(Supplementary Information)

Hydrothermal Synthesis of Arginine Decorated $Na_xLi_yPr(MoO_4)_2:Tb^{3+}$ and $Na_xLi_yPr(WO_4)_2:Tb^{3+}$ Nanomaterials: Photocatalytic Degradation and Luminescent Sensing of Picric Acid in an Aqueous Medium

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Table of Contents

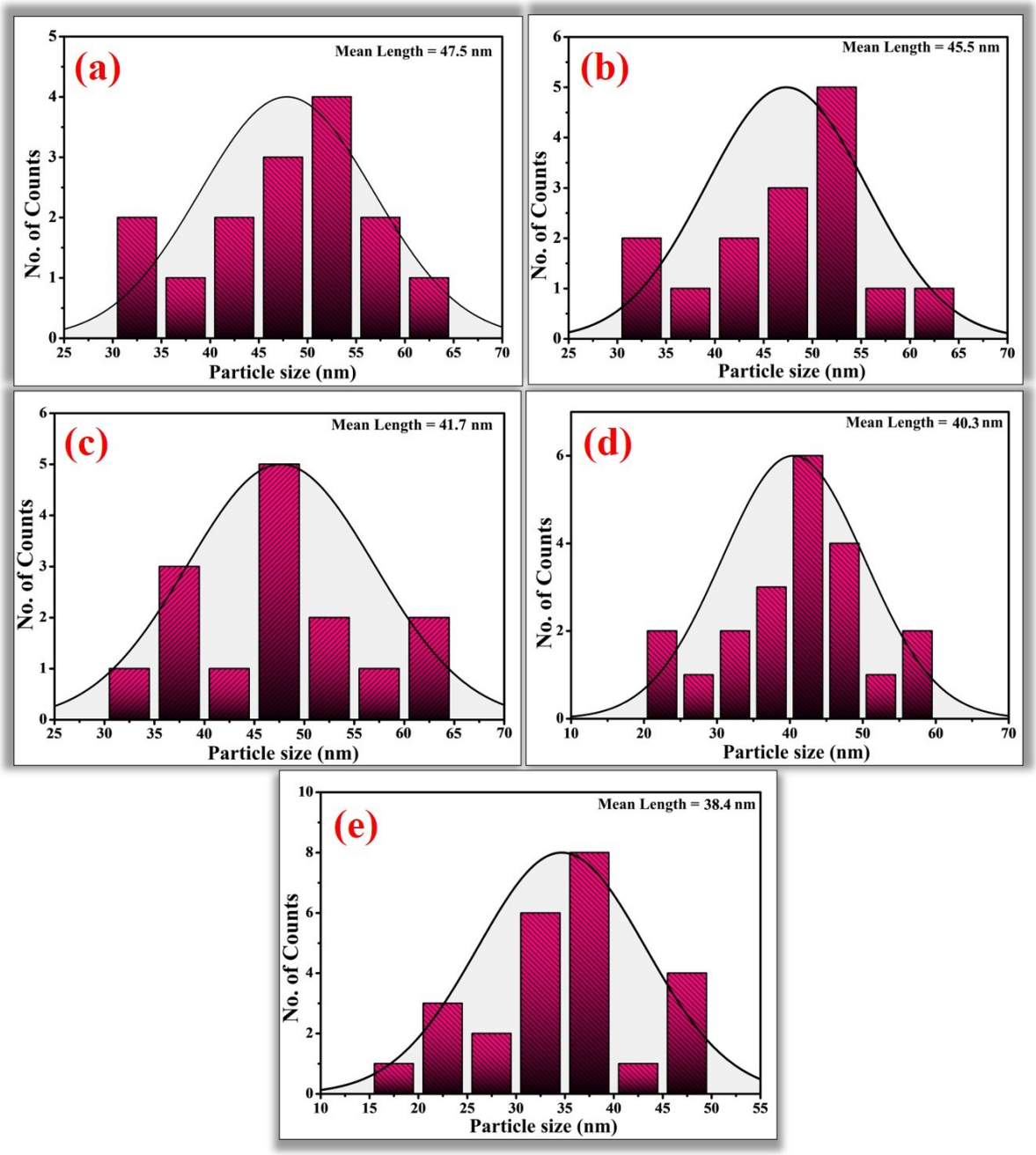

Fig. S1 SEM particle distribution graphs of as-synthesized $Na_xLi_yPr(MoO_4)_2:Tb^{3+}$ nanoparticles with different Li/Na ions concentrations: **(**Where x/y = (a) x=15 mmol y=0 mmol, (b) x=12.5 mmol, y=2.5 mmol, (c) x=10 mmol y= 5 mmol, (d) x=5 mmol, y=10 mmol and (e) x=0 mmol, y=15 mmol**)**

