**Title: Facile fabrication route for Mn3O4-TiO2 Janus nanoparticles for cancer theranostic applications**

**Abstract**

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Cancer, unrestrained development of abnormal cells in the body, is a serious threatening disease which has been defeating many important lives every year. The tumor, mass of tissue, clotting of abnormal cells, is started when old cells do not die and grow in uncontrollable behavior. Proper diagnosis at early stage can increase the survival rate. Therefore, scientists and medical experts are putting their efforts for early detection for premature tumor and proper treatment to improve the life of cancer patients. Nanotechnology has been applying extensively in the field of cancer research, particularly nanotheranostics for the advancement of effective approaches for diagnosis and treatment. Magnetic nanohybrids particles, combining noninvasively molecular imaging probe with therapeutic particles, have been contributing significantly towards magnetic resonance imaging and photodynamic therpay for cancers. Magnetic nanoparticles are successfully applied as MRI contrast agents and excited photosynthesizers are able to produce cytotoxic reactive oxygen species (ROS), such as singlet oxygen (1O2) which can oxidize cellular macromolecules leading to tumor cell ablation. In this work, a unique liquid-phase method was employed to fabricate Mn3O4-TiO2/ZnO/Fe3O4 multifunctional binary transition metal oxide-based Janus nanoparticles, using the concept of epitaxial growth and lattice mismatch among synthesized materials. These multifunctional Mn3O4-TiO2 Janus nanoparticles enhance T1-weighted magnetic resonance imaging contrast in the heart, liver, and kidneys and show excellent tumor ablation in photodynamic therapy.