106 Preparation and utilization of alginate-carbon nanotubes composites as templates for electrocrytallization of calcium carbonate

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Biominerals are inorganic-organic hybrid materials hierarchically organized from nano to ma-cro scale. Calcium carbonate ($CaCO_3$) is the the most abundant biomineral and has considerable industrial interest. Significant efforts have been made to synthesize crystals with defined sizes, morphologies and structures for applications in pharmaceuticals, biomaterials and nanomaterials. In order to achieve control over these features it is necessary to understand the mechanisms by which crystals form and the interactions between organic and inorganic phases in a laboratory environment.

In addition, stable suspensions of functionalized multi-walled carbon nanotubes (MWCNT) allow controlling the morphology, polymorphims, composition and crystallization kinetics of $CaCO_3$ particles. Functionalizated MWCNT can be obtained by oxidation followed by coupling based on hydroxyl groups, which improves the agglomeration degree and dispersion in aqueous solutions.

On the other hand, alginate (ALG) is a natural biopolymer composed of ß-D-mannuronic acid (M) and α-L-guluronic acid (G) co-units monomers. ALG is a biocompatible compound, exhibits low toxicity, has low cost and shows mild gelation by the addition of divalent cations. ALG has demonstrated great utility and potential as a biomaterial for numerous biomedical applications, particularly in wound healing, drug delivery, cell culture, restaurative/regenerative medicine, etc. Recently, Neira-Carrillo´s group has extracted ALG from Chilean *Lessonia nigrescens* brown seaweed.

Herein, we evaluated the effect of different ALG-functionalized MWCNT composites on the *in vitro* $CaCO_3$ crystals using an electrocrystallization method. The electrocrystallization of $CaCO_3$ on ITO electrodes was performed using the procedure reported by Lédion *et al.* (1985). ALG acts as organic template and substrate modifier on the $CaCO_3$ crystals nucleated by potenciometric titration controlling its polymorphism, kinetic and morphology of the $CaCO_3$ particles. Here, we found $CaCO_3$ crystals with uniform sizes and homogenous distribution, resulting calcite in a higher proportion. The ALG and ALG-MWCNT composites showed different cyclic voltammetry measurements and a strong influence on the crystallization of $CaCO_3$.

Finally, the structural, composition and chemical nature of the hybrid ALG-MWCNT composites reveals its great potential as a biomaterial and its efficient modifier capacity as template for the *in vitro* $CaCO_3$ crystallization.

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