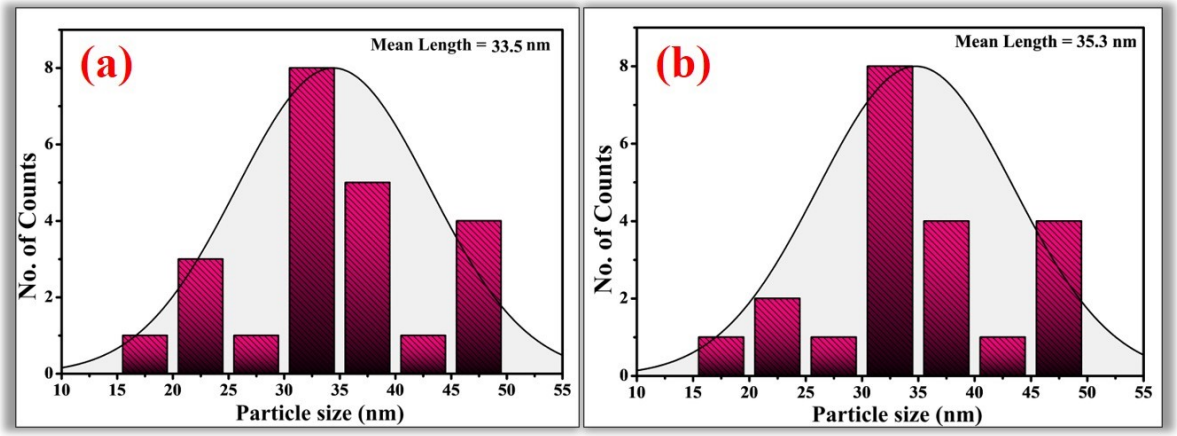

Fig. S2 Particle distribution graphs of (a) $Na_xLi_yPr(MoO_4)_2:Tb^{3+}$@Arg and (b) $Na_xLi_yPr(MoO_4)_2:Tb^{3+}$@Lys (x=10 mmol and y=5 mmol)

