

An experimental study of the early stages of calcium phosphate formation and the role of additives

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Experimental studies on calcium phosphate formation are relevant not only for improving our understanding of how bones form in vivo but also because they may help in the design of new advanced functional materials. Here we have analysed the formation of calcium phosphate in the presence of citrate and magnesium by titration experiments in which pH, free calcium concentration and particle size distribution are continuously monitored. Titration calorimetry experiments under the same conditions are also performed. Additionally, reaction solution aliquots were drawn from solution, quenched in ethanol and analysed by means of TEM. Using these methods, we provide experimental evidence demonstrating that citrate and magnesium contribute at stabilizing a dense calcium phosphate liquid phase that occurs at a critical concentration of bound calcium. We propose that this effect could facilitate the infiltration of calcium phosphate into the interstices of the collagen fibrils during the bone formation, a role that so far has been mainly attributed to macromolecules, i.e. non-collagenous proteins.

References

Delgado-López JM, Bertolotti F, Lyngsø J, Pedersen JS, Cervellino A, Masciocchi N, Guagliardi A. (2017) The synergic role of collagen and citrate in stabilizing amorphous calcium phosphate precursors with platy morphology. *Acta Biomater.* 49:555-562.