

Synthesis, Characterization and Bioactivity of Methotrexate Conjugated Fluorescent Carbon Nanoparticles in vitro Model System Using Human Lung Carcinoma Cell Lines

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Abstract : Carbon nanoparticles (CNPs) have unique properties that are useful for the diagnosis and treatment of cancer due to their precise properties like small size (ideal for delivery within the body) stability in solvent and tunable surface chemistry for targeted delivery. Here, highly fluorescent, monodispersed and water-soluble CNPs were synthesized directly from a suitable carbohydrate source (glucose and sucrose) by one-step acid assisted ultrasonic treatment at 35 KHz for 4 hours. This method is green, simple, rapid and economical and can be used for large scale production and applications. The average particle sizes of CNPs are less than 10nm and they emit bright and colorful green-blue fluorescence under the irradiation of UV-light at 365nm. The CNPs were characterized by scanning electron microscopy, fluorescent spectrophotometry, Fourier transform infrared spectrophotometry, ultraviolet-visible spectrophotometry and TGA analysis. Fluorescent CNPs were used as fluorescent probe and nano-carriers for anticancer drug. Functionalized CNPs (with ethylene diamine) were attached with anticancer drug-Methotrexate. In vitro bioactivity and biocompatibility of CNPs-drug conjugates was evaluated by LDH assay and Sulforhodamine B assay using human lung carcinoma cell lines (H157). Our results revealed that CNPs showed biocompatibility and CNPs-anticancer drug conjugates have shown potent cytotoxic effects and high antitumor activities in lung cancer cell lines. CNPs are proved to be excellent substitute for conventional drug delivery cargo systems and anticancer therapeutics in vitro. Our future studies will be more focused on using the same nanoparticles in vivo model system.

Keywords : carbon nanoparticles, carbon nanoparticles-methotrexate conjugates, human lung carcinoma cell lines, lactate dehydrogenase, methotrexate

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