Solamargine Incorporation into Yttrium Vanadate Nanoparticle Doped with Europium III Ions

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Over the last decades, scientists have been searching for different ways to apply nanotechnology. Vanadates doped with lanthanide ions display excellent luminescent properties, which enables their use as drug carriers, biological markers, and fluoroimmunoassay probes, among other applications [1]. The sol-gel methodology allows the preparation of nanometric particles; that is, particles with crystallite sizes smaller than 50 nm, which is essential for these particles to cross the cellular and nuclear walls and reach DNA during the treatment of diseases like cancer [2]. Solamargine is a glycoalkaloid steroid isolated from plants belonging to the family *Solanaceae*. This compound inhibits the growth of human cancer cell lines such as breast and prostate cancer cells, for example [3]. We have prepared yttrium vanadate (YVO_4) particles doped with europium(III) ions by the hydrolytic sol-gel method, functionalized these particles with the alkoxide 3-chloropropyltrimethoxysilane, and incorporated them with solamargine. The particles were characterized by Infrared absorption spectroscopy (IR), X-ray diffraction (XRD), and photoluminescence (PL). The excitation spectra were obtained at a fixed emission wavelength—618 nm, corresponding to europium(III) emission. A broad excitation band emerged at 325 nm, which was attributed to a charge transfer band (CTB) from the excited ligand to the central vanadium atom. The emission spectra of europium(III) in the host matrix were recorded upon excitation at the CTB. The spectra displayed the bands due to the $^5D_0 \rightarrow {}^7F_J$ (J = 0-4) transition. The IR spectra presented the typical vibrations of the $YVO_4:Eu^{3+}$ matrix. After functionalization of the particles with 3-chloropropyltrimethoxysilane, the bands ascribed to the methyl groups appeared in the IR spectrum. IR also proved solamargine incorporation into the nanoparticle. XRD revealed that the average crystallite size of the functionalized particles was 24 nm. In vivo antitumoral activity tests involving the functionalized nanoparticles incorporated with solamargine afforded promising results.

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