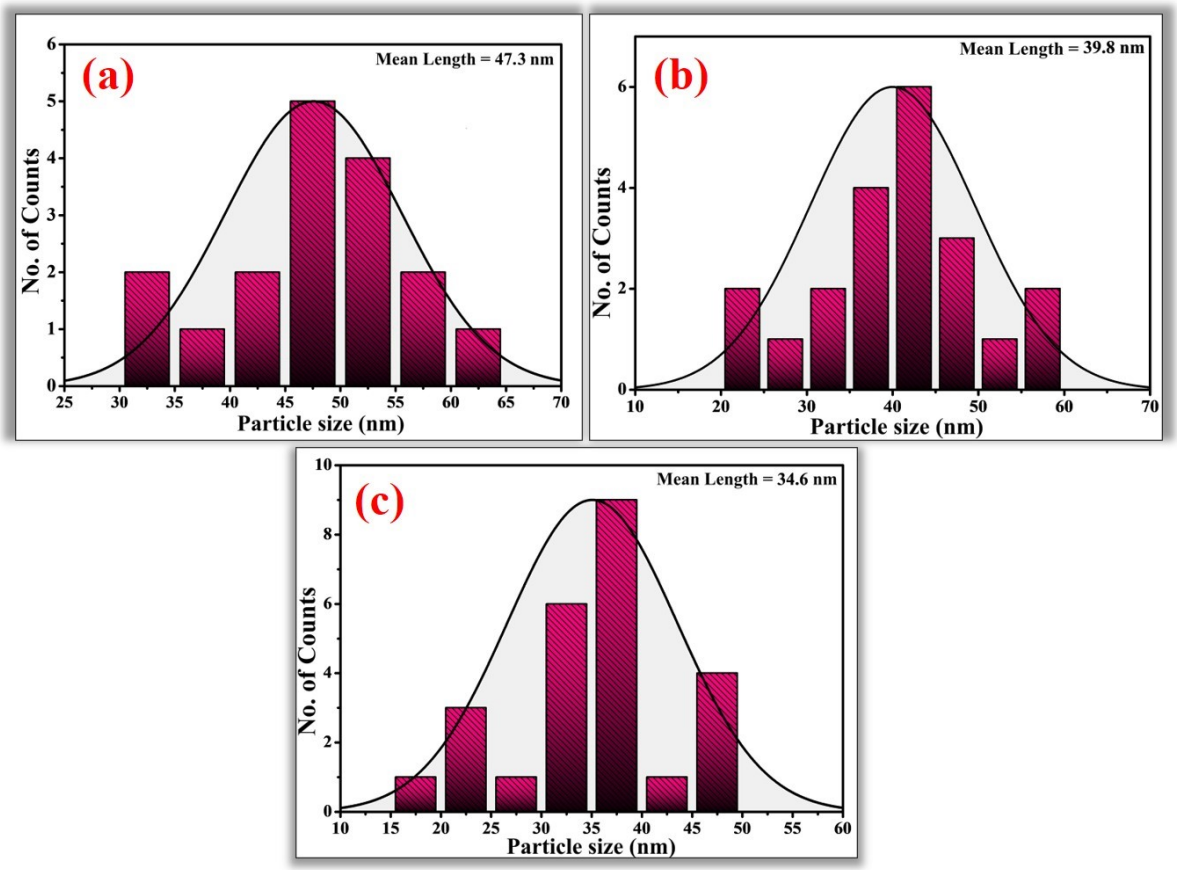

Fig. S3 Particle distribution graphs of (a) $Na_xLi_yPr(WO_4)_2:Tb^{3+}$, (b) $Na_xLi_yPr(WO_4)_2:Tb^{3+}$@Lys and (c) $Na_xLi_yPr(WO_4)_2:Tb^{3+}$@Arg (x=10 mmol and y=5 mmol)

