

# *List of Figures*

<b>Figure 1.1</b> <i>Plasmon resonance in a metallic NP excited by a light wave.</i> .....	26
<b>Figure 1.2</b> <i>Jablonski diagram illustrating electronic excitation processes</i> .....	33
<b>Figure 2.1</b> <i>The schematic diagram of combined microemulsion/sol-gel process for producing SiNPs.</i> .....	41
<b>Figure 2.2</b> <i>TEM pictures of SiNPs and their typical electron diffraction pattern</i> .....	45
<b>Figure 2.3</b> <i>Size distribution of SiNPs showing mean size ~30 nm</i> .....	45
<b>Figure 2.4</b> <i>TEM Pictures of gold nanorods and their SAED</i> .....	46
<b>Figure 2.5</b> <i>Size distribution of AuNRs showing rods with aspect ratios</i> .....	46
<b>Figure 2.6</b> <i>The mean size and distribution of SiNP-VA as measured by DLS.</i> .....	47
<b>Figure 2.7</b> <i>Optical heterodyne used for zeta potential measurement.</i> .....	49
<b>Figure 2.8</b> <i>FTIR spectra of different components of ORMOSIL NP.</i> .....	52
<b>Figure 2.9</b> <i>FTIR spectra of gold rods, coated with A)CTAB, B)PSS, C)PAH and D)PDDAC along with the respective polymers</i> .....	53
<b>Figure 2.10</b> <i>Block diagram representing the concept of time correlated single photon counting.</i> .....	55
<b>Figure 3.1</b> <i>Chemical structures of aniline naphthalene sulphonates used in the study</i> ....	60
<b>Figure 3.2</b> <i>Photoisomerization of MC540 around the central double bond</i> .....	61
<b>Figure 3.3</b> <i>pH titration curves: Variation of zeta potential of SiNP-VA and SiNP-V with pH.</i> .....	63
<b>Figure 3.4</b> <i>Fluorescence emissio and lifetimes of ANS (a) and TNS (b) in presence of BSA, SiNP-V, SiNP-VA and water..</i> .....	65

<b>Figure 3.5</b> <i>pH titration curves: Variation of fluorescence with pH of ANS (a) and TNS (b) in presence of SiNP-V and SiNP-VA.</i> .....	67
<b>Figure 3.6</b> <i>Fluorescence emission and lifetimes of ANS (a) and TNS (b) in isopropanol, and isopropanol containing VTES and APTS.</i> .....	69
<b>Figure 3.7</b> <i>Fluorescence anisotropy decay curves along with fitted curves of ANS and TNS in presence of BSA and SiNP-VA.</i> .....	70
<b>Figure 3.8</b> <i>Absorption, emission and fluorescence decay curves of MC540 in aqueous medium and in presence of ~940 <math>\mu\text{g}/\text{mL}</math> SiNP.</i> .....	72
<b>Figure 3.9</b> <i>Relative integrated emission intensity and average lifetimes of MC540 in presence of varying amounts of SiNP added..</i> .....	73
<b>Figure 3.10</b> <i>Photobleaching of MC540 in aqueous medium in the absence and in the presence of ~940 <math>\mu\text{g}/\text{mL}</math> SiNP.</i> .....	74
<b>Figure 4.1</b> <i>Different ionic structures of <math>\text{Cp}_6</math> possible in the pH range of 3-8.</i> .....	79
<b>Figure 4.2</b> <i>Absorption &amp; emission spectra of <math>\text{Cp}_6</math> in the presence of 940 <math>\mu\text{g}/\text{mL}</math> SiNP at different pH.</i> .....	83
<b>Figure 4.3</b> <i>Fluorescence titration of <math>\text{Cp}_6</math> with increasing amounts of SiNP at pH 8.</i> .....	85
<b>Figure 4.4</b> <i>Fluorescence titration of <math>\text{Cp}_6</math> with increasing amounts of SiNP at pH 5</i> .....	86
<b>Figure 4.5</b> <i>Fluorescence titration of <math>\text{Cp}_6</math> with increasing amounts of SiNP at pH 3.0.</i> ...	87
<b>Figure 4.6</b> <i>Autocorrelation traces and their fits of 10 <math>\mu\text{M}</math> <math>\text{Cp}_6</math> in various environments.</i>	90
<b>Figure 4.7</b> <i>Cellular uptake of <math>\text{Cp}_6</math> as relative fluorescence intensity in intact cells and after extraction in SDS:NaOH solution for Colo-205 and Nt8e cells..</i> .....	91
<b>Figure 4.8</b> <i>Fluorescence microphotographs of Colo-205 cells and Nt8e cells showing intracellular localization of <math>\text{Cp}_6</math> and <math>\text{Cp}_6</math>-SiNP.</i> .....	92

