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31) Microbially Induced Calcium Carbonate Precipitation in cyanobacteria as a tool to produce biomaterials from marble extraction leftovers

Reali L.[a], Sampietro G.[a], Tredici F.[b], Diani M.[a], Celli T.[c], Cantini F.[c], Marseglia M.[c], and Biondi N.[a]

[a] Department of Agriculture, Food, Environment and Forestry (DAGRI), University of Florence, Piazzale delle Cascine 18, 50144 Florence (Italy). Email: natascia.biondi@unifi.it
[b] Fotosintetica & Microbiologica S.r.l., Via Leonardo da Vinci 12, 50132 Florence (Italy)
[c] Department of Architecture, Design Campus, University of Florence, Via Sandro Pertini 93, 50041 Calenzano, Florence, Italy. Email: marco.marseglia@unifi.it

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Abstract

Biomineralization can be found in cyanobacteria as microbially induced calcium carbonate precipitation (MICP) via the photosynthetic pathway involving carbon concentrating mechanisms[1]. MICP processes are studied with the intent to produce new materials like bioconcrete and self-healing biomaterials, able to auto-repair microfractures and reduce crack formation. Currently MICP is exploited in stone monument restoration[2]. In this work, the pretreatment of cyanobacterial biomass was investigated aiming to improve the production of a novel biomaterial obtained from leftovers of Carrara's marble cave extraction, using a transdisciplinary approach including biodesign and material-driven design methods. Three strains of unicellular cyanobacteria were tested, diversifying culture systems and carbon supply to verify their effect on cyanobacterial biomass pretreatment and on the obtained biomaterials. In a trial, cultures were grown for few days in different systems on a calcium and bicarbonate enriched medium at the same temperature and light intensity. Calcium concentration reduction in the medium was evaluated. In another trial, the pretreatment was carried out by mixing biomass and inert material using the enriched culture medium. The mixture obtained was left under artificial light and controlled temperature for a protracted

period. These mixtures, as well as the biomasses obtained in the first trial, were used to produce artifacts, tested for their mechanical properties. In the first trial, calcium concentration reduction in the medium changed according to strain and culture system. Acknowledgments. Project INERTIAL is funded by EU-NextGenerationEU and Fondazione Cassa di Risparmio di Firenze. Research was partly performed at Centro di Competenza VALORE, Florence, Italy (Regione Toscana, Par-FAS 2007-2013).

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