INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Thesis Title: Design and Synthesis of Fluorescent Probes for Applications in Sensors and Modulating Amyloid β Fibrils

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SHORT ABSTRACT

The content of this thesis report entitled “Design and Synthesis of Fluorescent Probes for Applications in Sensors and Modulating Amyloid β Fibrils” is divided into 5 chapters and the chapters 2 to 5 having subdivisions based on the results of experimental research work. Chapter 1 is the introductory explanation to the respective research areas of “Design and Synthesis of Fluorescent Probes for Applications in Sensors and Modulating Amyloid β Fibrils” where the scope and relevance of the subsequent chapters are described highlighting the existing literature knowledge. Chapter 2a discusses about the synthesis of new conjugated polymer PHQ followed by monitoring its binding ability with Fe^{2+}/Fe^{3+} ions, non–heme metalloprotein ferritin via photoluminescence quenching study. Chapter 2b discusses about disruption or modulation of aggregated amyloid–β (Aβ) fibrils using fluorescent conjugated polymer PHQ. Chapter 3a discusses about synthesis of a new conjugated polymer PF–DPA and its selectivity study with Co^{2+} ion and vitamin B_{12} via photoluminescence quenching. PF–DPA, exhibits a large and unique red shifted enhanced emission at 556 nm in higher water ratio around 1:9 (THF: H_2O) due to the formation of polymer nanoparticles. Further, PF–DPA utilized for cell imaging that showed high biocompatibility up to 1.6 mg/mL in normal cells but shows potent cytotoxicity against cancer cell in higher doses (>80 µg/mL). Chapter 3b discusses about inhibition of Aβ fibrillation and modulation effect on preformed Aβ oligomers and fibrils by the influence of AIEE luminogen of PF–DPA PDots. Chapter 4a discusses about the synthesis of new indole–3–carboxaldehyde functionalized fluorescein hydrazone (FI) molecule followed by its selective “turn–on” sensing ability with Cu^{2+} ion and “turn–off” sensor with nitric oxide (NO) were studied by photoluminescence properties. Further, we utilized FI to detect Cu^{2+} ion and endogenous NO gas in living cells. Chapter 4b discusses about the extension of this nontoxic indole–3–carboxaldehyde fluorescein hydrazone (FI) probe to perform multiple tasks of disaggregating Aβ aggregates in different biomarker environment such as cerebrospinal fluid (CSF), Aβ1–40, Aβ lysozyme aggregates (LA) and U87 MG Human astrocytes cells. Chapter 5a discusses about the synthesis of fluorescent perylene diimide (PDI–HIS) molecule followed by its selective “turn–off” sensing ability with Cu^{2+} ion and “turn–on” sensor for ATP were studied by photoluminescence properties. Chapter 5b discusses about the synthesis of highly water-soluble biocompatible nanocomposite with graphene oxide (GO) probe for the exclusive detection of pyrophosphate (PPi) in physiological conditions and in vitro live melanoma cancer cells (B16F10). Chapter 5c discusses about modulation of Aβ fibrils into mature micro rod–shaped coassembly structure by PDI–HIS.