Nanocomposites and nanomaterials

CD sensing of conformation's alterations of serum albumin by iron (II) clathrochelates

M. Kuperman[1], M. Losytskyy[1], S. Vakarov[3], E. Gumienna-Kontecka[2], O. Varzatskii[3], V. Kovalska[1]

[1]*Institute of Molecular Biology and Genetics of NASU, Kyiv, Ukraine*
E-mail: mvkuperman@gmail.com

[2]*Chemical Faculty, Wroclaw University, Wroclaw, Poland*

[3]*Institute of General and Inorganic Chemistry of NASU, Kyiv, Ukraine*

The conformational transitions of proteins usually impact on their functions that cause an actuality of their exploring. Molecules gaining chirality upon binding to proteins (i.e. giving response in circular dichroism (CD) spectra) could possess high spectral sensitivity to such conformational alterations. The ability of cage metal complexes - iron (II) clathrochelates to induce a specific signal in visible range of CD-spectra upon binding to protein was discovered. The most pronounced signal was observed for their complexes with serum albumins. The higher binding affinity to serum albumins was for clathrochelates with carboxy groups. For hexacarboxy derivatives the binding constants were 10^3-10^4 M^{-1}, binding ratio - 1-2 clathrochelate per protein molecule. Here we report that clathrochelate bearing six orthocarboxyphenyl groups is able to reflect by changes in CD spectra the alterations in protein structure (1) on "close structure" of human and bovine serum albumins HSA/BSA and (2) upon the protein conformational changes. The clathrochelate ability to discriminate HSA from BSA by gaining CD-spectra of different shape was shown. The conformational changes that albumins undergo upon pH variation were reflected by the changes of form, negative/positive sign and intensity of clathrochelate's CD-bands (Fig.1). That points out the structure alterations of clathrochelate-albumin complex with the pH variations. These alterations were confirmed by protein fluorescence quenching studies. The binding of clathrochelate to albumin resulted in decrease of protein intrinsic emission; it varied with pH and correspondingly BSA conformational transitions. The quenching was weak at pH 3.7 (in 1.5 times) - partially unfolded in domain III and significant at pH 6 (in 14.6 times) – native form. We suggest the interest in further study of clathrochelates as reporters with CD sensitivity to proteins that are able to determine their conformational alterations.

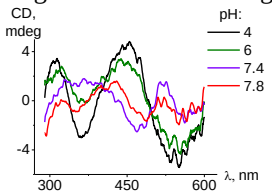

Fig.1. CD-spectra of clathrochelate (in BSA complex) depending on pH.