Multifunctionalization of narrow-sized magnetic nanoparticles with biomolecules for targeting of cancer cells

Roberta M. Cardoso[1]* (PG), Koiti Araki[1] (PQ)

[1]Institute of Chemistry – University of São Paulo - Av. Prof. Lineu Prestes 748, Butantan, Sao Paulo, Brazil.

Magnetite, nanoparticles, targeting, theranostics

Summary

The focus of this project is functionalization of magnetic nanoparticles with several biomolecules, creating new routes for targeting, imaging and treatment of tumor cells. Several groups can be added on surface of nanoparticle to improve interaction of solvent and biological systems, generating multifunctional systems.

Results and discussion

Magnetite nanoparticles of about 6 nm prepared by thermal decomposition method were stabilized with phosphorylethanolamine, dopamine or sugars. The functional reactive groups on the surface were exploited to bond biomolecules using EDC and NHS as crosslinking activators generating new hybrid nanobiomaterials. Nanoparticles functionalized with more than one molecule/biomolecules were also prepared and characterized.

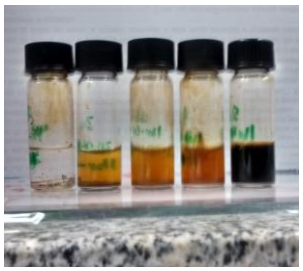

Figure 1. Nanoparticles with different ratios of two functionalizing molecules exhibiting increasing dispersibility in water.

Typically, 15 mg of magnetite were reacted with those functionalizing molecules in aqueous solution. The hybrids were characterized by ir spectroscopy and DLS analyses that demonstrated the high colloidal stability with no nanoparticles aggregation.

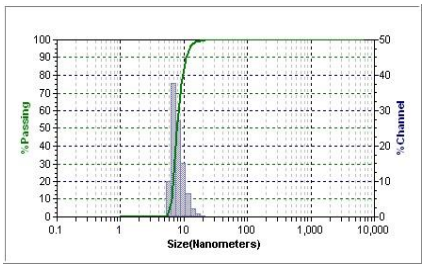

Figure 2. Size distribution histogram obtained by DLS technique, showed no aggregation.

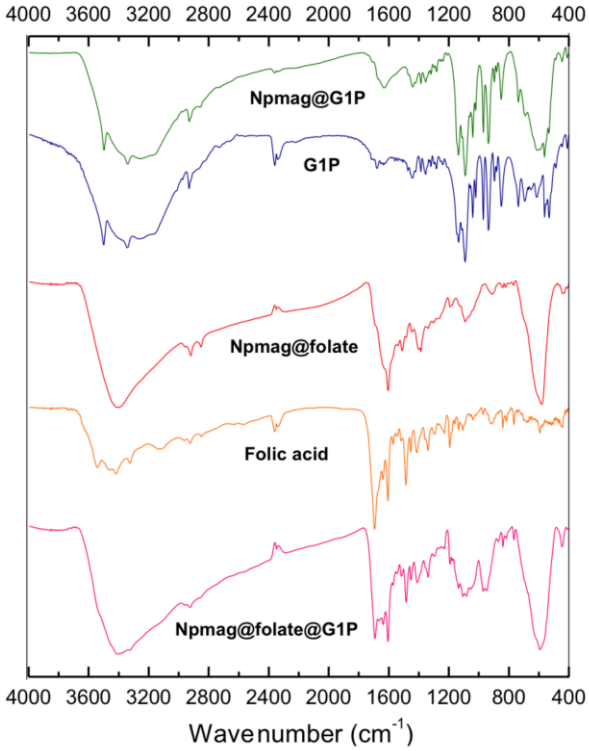

Figure 2. IR Spectra of magnetic nanoparticles functionalized with glucose 1-phosphate (G1P) and folate.

Conclusions

Magnetite nanoparticles hybridized with folate and glucose were realized demonstrating the possibility of multifunctionalization and tuning of their properties for selected applications. The reactions were carried out within 20 minutes in aqueous media. Those reactions are being implemented in microfluidic systems to enhance the efficiency reduce energy consumption.

Aknolegements

CAPES – University of São Paulo

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