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A study on kinetic and physicochemical properties of protein or enzymatic products in the presence of silver nanoparticle.

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Background and Aims: Nanomaterials and nanoparticles have received considerable attention recently because of their unique properties. Nanosilver products, which have well-known antimicrobial properties, have been used extensively in medical settings. Despite the widespread use of nanosilver products, relatively few studies have been undertaken to determine the biological effects of nanosilver exposure. The present study was designed to evaluate size-dependent protein interactions of known biologically active with silver nanoparticles (Three different size) by various kind of spectroscopic methods. Lactate dehydrogenase (LDH) was selected as a enzymatic model in this study.
Methods: In order to study the mechanisms underlying the effects of silver nanoparticles on lactate dehydrogenase (LDH, EC1.1.1.27), we injected nanosilvers of various concentrations into LDH solutions. Then we examined LDH activity and the interactions between nanosilver and LDH by using fluorescence spectral methods.
Results: The results showed that nanosilver could significantly decrease LDH activity. By fluorescence spectral assays, the silver nanoparticles was determined to be directly bound to LDH and induced the protein unfolding.
Conclusions: It was concluded that the binding of silver nanoparticles to LDH enzyme altered its structure and function. The fluorescence data showed that the binding of nanosilver to proteins caused strong static fluorescence quenching. The binding constants of nanosilver to LDH were determined in presence of three different sizes of nanoparticles under the physiological conditions. The titration results indicated that nanosilver quenched the fluorescence intensity of LDH through static mechanism. In addition, according to decreased activity of LDH, the results showed that the fluorescence quenching of LDH origi¬nated from the Trp and Tyr residues, and indicated a conformational change of LDH with the addition of the silver nanoparticles.

Keywords: Lactate dehydrogenase; Silver nanoparticles; Fluorescence spectroscopy