Biocompatible narrow-size iron oxide nanoparticles with different superficial charge for targeting of cancer cells

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The objective of this project is functionalization of magnetic nanoparticles with several biomolecules with the purpose of cancer treatment, using ligands capable of generate tumor-selective nanoparticles. Magnetic nanoparticles have large advantages in biomedical applications such as magnetic concentration, MRI contrast and hyperthermia agent. Nanomaterials properties such as size, shape and surface charge influence on response of biological media. Bioactive agents as sugars, vitamins, anti-inflammatory and antitumor agents can contribute for synergic and improved cellular response.

For primary studies, nanoparticles of magnetite of about 6 nm synthetized by thermal decomposition method were stabilized with different ligands, generating mono and multifunctional water-dispersible-nanoparticles. This summary emphasizes three ligands: phosphorylethanolamine, glucose-phosphate and 4,5-dihydroxy-1,3-benzenedisulfonate. These modifications were performed as rapid reactions (until 20 minutes), using 15 mg of magnetite and water as solvent. The results are monodisperse nanoparticles which contain positive, neutral and negative superficial charge. Transmittance, TRXF Spectroscopy and Thermogravimetry analysis prove the linkage and estimate how many biomolecules are associated with the surface of magnetite. DLS dispersion indicates absence of aggregates. The toxicity of magnetic nanoparticles was verified by Intravital Microscopy by scanning of vascular toxicitiy or occurrence of hemorrhages. Tests were performed using Wistar rats having mesenteric tissues which allow vasculature visualization by Microscopy. This allows visualization of different phenomena such as changes on cell behavior and thrombi or hemorrhage onset after drug administration. The tests indicate absence of toxicity and allow the advancement of research, through the development of multifunctional systems with synergistic activity. Moreover, understanding how material properties influence the biological events lead to development of intelligent materials for combating diseases such as selective-drugs applied on cancer treatment.

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References

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