

Influence of biomimetic chiral amino-acid derivatives upon the crystallization process of a fluorescent dye

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The biomineralization process, that is the formation of shells and bones, is known to be directed by proteins and glycoproteins although their role is still badly understood. Of course, biomineralization involves inorganic compounds such as hydroxyapatite. But, inorganic and organic compounds share many common points as far as crystallization is concerned, and it is possible that information obtained with organic compounds may allow the biomineralization process to be better understood.

Since the last few years, we have been studying the formation of organic microcrystals using a simple method based on solvent exchange. To do so, we used of a fluorescent dye, the crystallization of which is very versatile and strongly depends on experimental conditions. In particular, placing different additives in the crystallization medium allowed us to tune the microcrystal morphology. This model was very useful to clarify the role of the additive, which both favours the formation of aggregates, stabilizes the microcrystal surface, and interferes with crystal growth.

In the present work, our aim is to get closer to the conditions of biomineralization. To do so, we intend to study the crystallization process of our dye in the presence of polypeptide derivatives. These widely studied compounds are the simplest models of proteins. Poly(L-glutamic acid) will be chosen as a structural element because we showed in a previous work that carboxylate-terminated macromolecules have a drastic effect upon the crystallization of our dye. This peptide is also appealing because of its ease of synthesis and well-defined conformational characteristics in water. Actually, it is well known that the chain conformation as α -helices, β -sheets or random-coil states depends on experimental conditions such as pH, ionic strength and temperature. This peptide can also be grafted on macromolecules, to give a soluble or an immobilized structure. The first aim of this study is to know whether the chain conformation has an influence upon the crystallization of the dye. It could also be interesting to know how the size and mobility of the additive influence the process. Finally, we shall see if the chiral nature of the additive is important or not.

The methods most currently used for the study of microcrystals are absorption spectroscopy, fluorescence microscopy and electron microscopy. A little experience in synthesis could be appreciated.