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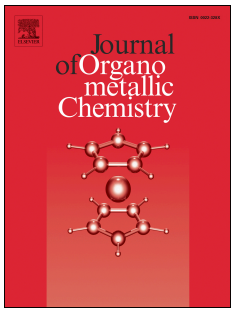

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Covalent Functionalization and Solubilization of Multi-walled Carbon Nanotubes by Using Zinc and Copper Complexes of Meso-tetra(4-aminophenyl) porphyrin

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1. Introduction

Carbon nanotubes (CNTs) stand out as distinctive materials owing to their variety of physical and chemical properties such as high surface area, high electrical and thermal conductivity, structural integrity, significant mechanical strength and chemical inertness [1-3]. CNTs are used as electrode materials in electrochemical devices in order to promote electron transfer reactions [4,5]. Literature studies show that cobalt corrole adsorbed on the surface of multiwalled carbon nanotubes (MWCNTs) demonstrated an exceptional electro-catalytic property towards the reduction of oxygen [6]. Furthermore, cobalt-porphyrin complex that attached to multiwalled carbon nanotubes (CNTs) have shown higher catalytic performance for oxygen-reduction reaction (ORR) in acidic medium, indicating the advantages of supramolecular complex formed by electro-catalytic metalloporphyrin covalently linked to CNTs [7]. Recent studies on heterogeneous nano catalysts containing iron (III) porphyrin covalently attached onto the surface of MWCNTs showed to be an efficient catalyst in the epoxidation of alkene under mild conditions [8]. Zhao *et. al.* constructed a sensor for the detection of nitrite in water sample by immobilizing hemoglobin on MWCNTs modified glass carbon electrode [9]. Recent studies have also shown that MWCNT-based nanohybrid systems in which MWCNTs are covalently functionalized with dye molecules as electron donor-acceptor ensembles (D-A) have attracted intense scientific interest due to their enhanced photo-electronic properties [10,11]. MWCNTs are preferred to other carbon nanomaterials as components of electron (D-A) ensembles due to the presence of large number of concentric graphitic tubes. Nevertheless, the use of MWCNTs in building various photovoltaic and non-linear optical (NLO) materials have been impeded due to their poor solubility in most of the organic and aqueous solvents and also difficulties associated with processing. Therefore, significant effort has been devoted towards the covalent functionalization of MWCNTs with chromophoric molecules in order to simultaneously promote the solubility and also to improve the photo-electronic properties of the nano-hybrid [12,13].