<b>Figure 4.9</b> <i>Changes in percent cell survival following photosensitizer treatment in dark and after exposure to light for Colo-205 and Nt8e cells..</i> .....	93
<b>Figure 4.10</b> <i>Photobleaching of 10 <math>\mu</math>M Cp<sub>6</sub> under irradiation at 660 <math>\pm</math> 20 nm</i> .....	94
<b>Figure 5.1</b> <i>Chemical structure of PP18 and Cp<sub>6</sub> and the conversion of PP18 to Cp<sub>6</sub>, due to its hydrolysis in the presence of water.</i> .....	103
<b>Figure 5.2</b> <i>Absorbance and fluorescence spectra of PP18 in acetone, buffer and serum at pH 7.4.</i> .....	105
<b>Figure 5.3</b> <i>The absorption and fluorescence spectra of PP18 in SiNP-VA, SiNP-V, PLGA NP and liposome suspended in neat buffer at pH 7.4.</i> .....	107
<b>Figure 5.4</b> <i>The absorption and fluorescence spectra of PP18 in SiNP-VA, SiNP-V, PLGA NP and liposome suspended in buffer at pH 7.4 in presence of 10% serum.</i> .....	109
<b>Figure 5.5</b> <i>Fluorescence intensity at 670 nm, in all four NPs suspended in buffer at pH 7.4, as a function of time in the absence (a) and in the presence of 10% serum (b).</i> .....	110
<b>Figure 5.6</b> <i>Normalized fluorescence intensity, at 712 nm in all four NPs suspended in buffer at pH 7.4, as a function of time, in the absence (a) and in the presence of 10% serum (b).</i> .....	110
<b>Figure 5.7</b> <i>Time dependent absorption spectra of PP18 in SiNP-VA, SiNP-V, PLGA NP and liposome at pH 7.4.</i> .....	113
<b>Figure 5.8</b> <i>Time dependent fluorescence spectra of PP18 in SiNP-VA, SiNP-V, PLGA NP and liposome at pH 7.4.</i> .....	114
<b>Figure 5.9</b> <i>Time dependent absorption spectra of PP18 in SiNP-VA, SiNP-V, PLGA NP and liposome suspended in 10% serum at pH 7.4.</i> .....	115
<b>Figure 5.10</b> <i>Time dependent fluorescence spectra of PP18 in SiNP-VA, SiNP-V, PLGA NP and liposome suspended in 10% serum at pH 7.4.</i> .....	116
<b>Figure 6.1</b> <i>Chemical structures of the MB and NB and the polymer PSS</i> .....	119

<b>Figure 6.2</b> Normalized absorption spectra of AuNRs along with the absorption spectra of MB and NB.....	120
<b>Figure 6.3</b> Changes in the absorbance spectrum of PSS coated AuNR upon addition of MB. Left: Tuned condition; right: detuned condition. ....	121
<b>Figure 6.4</b> Changes in the absorbance spectrum of PSS coated AuNR upon addition of NB. Left: Tuned condition; right: detuned condition.....	122
<b>Figure 6.5</b> Absorption spectra of MB and NB in the presence of varying amount of PSS. ....	123
<b>Figure 6.6</b> Changes in the absorption peak positions upon increasing amount of dye. .	124
<b>Figure 6.7</b> Relative changes in the fluorescence quantum yield and lifetime of the two dyes in the presence of varying amount of PSS coated AuNRs.....	125
<b>Figure 6.8</b> Changes in the fluorescence lifetimes of the two dyes in the presence of various amounts of AuNRs.....	126
<b>Figure 6.9</b> Relative changes in the $k_r$ and $k_{nr}$ of the two dyes in the presence of varying amount of PSS coated AuNRs. Left: tuned and right: detuned condition. ....	127
<b>Figure 6.10</b> Fluorescence spectra of MB and NB in the presence of varying amount of PSS. B: No PSS; C: 0.1 nM PSS; D: 1 nM PSS; E: 10 nM PSS; F: 100 nM PSS; G: 1 $\mu$ M PSS and H: 10 $\mu$ M PSS.....	127
<b>Figure 6.11</b> Fluorescence decay traces of MB and NB in the presence of varying amount of PSS. ....	128
<b>Figure 7.1</b> Chemical structure of $Cp_6$ and repeating unit of the two polymers PAH and PDDAC. ....	135
<b>Figure 7.2</b> Absorbance spectra of CTAB, PAH and PDDAC coated AuNRs at physiological pH.....	136

**Figure 7.3** *The observed zeta potentials of the coated AuNRs with L-SPR ~ 660 nm and ~800 nm and their complexes with Cp<sub>6</sub>.* ..... 137

**Figure 7.4** *Absorption and fluorescence spectra of Cp<sub>6</sub> in presence of different coated AuNR at physiological pH. The inset at bottom panel shows the corresponding fluorescence decay of the drug..* ..... 138

**Figure 7.5** *Radiative and nonradiative decay rates of the free Cp<sub>6</sub> and Cp<sub>6</sub> in the presence of coated AuNRs.* ..... 139

**Figure 7.6** *Percentage photobleaching of Cp<sub>6</sub> and its complexes with different coated AuNRs* ..... 140