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# Modulating Effect of Organic Matrix on the Crystallization of Calcium Carbonate

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Summary

Calcified hard tissues and skeletons, such as various shells and pearls, provide structural support and protection for many marine invertebrate phyla. Calcified shell layer is composed of two polymorphs of calcium carbonate, aragonite or calcite, and an organic matrix. The organic matrix is though to function in shell formation (biomineralization) by determining structural properties such as crystal type, size and shape. The matrix, which consists of various proteins, polysaccharides and proteoglycans, can be separated into soluble and insoluble fractions. In this study, the modulating effect of invertebrate C-type lectins and organic matrices on the crystallization of calcium carbonate was investigated. The multiple C-type lectins, named BRA-1, -2 and -3, isolated from the acorn barnacle, *Megabalanus rosa*, inhibited the nucleation and growth of calcium carbonate crystals. Among BRAs, BRA-2 most efficiently inhibited the crystal nucleation of aragonite and calcite at the concentrations of >1.7 and >13.3 μg/ml, respectively. The inhibitory activities of BRAs were enhanced by the addition of various biomolecules such as glucosamine, galactosamine, chitosan oligosaccharides, arginine, and aspartic acid. Although the crystals of aragonite and calcite were formed in the presence of lower concentrations of BRAs, the shape and size of the crystals were changed. The formed crystals were examined under various microscopy (optical, electron and confocal) and analyzed by Fourier transform infrared spectroscopy. The interaction between BRAs and soluble substrates and its effect on the crystallization of calcite and aragonite were examined. The morphology of the formed crystals was also studied. The obtained findings indicate its applicability to artificial crystallization in the sect of nanotechnology.