Synopsis of Original Research Paper

Design of enzyme-loading nanoparticles with both high thermostability and high dispersability

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Glucose dehydrogenase (PQQ-GDH) and α-methoxy-poly(ethyleneglycol)-*b*-poly[2-(*N*, *N*-dimethylamino) ethyl methacrylate] (PEG-PAMA) were dropped into gold sol (pH=9.0) to formulate enzyme/polymer/gold hybridizes called nanozymes. Size growth and red-shift in the surface plasmon resonance (SPR) of the gold nanoparticles (GNPs), observed in dynamic light scattering (DLS) and ultra-visible (UV) spectroscopy analysis, respectively, suggested the adsorption of the PQQ-GDH and PEG-PAMA on the surface of the GNPs. Transmission electron microscopy analysis (TEM) showed that the nanozyme mainly composed of single GNP, on the surface of which the PQQ-GDH and/or the PEG-PAMA were loaded. ζ-Potential of the nanozymes evidenced the presence of the PEG-PAMA layer around the GNP. The nanozyme thus obtained was highly dispersible even though under physiological saline condition for one week by the protection of the peripheral hydrophilic PEG shell. It also kept its architecture in fact spanning broad pH regions from 9.0 to 2.5, providing a desirable, convenient approach to generate nanozymes at various pH regions, retaining high dispersion stability of the GNPs. It is interesting to note that apparent enzymatic activity decreased ca. 40% when the PQQ-GDH adsorbed on bare GNP surface, while co-immobilization with the PEG-PAMA gave 1.4 times higher activity than that of free enzyme, associated with notable improvement of the poor thermostability of the PQQ-GDH at pH=9.0, 25 ℃ . These results significantly indicated the responsibility of the PEG-PAMA not only for the structure stability of the nanozyme, but also its enzymatic activity.