NEW FUNCTIONALIZED MAGNETIC NANOPARTICLES FOR TARGETED DRUG DELIVERY

Angela Spoială[a], Cornelia-Ioana Ilie[a], Cristina Uncu[a], Ludmila Motelica[a], Roxana-Doina Truşcă[a], Denisa Ficai[a], Adrian Surdu[a], Ovidiu Oprea[a,b] and Anton Ficai[a,b]

[a]University Politehnica of Bucharest, 011061 Bucharest, Romania
[b]Academy of Romanian Scientists, 3 Ilfov Street, Bucharest, Romania

Even since ancient times, cancer remains the most devastating disease, being one of the main factors of death and morbidity worldwide. Although early diagnosis and treatment represent the appropriate approaches to fighting against cancer; traditional therapies such as chemotherapy, radiotherapy, targeted therapy, and immunotherapy present drawbacks. These drawbacks represent a restless challenge to establishing a simultaneous treatment and diagnosis of cancer [1]. It has been demonstrated that using nanotechnology has given important outcomes in cancer diagnosis and treatment. Due to their special advantages, such as low toxicity, high stability, good permeability, biocompatibility, improved retention effect, and precise targeting, nanoparticles with sizes ranging from 1 to 100 nm have been successfully used in cancer diagnosis and treatment. To replace current cancer treatments, various nanomaterials, especially magnetic nanoparticles are being used in clinical trials to ensure the targeted and triggered delivery of biologically active agents into the desired tissue/organ, according to a desired release profile. Among the various magnetic nanoparticles used in cancer treatment, special attention was given to magnetite nanoparticles [2]. Significant attention was paid to the functionalization of the magnetic nanoparticles that assure higher chemical stability and better/preferential internalization inside the tumour cells. In this context, modifying the surface of the nanoparticles along with the possibility of obtaining controlled shape and size is conducted in developing magnetite nanoparticles loaded with aminoacids and cytostatics core-shell nanostructures for targeted cancer treatment [1]. There are studies on effective strategies achieved by encapsulating magnetite nanoparticles into inorganic shells (C, SiO_2, ZnO) to form magnetic core-shell nanostructures with unique characteristics (which can act as a Trojan horse) and their ability to provide the proper platform for their development [3]. Therefore, the obtained nanostructures were characterized through SEM, TEM, XRD and DLS.

Acknowledgement: The financial contribution was received from the national project "Magnetic smart drug delivery systems for theranostic using a personalized approach"- PN-III-P1-1.1-TE-2021-1342, Ctr. No. TE96/2022 and National Centre for Micro and Nanomaterials are highly acknowledged.

___

[1] Spoială, A.; Ilie, C.-I.; Motelica, L.; Ficai, D.; Semenescu, A.; Oprea, O.-C.; Ficai, A. Smart Magnetic Drug Delivery Systems for the Treatment of Cancer, *Nanomaterials*. **2023,** *13*, 876.

[2] Unsoy, G.; Gunduz, U.; Oprea, O.; Ficai, D.; Sonmez, M.; Radulescu, M.; Alexie, M.; Ficai, A. Magnetite: From Synthesis to Applications. *Curr. Top. Med. Chem*. **2015**, *15*, 1622–1640.

[3] Chircov, C.; Matei, M.-F.; Neacsu, I.A.; Vasile, B.S.; Oprea, O.-C.; Croitoru, A.-M.; Trusca, R.-D.; Andronescu, E.; Sorescu, I.; Barbuceanu, F. Iron Oxide–Silica Core-Shell Nanoparticles Functionalized with Essential Oils for Antimicrobial Therapies. *Antibiotics***. 2021**, *10,* 1138.