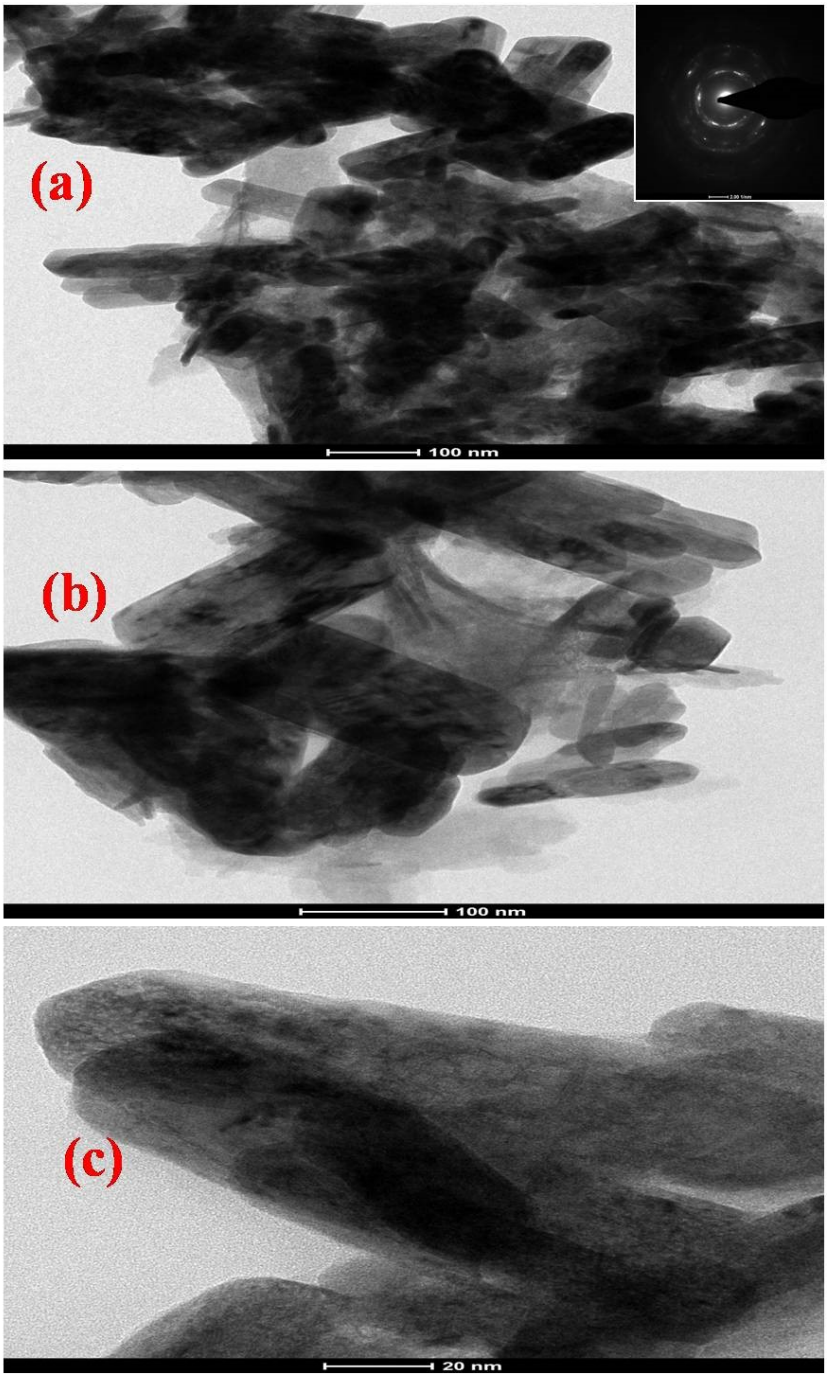

Fig. S4 TEM micrographs of (a) $Na_xLi_yPr(MoO_4)_2:Tb^{3+}$, (b) $Na_xLi_yPr(MoO_4)_2:Tb^{3+}$@Arg and (c) $Na_xLi_yPr(MoO_4)_2:Tb^{3+}$@Lys (x=10 mmol and y=5 mmol)

