Thesis Abstract

In the modern era of scientific exploration and technological innovation, an innumerable number of diverse applicative outcomes from different research fields have been observed. In this light, two apparently most diverse but important applications, biomedical and optoelectronic understandings of various systems have been explored in this thesis. However, the biomedical applications have been restricted to only in studying the drug encapsulation inside different biomaterial and nanomaterial systems; whereas, for optoelectronic outcomes, I have focused on the white light (WL) response of the respective nano-bio conjugated systems. The biomedical application also involves the construction of suitable cargo delivery systems and in this scenario, I have fabricated a surface active ionic liquid (SAIL) from biological building block units to study its aggregation outputs in different media. In the same line, the fabrication of a protein stabilized gold nanoparticle (Au NP) system and the effects of common chemical denaturants, urea and guanidine hydrochloride (Gn.HCl) on the NP formation and respective drug (Doxorubicine hydrochloride or Dox) encapsulation responses have also been monitored. This most widely used anticancer drug, Dox has also been observed to undergo aggregation in a SAIL medium to produce spherical aggregates, which in presence of a bile salt undergo morphological transformation to rod like fibrillar aggregates. Now, apart from these biomedical applications, optoelectronic application in the form of generation of WL emission from the drug (Dox) encapsulation inside a fluorescent nanomaterial, carbon dot (CD) at pH 2 has been obtained. The excellent pH dependence and reversibility of the CD system also produce pH mediated reversible photoswitching behaviour of the fabricated CD-Dox WL system between pH 12 and 2. Furthermore, I have introduced a WL emissive system by controlling the DNA mediated energy transfer efficiency in presence of a fluorescent NP derived from an important neurotransmitter, dopamine hydrochloride (DA). Moreover, similar types of fluorescent NPs derived from biomolecules associated with Parkinson's disease (PD), upon encapsulation of the chemotherapeutic drug, Dox also produce WL emission, which again show protein specific responses depending on the nature of the protein as well as NP. Therefore, all these studies discussed in the present thesis are extremely important and interesting as they cover a wide range of diverse, yet interconnecting applicative responses of different important systems and as a consequence, will help to build a new horizon in different applicative research fields.

Keywords: Biomedical, Optoelectronic, Drug Encapsulation, White Light, Nanoparticle, Photoswitching, Neurotransmitter and Parkinson's Disease.