EFFECT OF CATIONIC BIO POLYMER ON CALCIUM CARBONATE CRYSTALLIZATION BY MICROBE

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Formation and deposition of the mineral upon an organic matrix is referred as bio-mineralization. Organic matrix provides a structural framework for the nucleation and growth of the minerals which is mainly consists with the macro molecules like protein and polysaccharides [1]. In this current study, effect of the cationic biopolymer on the $CaCO_3$ crystallization was analyzed by using microbial induced carbonate precipitation method. Poly-L-lysine was used as cationic biopolymer and the chemical structure of the poly-L-lysine is given in Fig. 1. Calcium carbonate was precipitated by the hydrolysis of the urea using ureolytic bacteria *Pararhodobacter* sp in the presence of Ca^{2+} ions. Experiments were conducted with and without adding bio-polymer for different bacteria concentrations and the effect of the poly-L-lysine concentration on the $CaCO_3$ crystallization was measured by varying the poly-L-lysine concentrations and morphology of the crystals were analyzed by using Scanning Electron Microscope (SEM). Figure 2 shows the variation of the amount of precipitate with the bacteria concentration with and without poly-L-lysine. In both of the cases, amount of the precipitate increases with the bacteria concentration. Poly-L-lysine gave higher amount of precipitate compared with that without poly-L-lysine. According to the SEM images, good rhombohedral crystals were obtained for the lower bacteria concentrations and for higher bacteria concentrations combination of rhombohedral crystals were obtained. In the presence of poly-L-lysine, morphology of the crystals changed to ellipsoidal crystals and XRD results confirmed that these crystals are entirely calcite. Relationship between the amount of precipitate and the poly-L-lysine concentration is bell shaped and the morphology changed from the polyhedron type crystals to agglomeration of ellipsoidal shaped crystals. Poly-L-lysine has a significant effect on $CaCO_3$ crystallization and its morphology.

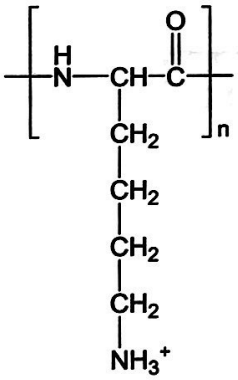

Fig. 1 Structure of the poly-L-lysine

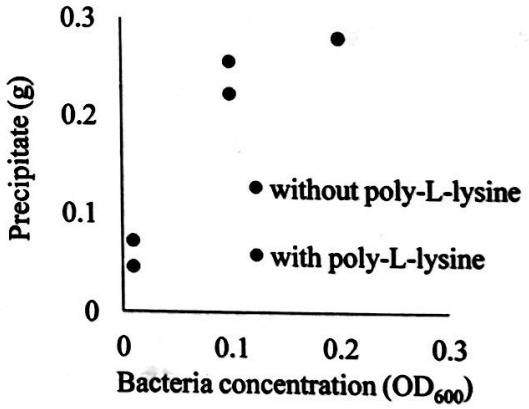

Fig. 2 Variation of the $CaCO_3$ precipitate with the bacteria concentartion in the presence of poly-L-lysine

References

[1] Xie, A.J., Shen, Y.H., Zhang, C.Y., Yuan, Z.W., Zhu, X.M. and Yang, Y.M. "Crystal growth of calcium carbonate with various morphologies in different amino acid systems", Journal of crystal growth, Vol. 285,2005, pp.436-443.