Carbon based nanozyme: Synthesis of metal free carbon nanosphere to mimic peroxidase and catalase activity

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Abstract

The unique enzymatic properties and advantages of carbon nanomaterials (CNMs) has received much attention in recent times and will continue to be an active and challenging field for the years to come. Nanozymes have advantages over natural enzymes, such as facile production on large scale, long storage time, low costs, and high stability in harsh environments. CNMs, including fullerenes, carbon nanotubes, graphene, carbon quantum dots, and graphene quantum dots, have become an interstellar family in materials science. In continuation of this, we synthesized nitrilotriacetic acid (NTA) functionalized carbon nanosphere from tea plant *Camellia Sinensis* (CS) (CS-CNS@NTA) using a simple hydrothermal reaction condition. The characterization studies revealed size of ~160 ± 20 nm along with fluorescence (Ext. 440nm and Em. ~520nm). Synthesized CS-CNS@NTA shows strong peroxidase and catalase activity over a wide range of substrate. In the presence of H_2O_2 and TMB as a substrate CS-CNS@NTA shows peroxidase activity with K_m and V_{max} value of ~ 413µM and 1.42 µM/s and 378 µM and 1.63 µM/s, respectively. Similarly, in the presence of H_2O_2 it shows good catalase activity with K_m and V_{max} value of ~0.874 µM and 2.87 µM/s, respectively. Interestingly, it was observed that our synthesized carbon nanozyme can act as a good combat agent against the reactive oxygen species (ROS) inside cellular *in vitro* studies and may help to maintain cellular integrity *via* peroxidase and catalase mimic activity.

Keywords: Carbon nanosphere; Nanozyme; Fluorescence; oxidative stress; Catalase and peroxidase activity.

References

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