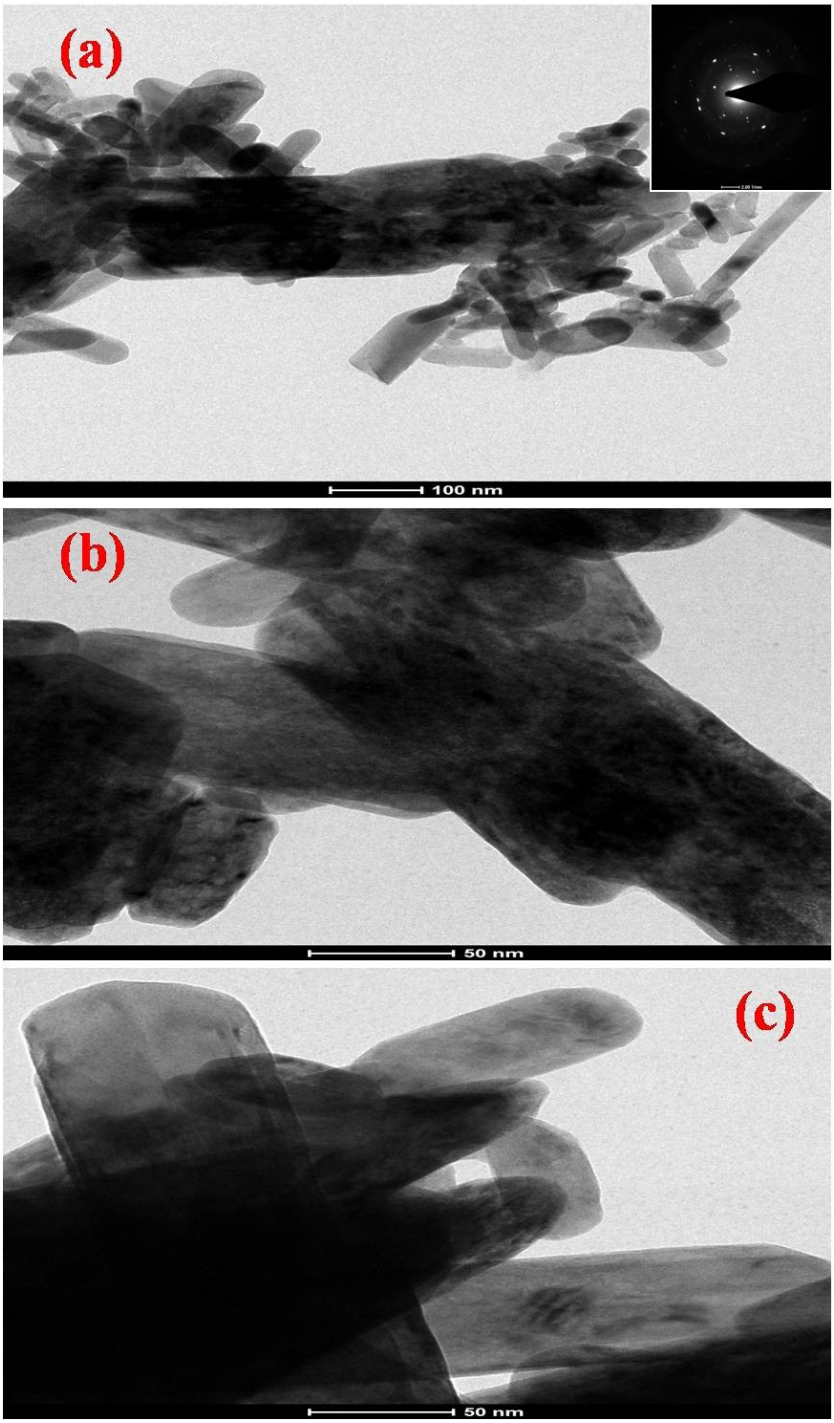

Fig. S5 TEM micrographs of (a) $Na_xLi_yPr(WO_4)_2:Tb^{3+}$, (b) $Na_xLi_yPr(WO_4)_2:Tb^{3+}$@Arg and (c) $Na_xLi_yPr(WO_4)_2:Tb^{3+}$@Lys (x=10 mmol and y=5 mmol)

