Abstract

This work reports on the covalent linkage of (3-aminopropyl)triethoxysilane (APTES) functionalised iron oxide (IONPs–APTES) and silica (SiNPs–APTES) nanoparticles with zinc(II) tetra–([3–(4–phenoxy) propanoic acid) phthalocyanine] (**1**) and zinc(II) mono–([3–(4–phenoxy) propanoic acid) phthalocyanine (**2)** via an amide bond to form the conjugates, **1**–IONPs-APTES, **1**–SiNPs–APTES, **2**-IONPs-APTES and **2**-SiNPs-APTES). The photophysicochemical behaviour of the conjugates was investigated. These were characterized by a decrease in the fluorescence quantum yields and lifetimes, and an increase in the triplet quantum yield and singlet oxygen quantum yield when compared to complex **1** and **2** alone. The conjugates to IONPs-APTES displayed higher Φ_T than those of SiNPs-APTES probably due to the heavy atom effect of iron compared to silica and the high loading capacity of the relatively smaller iron oxide NPs, however, there was no significant difference in the Φ_Δ values of **2**-IONPs-APTES ($\Phi_{\Delta=}0.59$) and **2**-SiNPs-APTES ($\Phi_{\Delta=}0.58$), suggesting that the energy transfer process between the excited triplet state of **2**-IONPs-APTES and ground state molecular oxygen was not effective. Photodynamic antimicrobial chemotherapy (PACT) studies showed that linkage of Pcs to NPs improves their photoinactivation capability against *Staphylococcus aureus* and *Escherichia coli*. IONPs-APTES and its conjugates generally displayed the highest log reductions than SiNPs-APTES and its conjugates except for studies after 75 min of irradiation for *S. Aureus* where the log reductions are the same. **2**-IONP-APTES was recovered using a magnet after each photodegradation cycle and its stability after 3 cycles confirmed re-usability.