Synthesis and Evaluation of Curcumin-loaded Polyphenol Nanoparticles as a Potential Anti-cancer Nanomedicine

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Abstract

Plant polyphenols are an emerging class of nanomaterials that are being investigated for biomedical applications such as drug delivery. Here we synthesized polyphenol nanoparticles (NPs) by base-catalyzed oxidation and subsequent polymerization of quercetin in the presence of curcumin as an anti-cancer drug and thiol-terminated poly (ethylene glycol) (PEG) in DMSO, followed by self-assembly upon the gradual addition of water. NP size was measured by dynamic light scattering and ranged from 33 nm (bare NPs) to 166 nm (PEGylated NPs). Surface modification of the NPs with PEG was confirmed by measuring the zeta potential and X-ray photoelectron spectroscopy. Drug loading was measured by UV-Vis spectroscopy and showed an optimum loading efficiency of 91% at a quercetin to curcumin ratio of 1: 0.25. Curcumin-loaded NPs demonstrated sustained drug release and were readily internalized by CT26 murine colon cancer cells, exhibiting potent *in vitro* cytotoxicity comparable to free curcumin. Our findings present a promising anti-cancer nanomedicine that can be synthesized from renewable sources using simple equipment.