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Surface Modified Core–Shell Type Lipid–Polymer Hybrid Nanoparticles of Trans-Resveratrol, an Anticancer Agent, for Long Circulation and Improved Efficacy against MCF-7 Cells

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Abstract : Trans resveratrol (RES) is a non-flavonoid poly-phenolic compound proved for its therapeutic and preventive effect against various types of cancer. However, the practical application of RES in cancer treatment is limited because of its higher dose (up to 7.5 g/day in humans), low biological half life, rapid metabolism and faster elimination in mammals. PEGylated core-shell type lipid polymer hybrid nanoparticles are the novel drug delivery systems for long circulation and improved anti cancer effect of its therapeutic payloads. Therefore, the main objective of this study is to extend the biological half life (long circulation) and improve the therapeutic efficacy of RES through core shell type of nanoparticles. D-α-tocopheryl polyethylene glycol 1000 succinate (vitamin E TPGS), a novel surfactant is applied for the preparation of PEGylated lipid polymer hybrid nanoparticles. The prepared nanoparticles were evaluated by various state of the art techniques such as dynamic light scattering (DLS) technique for particle size and zeta potential, TEM for shape, differential scanning calorimetry (DSC) for interaction analysis and XRD for crystalline changes of drug. Entrapment efficiency and invitro drug release were determined by ultracentrifugation method and dialysis bag method, respectively. Cancer cell viability studies were performed by MTT assay, respectively. Pharmacokinetic studies after i.v administration were performed in sprague dawley rats. The prepared NPs were found to be spherical in shape with smooth surfaces. Particle size and zeta potential of prepared NPs were found to be in the range of 179.2±7.45 to 266.8±9.61 nm and -0.63 to -48.35 mV, respectively. DSC revealed absence of potential interaction. XRD study revealed presence of amorphous form in nanoparticles. Entrapment efficiency was found to be 83.7 % and drug release was found to be in controlled manner. MTT assay showed low MEC and pharmacokinetic studies showed higher AUC of nanoformulaition than its pristine drug. All these studies revealed that the RES loaded PEG modified core-shell type lipid polymer hybrid nanoparticles can be an alternative tool for chemopreventive and therapeutic application of RES in cancer.

Keywords : trans resveratrol, cancer nanotechnology, long circulating nanoparticles, bioavailability enhancement, core shell nanoparticles, lipid polymer hybrid nanoparticles
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