

Novel anti-tuberculosis nanodelivery formulation of ethambutol with graphene oxide

ABSTRACT

Tuberculosis (TB) is a bacterial disease responsible for millions of infections and preventable deaths each year. Its treatment is complicated by patients' noncompliance due to dosing frequency, lengthy treatment, and adverse side effects associated with current chemotherapy. However, no modifications to the half-a-century old standard chemotherapy have been made based on a nanoformulation strategy to improve pharmacokinetic efficacy. In this study, we have designed a new nanodelivery formulation, using graphene oxide as the nanocarrier, loaded with the anti-TB antibiotic, ethambutol. The designed formulation was characterized using a number of molecular analytical techniques. It was found that sustained release of the drug resulted in better bioavailability. In addition, the designed formulation demonstrated high biocompatibility with mouse fibroblast cells. The anti-TB activity of the nanodelivery formulation was determined using whole-cell resazurin microtiter plate assay, modified-spot culture growth inhibition assay, and biofilm inhibition assay. The nanodelivery formulation showed good anti-mycobacterial activity. The anti-mycobacterial activity of Ethambutol was unaffected by the drug loading and release process. The results of this study demonstrated the potential of this new nanodelivery formulation strategy to be considered for modifying existing chemotherapy to yield more efficacious antibiotic treatment against TB.

Keyword: Graphene oxide; Nanocarrier; Ethambutol; Tuberculosis; Nanodelivery formulation