








The effect of aluminum oxide on red blood cell integrity and hemoglobin structure at nanoscale

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Abstract

Herein, we explored the interaction of Al₂O₃ NPs with RBCs and Hb to determine the effect of Al₂O₃ NPs on hemolytic activity and Hb denaturation. The percentage of hemolysis of extracts and direct contact assays triggered by Al₂O₃ NPs was calculated by determining supernatant Hb concentration at 540 nm. Far-UV CD and Trp/ANS/acrylamide fluorescence spectroscopic methods were used to determine the structural changes of Hb upon interaction with Al₂O₃ NPs. Theoretical studies were carried out to display the residues involved in the binding site of Hb with Al₂O₃ nanocluster as well as the structural changes of Hb after interaction. The results showed that the percentage of hemolysis of extract and direct contact assays induced by Al₂O₃ NPs were 1.16 and 0.46, respectively. Fluorescence spectroscopy revealed that Al₂O₃ NPs alter the quaternary structure of the protein; however, CD spectroscopy indicated that the secondary structure of Hb remains almost unchanged. Theoretical study displayed that Al₂O₃ nanocluster interacts with different residues of protein, and Hb tends to be destabilized at the binding site with nanocluster. This study may be significant in exploring the toxicity profile of Al₂O₃ NPs for their *in vivo* implementations.