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# Synthesis of gentamicin functionalized magnetic nano-particles and its antimicrobial activity

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Iron oxide nanoparticles have been widely used in biomedical research as contrast agents for magnetic resonance imaging (MRI), as hyperthermia agents and as carriers for targeted drug delivery to treat several types of cancer because of its biocompatibility and magnetic properties. It is further believed that through the use of magnetic nanoparticles, an optimal drug delivery system can be developed by using an external magnetic field to direct such nanoparticles to desirable sites (such as implant infection) for immediate treatment. Gentamicin, an antibiotic, is in general very effective against any bone implant infections. So, gentamicin loaded nanoparticles have great potential to be used as targeted antimicrobial agents in which the drug will be loaded on the magnetic nano carrier. In this present work, Gentamicin coated magnetic nanoparticles have been synthesized by simple co-precipitation method. Briefly, 20 ml of 0.2 M Ferrous chloride and 0.3 M ferric chloride is mixed at room temperature and 2 gm Gentamicin in 25 ml water is added slowly to it under mild stirring conditions. The pH was maintained at ~12. The precipitate obtained was washed with DD water and then oven dried overnight. The diameter of the particles were observed to be about 10-15 nm from HR-TEM. XRD and SAED results confirm the formation of highly crystalline particles. The particles were found to possess superparamagnetism, as confirmed by SQUID results. The zeta potential of these particles came to be -10.5mV. These are shown in Figure 1.

The release characteristics of the antibiotic from the particles are also studied.

The antibacterial effect of these nanoparticles were studied using both gram positive (S. aureus) and gram negative bacteria (E.coli). The Zone of Inhibition studies confirm its antibacterial effect on both S.aureus and E.coli. The particles showed more activity towards S.aureus than E.coli. It has been found that with increasing concentration of the nano-particles, the zone diameter also increased for both the bacteria. It was also seen that the zone diameter was greater for well diffusion compared to disc diffusion assay. The Colony Forming Unit (CFU) of *S.aureus* at a concentration of 0.5 mg/ml reduced significantly. It can be concluded that Gentammicin loaded magnetic nanoparticles are very effective as antimicrobial agents and it can be seen that iron oxide nanoparticles have no reported toxicity and thus it can be very safely used as drug carrier in human body. Further studies will be carried out to investigate the mechanism of action of these drugs on bacteria. These mechanistic investigations will open new pathways in the development of novel antibacterial agents.

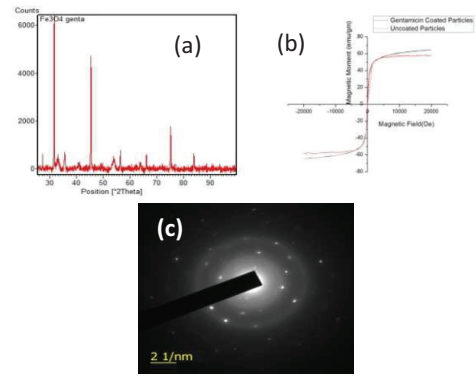


Figure 1: (a): XRD pattern (b): comparison between uncoated and coated IO, (c) SAED image

## References

1. S.Palanikumar, B. Meenarathi, R.Anbarasan, Synthesis, "Characterization and applications of Gentamicin functionalized $Fe_3O_4$ nano hybrid", International Journal of Emerging Technologies and Engineering (IJETE) (2014) ISSN: 2348–8050
2. S. S. Behera, J.K Patra, K.Pramanik, N.Panda, H.Thatoi, "Characterization and Evaluation of Antibacterial Activities of Chemically Synthesized Iron Oxide Nanoparticles", World Journal of Nano Science and Engineering, 2012, 2, 196-2