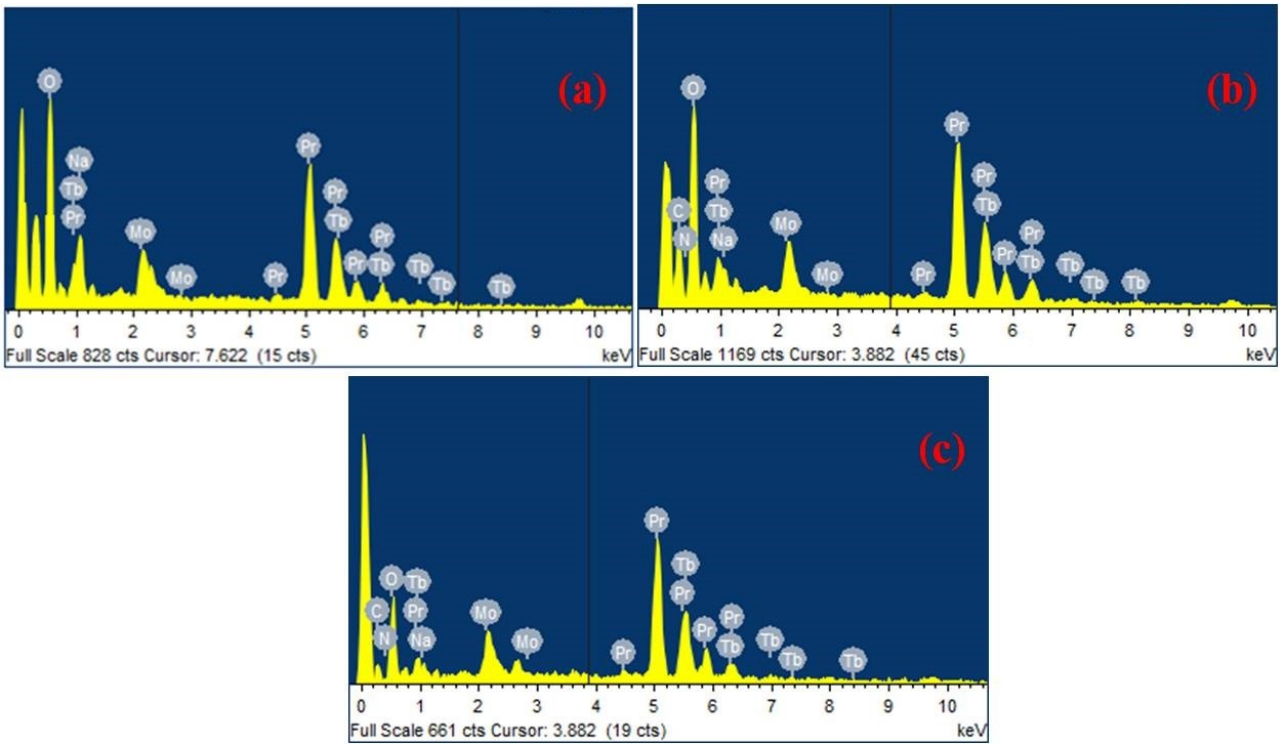

Fig. S6 EDS spectra of (a) $Na_xLi_yPr(MoO_4)_2:Tb^{3+}$, (b) $Na_xLi_yPr(MoO_4)_2:Tb^{3+}$@Arg and (c) $Na_xLi_yPr(MoO_4)_2:Tb^{3+}$@Lys (x=10 mmol and y=5 mmol)

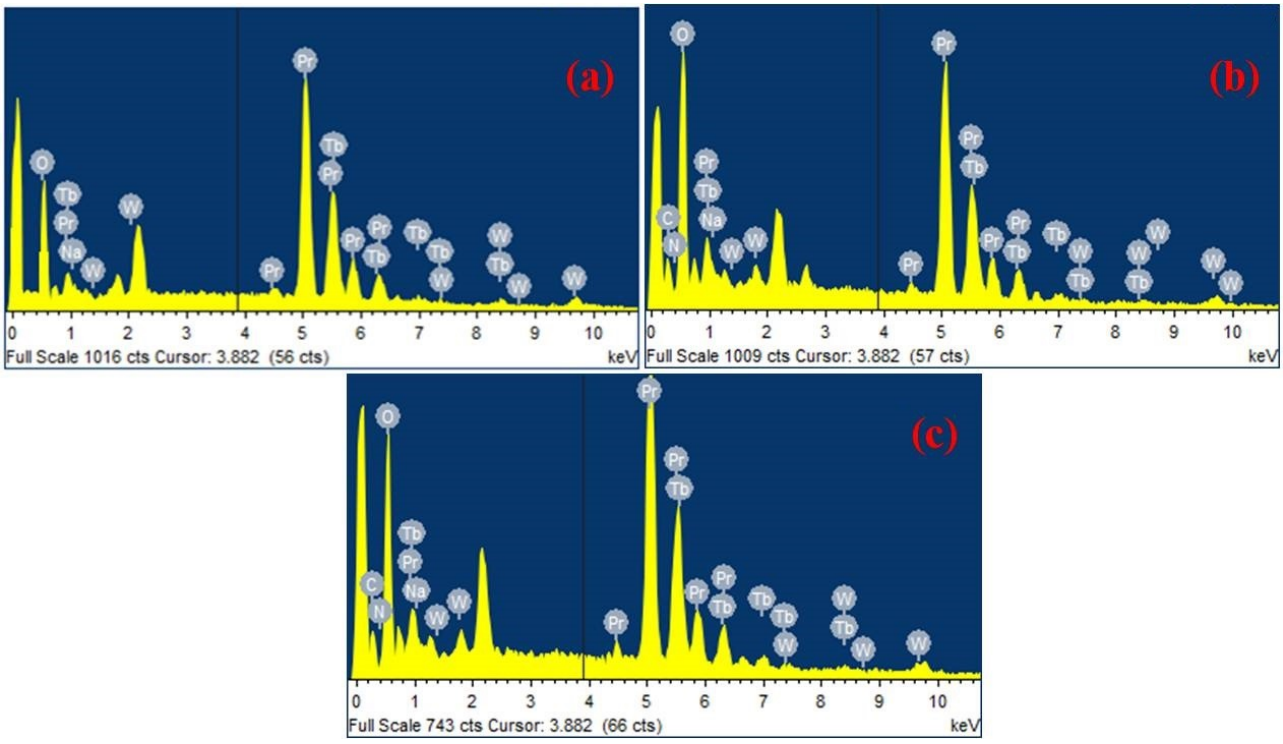

Fig. S7 EDS spectra of (a) $Na_xLi_yPr(WO_4)_2:Tb^{3+}$, (b) $Na_xLi_yPr(WO_4)_2:Tb^{3+}$@Arg and (c) $Na_xLi_yPr(WO_4)_2:Tb^{3+}$@Lys (x=10 mmol and y=5 mmol)

