INTERACTIONS OF As(III), Sb(III) AND Hg(II) SPECIES WITH HUMAN SERUM ALBUMIN

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Arsenic, antimony and mercury are among the most toxic elements of environmental and biomedical concern. They are associated with severe health effects, but their toxicity depends on the duration of exposure, dose and the molecular form that causes the poisoning. After entering the bloodstream, metal ions may interact with serum proteins. Human serum albumin (HSA), the most abundant protein in the serum, is particularly relevant due to its central role in the transport of organic hydrophobic compounds and metal ions. The molecular interactions and biochemical pathways of As^{III} and Sb^{III} in the human body remain poorly explored [1–3], and the binding properties of Hg^{II} and the metalloids to HSA are not thoroughly characterized, either.

In this study, we investigated the interactions of As^{III}, Sb^{III} and Hg^{II} with human serum albumin under physiologically relevant conditions. Two complementary spectroscopic methods were employed. First, we examined the potential binding of the metal ions to the free Cys34 thiol group of HSA using the 2,2-dithiodipyridine (DTDP) assay, monitored by UV-Vis absorption spectroscopy. In addition, tryptophan fluorescence quenching measurements were carried out to detect binding interactions near the Trp-214 group.

The experiments revealed that neither As^{III} nor Sb^{III} display significant affinity to HSA, since no consistent reactivity or fluorescence quenching was observed under the applied conditions. In contrast, the results of measurements carried out with Hg^{II} showed unambiguously the binding of this metal ion to HSA. Both the DTDP assay and the fluorescence quenching indicated strong binding to the protein, in line with the high affinity of thiol groups to Hg(II) and the known ability of Hg(II) to alter proteins' structure.

In summary, the present results provide a new insight into the molecular interactions and binding behavior of toxic metal ions with the blood transport protein (HSA). The lack of interaction observed for As^{III} and Sb^{III} indicates that other biomolecular targets may be more relevant in their transport in the human body. Exploring the binding characteristics of Hg^{II} to HSA is important for clarifying the mechanisms of the adverse effects of mercury and its transport in the bloodstream.

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