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Biocompatible Formation of Silica/Titania Nanocomposite Shells on Living Chlorella Cells

고은혜[1], 윤연정[2], 진승욱[2], 황지민[2], 이규남[2], 양성호[1], 최인성[1,*]

[1]Molecular-Level Interface Research Center, Department of Chemistry, KAIST, Daejeon 305-701, Korea,
[2]Korea Science Academy of KAIST, Busan 614-822, Korea.

The artificial shells of hard inorganic nanocomposites on individual cells would protect the cells physically and chemically, and control cell division. These emerging properties could be combined with cell-surface functionalizations for applications to cell-based sensors and assays as well as for fundamental studies on single-cell biology. In this work, individual Chlorella cells were encapsulated within a silica/titania nanocomposite shell in a biocompatible fashion that utilized a designed peptide, RKKRKKRKKRKKDDDDDDDD, as a catalytic template for formation of both SiO_2 and TiO_2 on the cell surface. The cell viability was maintained, and the division of the encapsulated Chlorella cells was controlled. The cell viability was enhanced compared with the TiO_2-shell formation. In addition, the incorporation of TiO_2 to the shell made it possible to anchor the ligands of interest to the shell via catechol chemistry. All in all, the combination of biological SiO_2 and abiolgical TiO_2 for the shell formation gave more tunability of the artificial shells compared with the SiO_2 or TiO_2 shells only.

Keywords: Artificial spore, Single cell encapsulation, Silica/titania nanocomposite