Catalytic Nanomedicine: Functionalized Nanobiocatalyzers for the Treatment of Cancer.

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Cancer has become a public health problem worldwide. The difficulty to develop a general approach for the disease relies on the heterogeneity of the underlying factors and the different nature of the cancer types. The use of nanodevices and nanosystems as efficient therapies for chronic-degenerative conditions (such as cancer) have shown excellent results in terms of early diagnosis and drug delivery. Through the sol-gel method, we have synthesized nanostructured metallic oxide particles impregnated with transition metals. The characterization techniques carried out (electronic microscopies, spectroscopies, surface area measurements, and catalytic assays) proved that the nanoparticles exhibit catalytic properties due to their carefully designed physicochemical characteristics: high surface area (640 m^2/g), stability, selectivity, ordered mesoporous nanostructure, and nanoscopic size. The nanoparticles are functionalized with organic compounds present in cells, which allow them to be biocompatible. Their particle size (<10 nm) and the selective receptor ligands make them suitable to traverse the cytoplasmatic membrane via endocytosis to reach the subcellular structures where they carry out catalytic reactions breaking the carbon-carbon, carbon-oxygen, and carbon-nitrogen bonds present in the DNA, hence destabilizing the molecule and activating the apoptosis mechanism that concludes in the death of the cell. The bionanocatalyzer has shown high selectivity for cancer cells with no affection to normal cells. The compound was tested with different cancer types: cervical cancer in HeLa cellular line, glioblastoma multiforme in rats, and prostate cancer in a patient. In all the studies, the bionanocatalyzer reduced tumor growth, and no toxicity nor adverse effects were observed.

Keywords

Cancer, catalytic nanomedicine, bionanomaterials, mesoporous structure, high superficial area, antineoplastic properties

Biography

Francisco Padilla completed his Bachelor of Engineering at 22 from the Western Institute of Technology and Higher Education. He is currently working as part of the research laboratory of Tessy Lopez and has published one paper.

The co-author is Tessy López obtained her Ph.D. at the age of 28 years from the Autonomous Metropolitan University. She is the director of the Laboratory of Nanotechnology and Nanomedicine, a premier research facility focused on catalytic nanomedicine. She has published more than 320 papers in reputed journals (h-index=72.3), has directed 62 thesis, and has been serving as an editorial board member of repute.

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