

ABSTRACT

Nanoparticles have a wide use in the treatment of cancer as passive and active drug delivery vehicles for anti-cancer drugs. In active drug delivery, anticancer drug is forced to reach the tumor after tagging with some legend such as liposome, dendrimer or antigens etc. Diffusion and specificity are the controlling parameters in passive delivery. Various materials, in the form of nanoparticles, have different tendencies to absorb or diffuse these drugs. This diffusion is generally controlled by diffusion parameters depending on the nanomaterial, anticancer drug and loading environment parameters such as temperature, pH and concentration etc and mainly governs the quantity of anticancer drug loaded onto the particles for the purpose of drug delivery and treatment.

Nanoparticles of different inorganic metal oxides like Fe_2O_3 , NiO, CoO, SnO, BaO and Co- Fe_2O_3 , Ni- Fe_2O_3 were synthesized by direct heating and precipitation methods. Structure and phase analysis were performed by XRD, SEM, EDX etc. Bonding and optical properties had been studies by FTIR and UV-Vis spectrophotometer. Then the ability of the drug to be loaded on the above nanometal oxides in terms of diffusion parameters has been evaluated and a comparative analysis has been carried out to select material which is more suitable for drug delivery. Various kinetic models have been used to evaluate diffusion properties of these drugs while loaded on to different nanomaterials. Drug releasing properties of some specific nanoparticles have also been evaluated along with in-vivo bio-distribution of iron oxide nanoparticles labeled with Tc99m radioisotope.

Our results show that CoO has the maximum loading capability for Doxorubicin anti cancer drug even without any functionalizing material. Size obtained of the nanoamaterials in case of our synthesise material are very suitable for medicinal application and have a range of 20 nm to 100 nm. Our results found that drug loading through diffusion obeys second order kinetic diffusion model. In-vivo biodistribution studies have shown that iron oxide nanomaterial have suitable distribution of the anticancer drug and even cross blood brain barrier. We conclude that these materials can be prepared in reasonable size with enough drug loading capability and releasing characteristics in the order of CoO, or Co dopped Fe_2O_3 and then other nanomaterials discussed in this thesis.