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Study of magnetic core-shell nanoparticles for drug delivery system in cancer treatment

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One of the promising areas of nanotechnology development is the medical field of application of nanostructures. Nanomedicine is a rapidly developing area in the last decade, including methods for the prevention, diagnosis and treatment of a wide range of diseases using various types of nanostructures. The control of the shape, size, and chemical composition of nanostructures allows to set their physical properties at the synthesis stage and opens up new possibilities for bioprocessing. A rather interesting possibility of using nanostructures is the targeted delivery of useful goods (drugs or proteins) using a magnetic field. In this method, a drug or protein is attached by functional groups to a magnetic nanostructure and introduced into the circulatory system, after which it is transported to a problem area through a magnetic field. One of the most promising materials for creating magnetic nanostructures is iron oxide or an alloy of iron with nickel due to its greater saturation magnetization compared to this value for pure ferromagnetic metals Co, Ni, and Fe.
The use of magnetic nanostructures in medicine can not only efficiently deliver biologically active molecules through various body barriers that they are not able to overcome on their own (skin, blood-brain), but also significantly change the nature of the drug. Nanostructures of magnetic metals (iron, cobalt and nickel) are rarely used in pure form for therapeutic purposes. Usually they are encapsulated or placed in bioinert matrices (various organic compounds or polymers, including those of natural origin) in order to reduce the possible toxic effects of the magnetic phase, increase its physico-chemical stability and create the possibility of immobilization of the surface of such capsules or matrices of drugs. Coating magnetic metals with a carbon shell or noble metals such as gold and silver increases their effectiveness in medical applications.

Authors: Mrs NAZAROVA, Assel; CHUDOBA, Dorota; Dr KOZLOVSKIY, Artem

Presenter: Mrs NAZAROVA, Assel

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