

superoxide dismutase mimics (nanozymes) for suppressing superoxide anions



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ABSTRACT

Introduction: Reactive oxygen species (ROS) including superoxide radical anion ($O_2^{\bullet-}$), hydrogen peroxide (H_2O_2) and hydroxyl radical (OH^{\bullet}) could usually be generated by either a metabolic process or environmental stress. Antioxidants play a vital role in cell protection from oxidative stress caused by ROS. One of the natural antioxidant defense systems is based on superoxide dismutase (SOD) function. SOD removes ROS by dismutation of $O_2^{\bullet-}$ into O_2 and H_2O_2 .

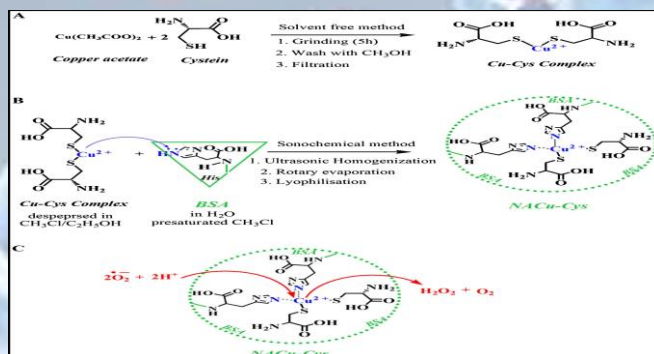
Methods: UV-Vis spectra, fluorescence spectra, dynamic light scattering (DLS), transmission electron microscope (TEM), fourier transform infrared (FT-IR) spectrometry and flow cytometer were applied.

Results and discussion: As the first, gold nanocomposite was composed of gold nanoparticles with copper-cysteine complex and applied in constructing a nano-sensor for determining superoxide concentration. The constructed nanozyme was coated with apoferritin. So, the nanozyme activity enhanced 3 times. Another superoxide dismutase mimetic nanozyme containing gold-silver hybrid nanoparticles coated with apoferritin was designed. This nanozyme was stable and active at room temperature. The last nanozyme superoxide dismutase mimic was designed from albumin nanoparticles containing copper-cysteine complex. Albumin nanoparticles enhanced the polydispersity and solubility of copper-cysteine complex.

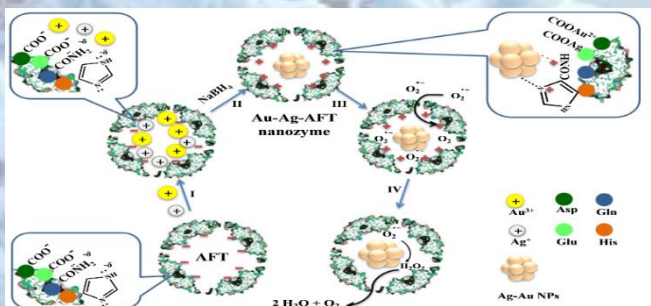
Conclusion: When the results were compared to natural superoxide dismutase, it was concluded that these nanozymes enhance the viability and decrease apoptosis like natural enzyme.

Keywords: Oxidative stress, Antioxidant, Nanozyme, Enzyme mimetic activity

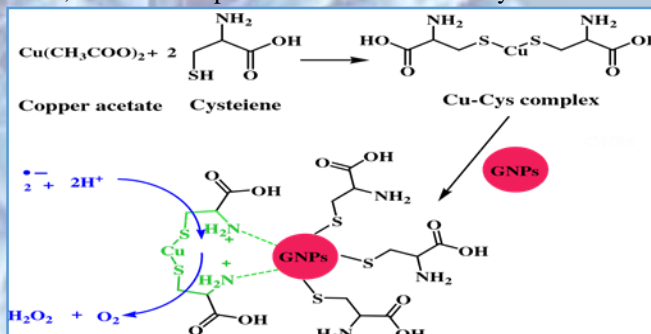
DISCUSSION



NACu-Cys shows good SOD mimetic activity for scavenging $O_2^{\bullet-}$. This could be due to $O_2^{\bullet-}$ elimination by covalent bonding between $O_2^{\bullet-}$ and Cu^{2+} and/or catalytic decomposition of $O_2^{\bullet-}$ to O_2 and H_2O_2 , similar to natural superoxide dismutase



Due to the catalase activity of AuNPs and AgNPs, the nanoparticles of AuAg alloy might enhance their individual enzymatic activity. Based on this logic, a novel nanozyme consisting of silver-gold nanohybrid in apoferritin cage (Au-Ag-AFT nanozyme) was designed which presents SOD, catalase and peroxidase mimetic activity



GNPs/Cu-Cys nanocomposite shows SOD mimetic activity in scavenging $O_2^{\bullet-}$. Because, it is composed up three convenient ingredients for scavenging $O_2^{\bullet-}$ such as copper (II), cysteine and GNPs

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Presentation Info:

Day 3th 1398

10_11 AM

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