Abstract

In this study, we made solutions of FeCl3.6H2O and CoCl2.4H2O and used them to make Cobalt Ferrite nanoparticles (CF NPs) coated with albumin (CF@Alb) for possible medicinal uses, notably in targeted drug administration. We then combined CF@Alb nano composites with the anticancer medication Doxorubicin (DOX) to create CF@Alb-DOX nano composites. Investigations into the synthesis procedure, physico-chemical characterization, and drug loading were extensive.Using a co-precipitation technique, the CF NPs were effectively created with the aid of NaBH4, hydrazine hydrate, and NaOH. Using environmentally friendly ultra sonication and stirring, the albumin coating was produced. Through electrostatic interactions between the negatively charged albumin and the positively charged amine groups of DOX at pH 7.4, DOX was successfully loaded onto CF@Alb nano composites. In vitro tests were done on the DOX allow to leave from CF@Alb-DOX nano composites at pH5 (which simulates the acidic tumor microenvironment) and pH 7.4 (blood plasma pH). The release profiles showed a consistent, well-controlled pattern, along with a notable pH-dependent activity. DOX release was significantly greater at pH 5 than it was at pH 7.4, highlighting the fact that CF@Alb-DOX nano composites are pH-responsive. These nano composites are interesting candidates for targeted drug administration due to prolonged release and pH responsiveness, which may lessen systemic toxicity.

Additionally, we carried out a thorough characterization of the generated materials, which included UV-Visible and FTIR spectroscopy.The formation of CF nanoparticles' and the CF@Alb nanocomposits' are demonstrated by FTIR spectra. UV-Visible analysis were used to demonstrate the loading and release studies of DOX. The impressive drug loading capability of CF@Alb nano composites for DOX was highlighted by the finding that the drug loading efficiency was 93.3%.

In conclusion, our study offers a flexible method for producing CF@Alb-DOX nano composites with potential uses in targeted drug delivery and cancer treatment. These nano composites are intriguing for further biomedical research and possible clinical applications due to their pH-responsive and sustained drug release behavior and outstanding biocompatibility.