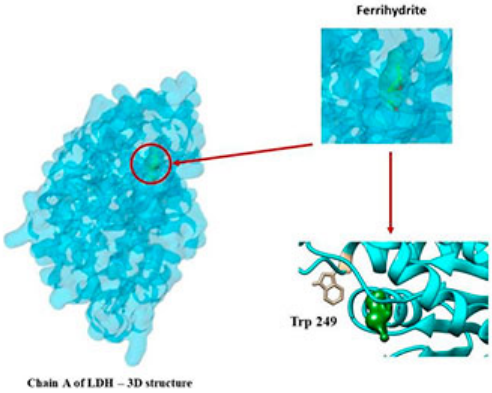
Lactate dehydrogenase and Ferrihydrite nanoparticles binding insights

Researchers have analysed the properties of the binding between the enzyme lactate dehydrogenase and ferrihydrite nanoparticles. It turns out that protein if doped with metal is more resistant to higher temperatures. These results can be applied to solving a wide range of biochemical, biological, pharmacological, or clinical problems. The article is published in the International Journal of Biological Macromolecules.



Lactate dehydrogenase is an enzyme that catalyses the conversion of lactate to pyruvate. It is the last stage of anaerobic glycolysis, during which glucose transforms to lactate (lactic acid). One of the ways to increase the stability of lactate dehydrogenase is to bind it to nanoparticles of oxides of metals such as iron (ferrihydrite). The researchers from Siberian Federal University and Kirensky Institute of Physics studied the mechanism of binding ferrihydrite nanoparticles (doped with cobalt and copper) with lactate dehydrogenase isolated from rabbit muscles.

> *'The results of our research reveals the prospects to apply lactate dehydrogenase and ferrihydrite nanoparticles binding in pharmacology. Also, understanding the structural or optical properties of this compound can facilitate its use as nanomaterial-based catalysts,'* said **Roman Yaroslavtsev**, co-author of the article.

For the first time, the researchers could form the lactate dehydrogenase and ferrihydrite nanoparticles compounds (with dimensions under 100 nm) in vitro. They also revealed some properties of the substance. The binding lactate dehydrogenase and ferrihydrite is an entropic process, which means that part of the energy is irretrievably dissipated. Metal nanoparticles inhibit the fluorescence of lactate dehydrogenase, as they affect the microenvironment of the amino acid tryptophan residues. Iron nanoparticles also make the protein more resistant to temperature effects, as it starts degrading at 5 °C higher than conventional lactate dehydrogenase can withstand. Significantly, ferrihydrite is more effective when doped with cobalt than with copper.

The researchers used small-angle neutron scattering revealing the information on the compound from scattering a beam of neutrons by molecules. They also applied Fourier-transform infrared spectroscopy, fluorescence spectrophotometry, and fluorescence resonance energy transfer methods. The researchers could determine the distance between lactate dehydrogenase and ferrihydrite nanoparticles, and besides, watch the nanoparticles docking.

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