Silica coated magnetic iron oxide nanoparticles doped with Thioflavin-T for beta-amyloid targeting

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One of the key factors influencing the onset of Alzheimer's disease, the most common age related human neurodegenerative disorder, is believed to be the accumulation of beta-amyloid (Aβ) peptide aggregates, which lead to the development of brain amyloid plaques [1]. The aggregated peptides constitute a potential target for early diagnosis and/or therapy of the disease. Various approaches, based on the design and engineering of nanoparticulate entities with multiple modalities present new possibilities in imaging, delineation of protein binding and interactions [2][3][4], collectively potentiating an early detection and better understanding of the disease process. To that end, magnetic iron oxide nanoparticles (MIONs) were synthesized using a modification of the iron salt co-precipitation method proposed by Kobayashi et al. [5].

Following production of MIONs, silica was overlayed in order to create core-shell magnetic nanoparticles [6]. During the encapsulation process of the magnetic core, Thioflavin-T (ThT), a fluorescent protein-marker was also added, for co-encapsulation and staining of the core-shell MIONs [7]. Ultimately, ThT doped silica coated magnetic nanoparticles were prepared, with well-established magnetic properties, detectable by both confocal and MRI imaging. The samples were characterised during the preparation phases by XRD, VSM, FTIR, Confocal Microscopy, Fluorescence Spectroscopy, and TEM.

The results at hand indicate that ThT has been successfully encapsulated in the silica core-shell MIONs, thus providing a valuable bimodal tool a) for targeting *in vitro*/*in vivo* Aβ aggregates, and b) in an effort to develop diagnostic/therapeutic technology in AD.

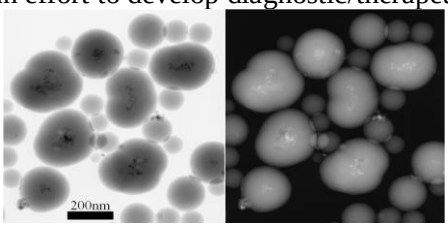

Figure 1: TEM – Silica coated MIONPs

References

[1] Findeis M.A., Pharmac & Therap. **116**(2), 266-286 (2007).
[2] Gobbi M., Re F., Canovi M., Beeg M., Gregori M., Sesana S., Sonnino S., Brogioli D., Musicanti C., Gasco P., Salmona M., Masserini M.E., Biomaterials **31**, 6519-6529 (2010).
[3] Skaat H. and Margel S., Biochem. Biophys. Research Com. **386**, 645-649 (2009).
[4] Mahmoudi M., Quinlan-Pluck F., Monopoli M., Sheibani S., Vali H., Dawson K., Lynch I., ACS Chem. Neuroscience **4**, 475-485 (2012)
[5] Kobayashi H. and Matsunaga T., J. Colloid Interf. Sci. **141**(2), 505-511 (1990)
[6] Andrade A.L. , Souza D.M., Pereira M.C., Fabris J.D., Domingues R.Z., Cerâmica **55**, 420-424 (2009)
[7] Du X. and He J., J. Colloid Interf. Sci. **345**, 269-277, (2010)

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