



Functionalized Superparamagnetic Iron Oxide Nanoparticles (SPIONs) in Cancer Theranostics

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Abstract:

Cancer is one of the dreadful diseases, which claimed many lives in the world. Recently, superparamagnetic iron oxide nanoparticles (SPIONs) - particularly magnetite (Fe_3O_4)/maghemite ($\gamma\text{-Fe}_2\text{O}_3$) - have gained a lot of research interest in cancer theranostics for simultaneous cancer diagnosis (via magnetic resonance imaging - MRI - as T2 contrast agents

- measured in terms of relaxivity) and cancer therapy (via magnetic fluid hyperthermia (MFH) - as heat inducing agents - measured in terms of specific absorption rate - SAR/intrinsic loss power

- ILP), since the SPIONs are chemically stable, biocompatible, biodegradable and non-toxic to healthy cells, and also show interesting superparamagnetism with high saturation magnetization. Moreover, the SPIONs can easily enter into leaky vasculatures of tumor tissues, which make the SPIONs based MRI and MFH techniques as highly efficient with very minimal side effects. The SPIONs can be designed/synthesized followed by in-situ functionalized with robust organic surface coatings and further encapsulated/bio-conjugated with chemotherapeutic drugs (CHDs) and fluorescence agents for multifunctional applications such as magnetic targeting in cancer drug delivery, bi-modal imaging, and combined thermo-chemo therapy. The imaging/therapeutic efficacies (i.e., relaxivity/SAR) of the SPIONs in MRI/MFH majorly depend on their magnetic properties, which are significantly influenced by their physicochemical properties such as size/shape, surface coatings, and crystallinity. Therefore, the physicochemical/magnetic properties of the SPIONs should be primarily optimized to enhance their relaxivity/SAR values for attaining better therapeutic/imaging efficacies for effective cancer treatments.

Biography:

Dr. Dipak Maity received his Ph.D. from NUS, Singapore and M.Tech. degree from IIT Kanpur in Materials



Engineering. Currently, he is working as an Asst. Professor at the Odisha campus of ICT Mumbai. He has published more than 35 research articles in peer reviewed journals with h-index of 18 and co-authored for 6 books/book chapters. He has been participated in several international scientific conferences, received numerous honors/awards and served as a Review/Editorial member for various scientific journals. His major research area lies in the field of Multifunctional Magnetic Nanoparticles for Biomedical Application particularly in the area of Drug Delivery, and Cancer Theranostics.

Publication of speakers:

1. D. Maity, P. Chandrasekharan, C-T Yang, K-H Chuang, B. Shuter, J-M Xue, J. Ding, S-S. Feng, "Facile synthesis of water-stable magnetite nanoparticles for clinical MRI and magnetic hyperthermia applications" *Nanomedicine* 5 (2010) 1571-1584.
2. Y. F. Tan, P. Chandrasekharan, D. Maity, Y. Cai Xian, K-H Chuang, Y. Zhao, S. Wang, J. Ding, S-S Feng "Multimodal tumor imaging by iron oxides and quantum dots formulated in poly(lactic acid)-D- α -tocopheryl polyethylene glycol 1000 succinate nanoparticles" *Biomaterials* 32 (2011) 2969- 2978.
3. P. Chandrasekharan, D. Maity, C-T. Yang, K-H. Chuang, J. Ding, S-S. Feng, "Vitamin E (D- α - tocopheryl-co-poly(ethylene glycol) 1000 succinate) micelles-superparamagnetic iron oxide nanoparticles for enhanced thermotherapy and MRI" *Biomaterials* 32 (2011) 5663-5672.

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