ABSTRACT

The aim of this study is to investigate the ability of the cefotaxime magnetic drug delivery systems efficiency by in-vitro model and effectively to deliver the drug to the lungs where Streptococcus pneumoea is in localized consolidation of the single lobe of the lung and spreading the infections to other lobes by animal model.

The study includes the design, optimization, evaluation, discussion and conclusion of the physicochemical characteristics, functionality tests (in-vitro), and animal model (in-vivo) of the formulation.

Cefotaxime is a cephalosporin third-generation antibacterial drug which is widely used in the treatment of pneumonia a lower respiratory tract infection with a dose of 1-2 g iv/im every 8 h. As the drug is having a short half-life of 1-1.5 h, requires administering such a large dose of maximum quantity 2 g iv/im every 8 h results in adverse reactions. Therefore, magnetic microparticles of cefotaxime were developed using ethylcellulose as the retardant polymer and magnetite to deliver the drug at the specific site.

Iron oxide has the ability to migrate and accumulate in the area of magnetic field is the background for the selection and inclusion of it in the delivery system.

Streptococcus pneumoniae is selected because in both human and rabbit the virulence of the strains having the same capsular serotype and the DNA of the strains were found to be the same for disease development. So the strains of S. pneumoniae were selected for the conduction of animal study to determine the bioperformance of the cefotaxime magnetic microparticular delivery system.

The New Zealand white rabbit is the considered strain because they are the most commonly used for the conduction of animal model for the disease of pneumonia and pneumococcal pneumonia and sepsis were easily induced.

The formulations were developed accordingly the design from CM1-CM8 formulations and practical yield, drug content, angle of repose, entrapment efficiency and drug release was studied by in-vitro diffusion method to determine the release pattern were comparatively
evaluated and the optimized formulation were studied for its compatibility by analyzing the formulation for chemical interaction by using FT – IR. The particle sizes were measured by using SEM and further the compatibility were confirmed by DSC thermograms.

The obtained in-vitro release profiles were plotted against the various kinetic models and using diffusion exponents to ascertain the in-vitro release mechanism.

Stability studies were conducted to determine the amount of drug retained after subjecting the formulation to elevated temperature (stress testing) for duration of six months.

Animal model using rabbit were demonstrated to determined the ability of the microparticle to accumulate at the site of action under the influence of external magnetic field. The MR images revealed the effectiveness of the microspheres to target the antimicrobial drug to the site of action.

The accumulation of cefotaxime magnetic microparticles at the site of action is may be due to the smaller size of microparticles, presence of iron oxide and the external magnetic field further increases and simplifies the antimicrobial therapy.