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Self-Assembled Peptide Structures for Efficient Water Oxidation

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In green plants, energy generation is accomplished through light-harvesting photosystem, which utilize abundant visible light and multi-stepwise redox reaction to oxidize water and reduce NADP+, transferring electrons efficiently with active cofactors1. Inspired by natural photosynthesis, artificial solar water-splitting devices are being designed variously. However, the several approaches involving immobilization2, conjugation3, and surface modification4 still have limitations. We have made artificial photosynthesis templates by self-assembling tyrosine-based peptide to mimick photosystem II. Porphyrin sensitizer absorbing blue light strongly was conjugated with the templates and they were hybridized with cobalt oxide through the reduction of cobalt ions in an aqueous solution. The formation of hybrid templates was characterized using TEM, and their water oxidation performance was measured by fluorescence oxygen probe. Our results suggest that the bio-templated assembly of functional compounds has a great potential for artificial photosynthesis.

Keywords: self-assembly, peptide, water oxidation, hybrid material