Formulation of Silica Nanoparticles using Tween-20, Tween-40 and Aerosol-OT: A Comparison

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ABSTRACTS

Nanotechnology is rapidly sweeping through all vital fields of science and technology. Nanoparticles are solid colloidal particles ranging from 1 -100 nm. Their properties depend on the shape, size, surface characteristics and inner structure. Curcumin is one of the popular Indian spice turmeric. Although Curcumin has a wide range of pharmaceutical properties, its anticancer properties have attracted a great interest. However, poor aqueous solubility and low bioavailability of Curcumin is a major challenge in its development as a useful drug. Ceramic nanoparticles are highly stable, and may not release any encapsulated biomolecules even at extreme conditions of pH and temperature. Recent work has established the feasibility of using amino-functionalized organically modified silica (ORMOSIL) nanoparticles as a nonviral vector for in vitro gene transfection (1). This formulation of nanoparticles overcomes many of the limitations of ‘‘unmodified’’ silica nanoparticles.

Keeping in view its importance, the ORMOSIL nanoparticles were synthesized using three different surfactants, namely Aerosol-O-T, Tween-40 and Tween-20 for Curcumin encapsulation and the impact of surfactant was studied on the stability of Curcumin. The nanoparticles were prepared by reaction of surfactant (Aerosol-OT/ Tween 40/ Tween 20) , 1-Butanol, triethoxyvinyl silane and 3-aminopropyltriethoxysilane using water as solvent. After the reaction completion, the nanoparticles were obtained by dialysis. The nanoparticles were characterized by DLS (Dynamic Light Scattering) and TEM (Transmission Electron Microscope). The particles size obtained using Tween 40 and Tween 20 was about 45nm whereas by using Aerosol-O-T, the particle size obtained was of 30nm. The nanoparticles were studied at different pH using Aerosol-O-T as surfactant and it was found to be incompatible with curcumin while the nanoparticle formed using Tween 40 and Tween 20 were compatible with Curcumin. Further the Curcumin-doped nanoparticles will be studied for their anti-cancer activity and biomedical studies.

1. Roy, I., Ohulchanskyy, T. Y., Mistretta, R. A., Bharali, D. J., Kaur, N., Pudavar, H. & Prasad, P. N. Proc. Natl. Acad. Sci. USA 102, 279–284.