

Green and Yellow Fluorescent Proteins Capable of Silica Deposition

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Silica are useful materials in particular its application in biology and medicine due to their ordered pores, large surface areas, easy surface functionalization and biocompatibility. The discovery of the principle molecules involved in biosilification in diatoms (Silaffin) brings out a new paradigm for silica synthesis at biological conditions. Green fluorescent protein (GFP) has been developed as a standard tool for investigating intracellular properties as a biosensor, and monitoring gene expression as a reporter gene. We designed a silica forming GFP by introducing some residues into the structural side beta-sheet of GFP, resulting in a similar three dimensional arrangement of some part of silaffin peptide sequences. This strategy worked when applied to yellow fluorescent protein as well. These mutant GFP and YFP gained a silica deposition activity without damaging the fluorescent activity. GFP-mediated silica deposition using TEOS or TMOS under aqueous and neutral condition produced fluorescent silica nanoparticles. These displayed a bright and stable fluorescence. Silica forming GFP may be promising candidates for use in bio-imaging, cell staining, and simultaneous drug delivery and bio-imaging.