

From Complexes to Nanoparticles and Back

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At the beginning of my scientific career, my research was focused on nickel complexes with Schiff bases, nitrogen donor ligands, and trithiocyanuric (trimercaptotriazine) acid. Most of the complexes were mononuclear^{1, 2}, but later preparation of dinuclear and trinuclear ones proved the formation of trithiocyanurate bridges among metal centers³.

Over the last 10 years, I have been mostly involved in projects focused on the synthesis and applications of nanomaterials. It was really a challenge to work on materials that were new, and I had to learn a lot about them. These materials were based not only on inorganic but also on organic bases and proteins. For example, we succeeded in preparing quantum dots such as CdTe, CdSe, CdS, ZnSe, and others for applications in analytical chemistry and imaging⁴. Except for nice papers, a patent on the detection of viruses was applied for. Superparamagnetic particles prepared by us were applied for the separation and analysis of different analytes, including toxic amines in foods. I was the inventor of superparamagnetic particles modified by lanthanides used for the detection of the Ebola virus. The patent received the rectors' prize. Our team has prepared Pt nanoparticles, and they are cytotoxic, like platinum drugs⁵. Moreover, our team studied the encapsulation of drugs such as doxorubicin and ellipticine in apoferritin and liposomes⁶. We have received a patent on the topic. All the experience was successfully applied to the encapsulation of nickel complexes within apoferritin. In our latest paper, we have utilized liposomes for the transport of binuclear complexes that were insoluble in water to cancer cells⁷.

Currently, my research focuses on the synthesis of benzimidazoles and bis(benzimidazoles) that contain different donor atoms in the chain connecting the two benzimidazoles. These can be bonded to metal central atoms in a tridentate mode, thereby forming chelates⁸. The complexes with many metal ions are interesting not only from a biological point of view⁹, as they can be used as drugs to treat bacteria and cancer cells, but they can also be of interest for their unique structural and magnetic properties.

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