General Conclusions

In this thesis, synthesis of low dimensional fluorescent organic materials and AIEE active fluorescent chemosensors based on fluorophore containing Schiff bases have been successfully synthesized for selective determination of analytes, such as 2,4,6-Trinitrophenol (TNP), Al^{3+} and Zn^{2+}. The probes and their adduct/molecular assembly have been characterized by different molecular and spectroscopic techniques. In some cases, computational studies have been performed to have an insight on the photophysical properties of synthesized probes. The thesis consists of seven chapters which are outlined below.

A short introduction on the AIEE based low dimensional materials and fluorescence chemosensors and their signal transduction mechanisms and pathways for selective determination of some cations and explosive are presented in ***Chapter I***. In ***Chapter II***, a brief literature survey on AIEE active low dimensional organic material and most of the reported fluorescence chemosensors for TNP, $Al^{3+}$and Zn^{2+} has been made.

In ***Chapter III,*** discovered the useful phenomenon of crystal induced phosphorescence (CIP) in the aggregated structures of $\mathbf{P^1}$. $\mathbf{P^1}$ shows intense structured fluorescence emission in its solution in THF at room temperature. But no red shifted long lived emission components are observed at room temperature. On the other hand aggregated hydrosol of $\mathbf{P^1}$ shows crystallization induced phosphorescence (CIP) emission at room temperature. The phosphorescence nature of emission is further supported by the long life time (*ms*) of the excited state of luminogen. This restricted intramolecular motion (RIM), permits to attaining a reasonable excited triplet population which allows the observation of room temperature phosphorescence emission.

In ***Chapter IV*** describes solvatochromic effect in the PL spectra of $\mathbf{P^2}$ molecule in THF-DMF mixture. $\mathbf{P^2}$ in THF shows structured fluorescence emission and aggregated hydrosol exhibits both E-type and Y-type excimer emission. The intense emission property of $\mathbf{P^2}$ is used as sensor for detecting nitroaromatics particularly PA present at a very low concentration in the solution. The detection limit of EP-PDI for PA has been determined using 3σ method and our obtained detection limit is 2.98 μM. On the other hand aggregated hydrosol of $\mathbf{P^2}$ exhibits strong excimer emission at longer wave length ~ 615 nm due to molecular association. The intense red shifted emission from the aggregated hydrosol of **P^2** has been explained due to Y and E- type excimer emission. This type emission is further substantiated using time resolved fluorescence study.

In ***Chapter V,*** synthesized a simple fluorescence probe **P^3** through one step condensation process which is weakly emissive in solution state, but it exhibits strong emission in its aggregated hydrosol showing aggregation induced emission enhancement (AIEE) properties. This emission behavior has been explained due to restriction of intramolecular rotation (RIR) and large amplitude vibrational modes of **P^3** in its aggregated state. One more superb utility of this AIEE active molecule is its selective sensitivity towards picric acid (PA) with quenching constant 1.91×10^5 M^{-1}. It is further explained with the help of both steady state and time resolved emission study that the fluorescence quenching of **P^3** hydrosol in presence of PA takes place through static quenching mechanism.

Chapter VI describes a low dimensional aggregated hydrosol from the **P^4** that possesses incredible AIEE properties. It exhibits very weak fluorescence in THF solution. Interestingly, the fluorescence intensity is increased enormously by the addition of 90% volume fraction of water. This increased PL intensity is due to restriction of intramolecular rotation and large amplitude vibrational modes of **P^4** in its aggregated state. Ratiometric fluorescence emission of **P^4** luminogen in presence of acid and base has been demonstrated as pH sensor for acidic and basic medium. The turn off fluorescence sensing property of aggregated **P^4** hydrosol is used for the selective detection of trace amounts of TNP with strong quenching constant (K_{sv}), 7.8 $\times 10^4$ M^{-1}. It is further explained with the help of both steady state and time resolved emission study that the fluorescence quenching of PhQ hydrosol in presence of TNP takes place through static quenching mechanism.

In ***Chapter VII*** synthesized a simple and low-cost fluorescent probe **P^5** which is weakly emissive in solution state, but exhibits interesting aggregation-induced emission enhancement (AIEE) properties in aggregated or solid state. This emission behavior has been explained due to restriction of intramolecular rotation (RIR) and large amplitude vibrational modes of **P^5** in its aggregated state. The present work is a judicious illustration of developing a single fluorescence-based probe for sensing dual-analytes. The 'turn on' luminescent property of **P^5** is used for dual sensing ability of trace amounts of Al^{3+} and Zn^{2+}. The LODs for Al^{3+} and Zn^{2+}were determined by 3σ methods and were found to be 1.05 nM and 2.35 nM respectively. The 1: 1 stoichiometry of the reaction between $\mathbf{P^5}$ and Al^{3+} and Zn^{2+} were determined by Job's method and also supported by ^1H titration.