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Curcumin Loaded Biotinylated Chitosan Nanoparticles for Targeted Cancer Drug Delivery

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Currently available chemotherapeutic drugs often have undesirable physiochemical and pharmacological properties, such as low solubility and narrow therapeutic index, apart from indiscriminate cytotoxic effect on rapidly proliferating cells. Targeted delivery of cytotoxic drugs using nano-scale drug delivery systems overcomes these limitations by specific uptake and action on cancer cells. Nanoparticles are particularly suitable for targeting because of inherent enhanced permeation and retention effect (EPR). The objective of present work was to formulate tumor-targeted nanoparticles by functionalization of curcumin encapsulated chitosan nanoparticles with biotin (Cur-BCS-NP). The conjugation of biotin on surface of chitosan NPs, which were prepared by ionic gelation method, was done by carbodiimide chemistry using EDC and NHS. The mean hydrodynamic radius of Cur-BCS-NPs was 56.11±13.02 nm, as determined by DLS, Fe-SEM, TEM and AFM. Biotin conjugation coupled with curcumin encapsulation was confirmed by surface-chemistry studies (FTIR and XRD) and thermal stability was analyzed by TGA. A steady and prolonged in vitro drug release was observed from Cur-BCS-NP at 51.5% over a period of 7 days. In vivo cell uptake in MCF-7 breast cancer cell lines was rapid as compared non-targeted NPs and native curcumin, partly due to the highly expressed biotin receptors in cancer cells. Cur-BCS-NP also exhibited increased cytotoxicity against MCF-7 cells with IC50 of 12.32µg/ml as compared to 22.47µg/ml of native curcumin in 24h. Therefore, the results suggest that biotin conjugated chitosan nanoparticles can be a promising delivery vehicle of chemotherapeutic drugs for tumor targeting.

Biography

Mukta Singh has done B.Pharm., M.Pharm. in Pharmaceutics and is currently pursuing Ph.D. from Indian Institute of Technology Roorkee, India. Her research area for doctoral thesis is polymeric nano drug delivery systems for cancer targeting. Her area of expertise includes liposomes, nanoemulsions, nanoparticles, transdermal drug delivery and targeted drug delivery. She is experienced in essential instrumental techniques including HPLC, SEM, AFM, DLS and TEM.

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