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NOVEL DIAGNOSTIC SILICON NANOPARTICLES FOR TARGETED DELIVERY OF THIOUREA TO EGFR-EXPRESSING CANCER CELLS

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Conventional cancer chemotherapies have been associated with serious systemic toxicities and dose-limiting side effects that limit their clinical application. Targeted therapeutics on the other hand, by being more selective, can potentially minimize the side effects of these anticancer agents. In efforts to develop targeted anticancer drugs, it is essential to consider many different aspects of molecular biology, such as the interactions with cell surface receptors. Protein tyrosine kinases (PTKs) have been identified as major contributors in numerous signal transduction pathways within cell membranes and are implicated in cell proliferation. Epidermal growth factor receptor (EGFR) kinase is one of the most important PTKs and plays a key role in a wide diversity of biological processes, including cell proliferation, metastasis, and angiogenesis. The novel thiourea-functionalized silicon nanoparticles (SiNPs) have been successfully synthesized using allylamine and sulforaphane, an important anticancer drug, followed by a hydrosilylation reaction on the surface of hydrogen terminated SiNPs. Their physiochemical properties have been investigated by photoluminescence emission, FTIR and elemental analysis. MTT assay has been employed to evaluate *in vitro* toxicity in colorectal cancer cells (Caco-2) and primary normal cells (CCD). The results show significant toxicity of thiourea SiNPs after 72 h incubation in the cancer cell line and the toxicity is concentration dependent and saturated for concentrations above 100µg/mL. Confocal microscopy images have demonstrated the internalization of thiourea-functionalized SiNPs inside the cells. Flow cytometry data has confirmed receptor-mediated targeting in cancer cells. This nanocomposite takes advantage of the EGFR active targeting of the ligand in addition to the photoluminescence properties of SiNPs for bioimaging purposes. The results suggest that this novel nanosystem can be extrapolated for active targeting of the receptors that are overexpressed in cancer cells such as EGFR using the targeting characteristics of thiourea-functionalized SiNPs and therefore encourage further investigation and development of anticancer agents specifically exploiting the EGFR inhibitory activity of such nanoparticles.

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