
Evaluation of PTE biomineralization of the marine bacterium *Lysinibacillus sphaericus* PG22

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Résumé

Environmental contamination represents one of the major threats to our generation. Among contaminants, Potentially Toxic Elements (PTE) are of concern due to their bioaccumulation and biomagnification in marine and terrestrial sinks. Removing these compounds led to the advancement of other methods, including biobased ones such as biomineralization processes. These can form PTE-bearing minerals through Microbial Induced Carbonate Precipitation (MICP)(1) which produces high amounts of calcium carbonate in very short time. This has encouraged the search for efficient MICP-able bacteria. Marine ecosystems, representing a priceless archive of biodiversity with unexploited biosynthetic potential, are a focal point for biotechnological innovation. In this study we evaluate the MICP potential of *Lysinibacillus sphaericus* PG22, a marine gram-positive sporulating bacterium isolated from N-Tyrrhenian sediments. Genome analysis revealed the presence of urease and metal resistance genes, confirming its validated ability to tolerate 1600ppm of Pb(NO). We demonstrated PG22's ureolytic activity, leading to the biomineralization of 61.7 g/L calcium carbonate in presence of urea. TGA, XRD, and ESEM-EDX analyses proved calcite polymorph formation already within 16 h of incubation. Additionally, in presence of Pb²⁺, PG22 promoted the formation of cerussite (PbCO) and hydrocerussite (Pb(CO)(OH)), effectively removing 100% of the Pb in solution. Future experiments will evaluate PG22 fitness in the treatment of more complex anthropogenic waste matrixes. The evidence of spores' involvement in the process could guarantee efficiency over time and in extreme conditions. These findings highlight *L. sphaericus* PG22's potential for MICP-based bioremediation strategies and the possibility of using biogenic carbonates in advanced materials.

Mots-Clés: biomineralization, MICP, PTE, marine bacteria, calcite, cerussite

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