Self-assembled Diphenylalanine Peptide Fibrils with Ultra-High Aspect Ratio: A Platform for Sensitive Electrochemical H₂O₂ Sensor

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Inspired from the pathogenic process of diphenylalanine (FF) self-assembly, a key structural motif in forming Alzheimer's β -amyloid peptide fibrils, a facile way for preparation of FF aromatic dipeptide fibrils and fabrication of an electrochemical biosensor were developed. Long persistence length FF fibrils with ultra-high aspect ratio over 1000 were obtained using cationic surfactant assisted evaporation induced self-assembly. The Cotton effects indicate a signature of dominant β -sheet arrangement and the thickness of the β -sheet monolayer is estimated to be 2.38 nm. The obvious blue-shift of intrinsic fluorescence indicates an extended H-aggregate between the phenyl rings in a parallel mode. The FF fibrils based electrochemical biosensor, taking horseradish peroxidase as a model enzyme, displayed an excellent electrocatalytic activity to the reduction of H₂O₂. The peak current was a linear function of concentrations ranging from 7.5×10^{-7} to 1.4×10^{-5} M, with a detection limit of 2.5×10^{-7} M. The apparent Michaelis-Menten constant was 7.2 μ M. These results indicate that the FF fibrils with ultra-high aspect ratio providing a new and promising platform for construction of electrochemical biosensors.

Keywords: Diphenylalanine; Aromatic dipeptide; Self-assembly; Nanofibrils; Electrochemical Biosensor

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