Development and Evaluation of Curcumin-Loaded Tannic Acid Nanoparticles as an Anti-Cancer Nanomedicine

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Abstract

Curcumin (CUR) is a bioactive natural compound with potent antioxidant and anticancer properties. However, the extreme lipophilicity and poor water solubility of CUR have hindered its widespread clinical use. The aim of this study was to develop a novel nanoparticle (NP) formulation for CUR by relying on the self-assembly behavior of tannic acid (TA) with the assistance of an amphiphilic polymer to entrap CUR. To optimize drug loading, formulation variables included the CUR: TA ratio and the type of amphiphilic polymer (Pluronic® F-127 (PL127) and Pluronic® P-123 (PL123). Characterization of the optimized CUR NP formulation confirmed the production of ≈200 nm NPs with a high degree of monodispersity and very good loading efficiency. The NPs maintained excellent colloidal stability under various conditions. In vitro release of CUR from the NPs revealed a biphasic controlled release pattern up to 72 h. Antioxidant and antiproliferative assays revealed significantly higher activity for CUR NPs compared to free CUR and TA, which has strong implications for potentiation of the bioactivities of the compounds and possible synergism in the newly developed NP formulation.

Keywords: Curcumin, tannic acid, self-assembly, nanoparticles, anticancer, antioxidant, nanomedicine.