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Preparation, physicochemical evaluation and antimicrobial activity of magnetic nanoparticles-alginate loaded with gentamicin

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Background and Aims: Biomedical uses of magnetic nanoparticles (MNPs) are mostly focused on tumor cells investigation and treatment of infectious diseases. The main aim of this study was to develop a drug delivery system based on magnetic nanoparticles-alginate containing gentamicin (MNPAG) applicable for target therapy of infections.
Methods: Magnetic nanoparticles were prepared in well shaped spherical form by a co-precipitation method and loaded onto gentamicin with cooperation of sodium alginate. TEM was used to determine the size, size distribution, and morphology of the particles; Particle size analysis by Laser diffraction method was also used to determine size and size distribution; FTIR spectra analysis was used to verify the presence of the MNPAGs. Antibacterial activity of the MNPAGs against P. aeruginosa PTCC 1330, E. coli PTCC 1609, S. typhi PTCC 1310 were evaluated by MIC method.
Results: TEM results showed that MNPAGs were smooth, well individualized and homogeneous in size. Size of MNPAG was in the range of 23-25nm. Particle size analysis showed the size range of 0.25-14.5 µm, that its difference from TEM results can be related to the attraction of the particles by each other to form agglomerates of large size. FTIR results showed that the vanishing of wave number of 1422.32 cm-1 in MNPAG spectrum can be related to the interaction of C=O groups of alginate to OH groups of gentamicin. This interaction may describe the slow release of gentamicin in the next steps. Antibacterial activity results showed that MIC of the MNPAG against P. aeruginosa, E. coli, and S. typhi were 80, 20, and 20 µg/ml , respectively.
Conclusions: It can be concluded that drug delivery system for gentamicin based on MNPs-alginate improved its antibacterial activity and its potential to permeate to target tissues.

Keywords: Magnetic nanoparticles; Gentamicin; Antibacterial activity