occur. Bacteria promote the conversion of suitable compounds into carbonate ions, change the microenvironment to favor precipitation of calcium carbonate, and act as precipitation sites for calcium carbonate crystals. Many bacteria have been discovered and tested for MICP potential. This paper reviews the bacteria used for MICP in some of the most recent studies. Bacteria that can cause MICP include ureolytic bacteria, non-ureolytic bacteria, cyanobacteria, nitrate reducing bacteria, and sulfate reducing bacteria. The most studied bacterium for MICP over the years is *Sporosarcina pasteurii*. Other bacteria from *Bacillus* species are also frequently investigated. Several factors that affect MICP performance are bacterial strain, bacterial concentration, nutrient concentration, calcium source concentration, addition of other substances, and methods to distribute bacteria. Several suggestions for future studies such as CO₂ sequestration through MICP, cost reduction by using plant or animal wastes as media, and genetic modification of bacteria to enhance MICP have been put forward.

Keyword: Bacteria; Biocementation; Construction; Microbially induced calcium carbonate precipitation