Formulation and In Vitro Evaluation of Nanoparticles Containing Docetaxel
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Purpose
Defined as one of the top causes of death, cancer is a complex disease. Currently applied cancer treatments may result in damaging the normal tissues. Due to the ability of a controlled release, pharmaceutical encapsulation into the nanoparticles reduces drug toxicity and can be targeted into the intended area; thus, it provides a solution to the problems encountered. In this study, nanoparticles have been developed that provide controlled release with reduced toxic effects of docetaxel.

Methods
The nanoparticle formulations prepared with simple oil-in-water (o/w) emulsification-solvent evaporation method. Poly(lactic-co-glycolic-acid) (PLGA) as a polymer, and polyvinyl alcohol (PVA) as a surfactant were used. Resomers of PLGA were used with different concentrations and were dissolved in different solvents. After in vitro characterization studies (particle size, zeta potential, encapsulation efficiency, release studies) effects of these variables on nanoparticle properties were examined. Selected optimum formulation through the prepared docetaxel loaded nanoparticles was used for cell culture studies in order to evaluate the cytotoxicity on MCF-7 cells.

Results
The particle sizes of nanoparticles were varied between 153.8 nm and 422.6 nm and the size was effected by polymer type, the percentage of polymer and organic solvent used in the preparation of the nanoparticles. Zeta potential of nanoparticles was found to be negative and it ranged between -7.44 to -24.6. Encapsulation efficiency values were ranged from 81.43% to 93.5%. The maximum encapsulation efficiency (93.5%) was obtained with 2% PLGA RG502. The release of the nanoparticle formulation of docetaxel showed fast release rate in the first 8 hours followed by a slow release afterwards. The comparison showed that docetaxel loaded nanoparticles have more cytotoxic effect than docetaxel solution on MCF-7 cells.

Conclusion
In the prepared formulations of docetaxel, high encapsulation efficiencies were observed and in the release profiles initial burst effect was followed by controlled release. Cytotoxicity studies showed that docetaxel loaded nanoparticle formulation has caused more cytotoxic effect in comparison with placebo nanoparticles. These studies have shown that the docetaxel loaded nanoparticles could be a new approach to the cancer therapy.