

Surface Modification of Magnetic Nanoparticles for Therapeutic Applications

K. C. Barick*, Suman Rana and P. A. Hassan*

Chemistry Division, Bhabha Atomic Research Centre, Mumbai – 400 085, India;

Abstract

Interfacial chemistry plays a vital role in developing nanostructured materials for drug delivery, catalysis, sensors etc. Selective binding of specific functional groups on nanoparticle surfaces can be exploited for the creation of organic layers that are susceptible to external stimuli such as pH, temperature and ionic strength. Superparamagnetic Iron Oxide Nanoparticles (SPIONs) have emerged as attractive materials for cancer therapy as well as for delivery of various drug molecules. Surface modification of SPIONs with desired functional groups is considered as a prerequisite for their biomedical applications. Organic molecules such as amino acids, polymers and receptor molecules can be introduced on the surface of SPIONs to make them amenable to biomedical applications. This review summarizes some of the recent developments in the area of surface functionalization of SPIONs and their therapeutic applications, especially drug delivery, hyperthermia treatment of cancer as well as combination therapy involving hyperthermia and chemotherapy. In particular, the presence of amino acids or peptide shells on the surface of these particles makes them attractive materials for pH-responsive charge reversal. The pH dependent charge reversal feature is conducive for selective binding and release of ionic drug molecules. The future prospects in this direction are also discussed.