Sensing the Influence of Resveratrol on the BSA Adsorption on Gold Nanoparticle Through Solid-State Nanopore

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Nanoparticles are increasingly considered in nanomedicine providing new solutions due to their unique physico-chemical properties. Together with other therapeutic agents, they can be formulated in a single hybrid nanocomposite, incorporating both diagnostic and therapeutic functions, leading to the so-called theranostic system[1].

Gold nanoparticles are one of the most promising candidate for theranostic applications. They are widely studied and employed as imaging agent for diagnosis, imaging and monitoring, but also in the treatment of malignant diseases and drug delivery systems[2].

Bovine serum albumin has been widely employed for the studies on protein-nanoparticle interaction and it is often used for the stability of gold nanoparticles suspensions. Gold nanoparticles, covered by bovine serum albumin BSA and loaded with different kind of antibiotics, have proved to be effective drug carriers, enhancing the antibacterial activity[3].

The use of resveratrol (RESV) as a drug has attracted interest among researchers for its antioxidant and chemical cancer inhibition activities. The increase of drug delivery application involving resveratrol leads to the need of a deep understating of its interaction with drug carriers, as gold nanoparticles, and proteins present in the biofluid of interest[4].

Through a combination of experimental techniques, we studied the interaction between gold nanoparticles, bovine serum albumin and resveratrol. We initially evaluated the gold nanoparticle aggregation, and the subsequent impact of the BSA and the resveratrol, by surface plasmon resonance spectroscopy and dynamic light scattering. We investigated the mechanism of interaction at the single-molecule level using solid-state nanopore technology for sensing the nanoparticle-protein corona complex and comprehend the influence of the resveratrol on the protein adsorption onto the particle surface. We pursued the investigation at the single-molecule level by fluorescence correlation spectroscopy, particularly suitable technique when the size of the nanoparticle approaches the protein dimension. The translocation thourgh the solid-state nanopore revealed different species in presence or absence of resveratrol, revealing the desorption, in NaCl, of the BSA from the nanoparticle when the polyphenol is involved. Clearly from our results, the resveratrol plays an important role, making the BSA adsorption reversible in presence of salt.

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