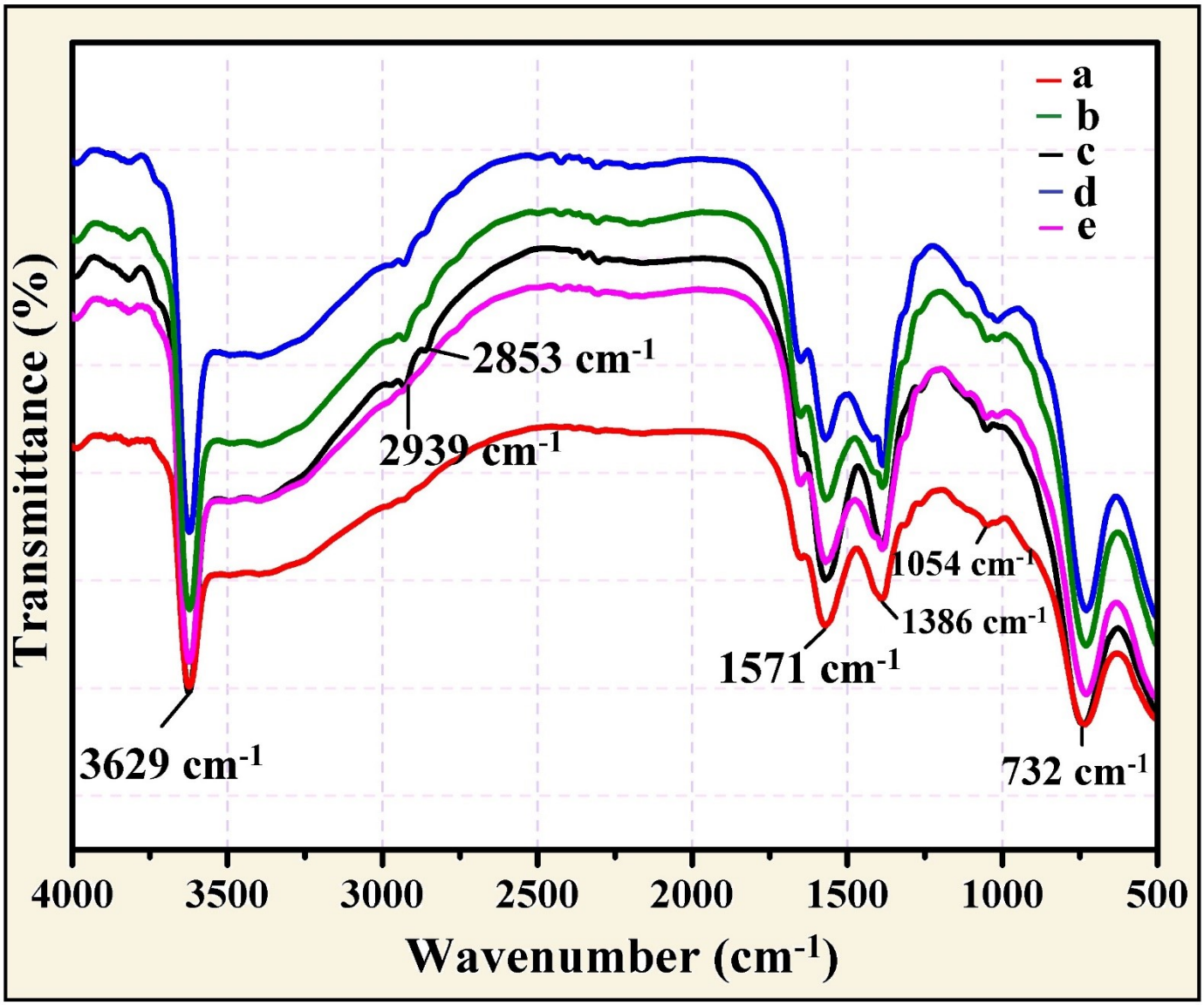

Fig. S8 FT-IR spectra of as-synthesized $Na_xLi_yPr(MoO_4)_2:Tb^{3+}$ nanoparticles with different Li/Na ions concentrations: **(**Where x/y = (a) x=15 mmol y=0 mmol, (b) x=12.5 mmol, y=2.5 mmol, (c) x=10 mmol y=5 mmol, (d) x=5 mmol, y=10 mmol and (e) x=0 mmol, y=15 mmol**)**

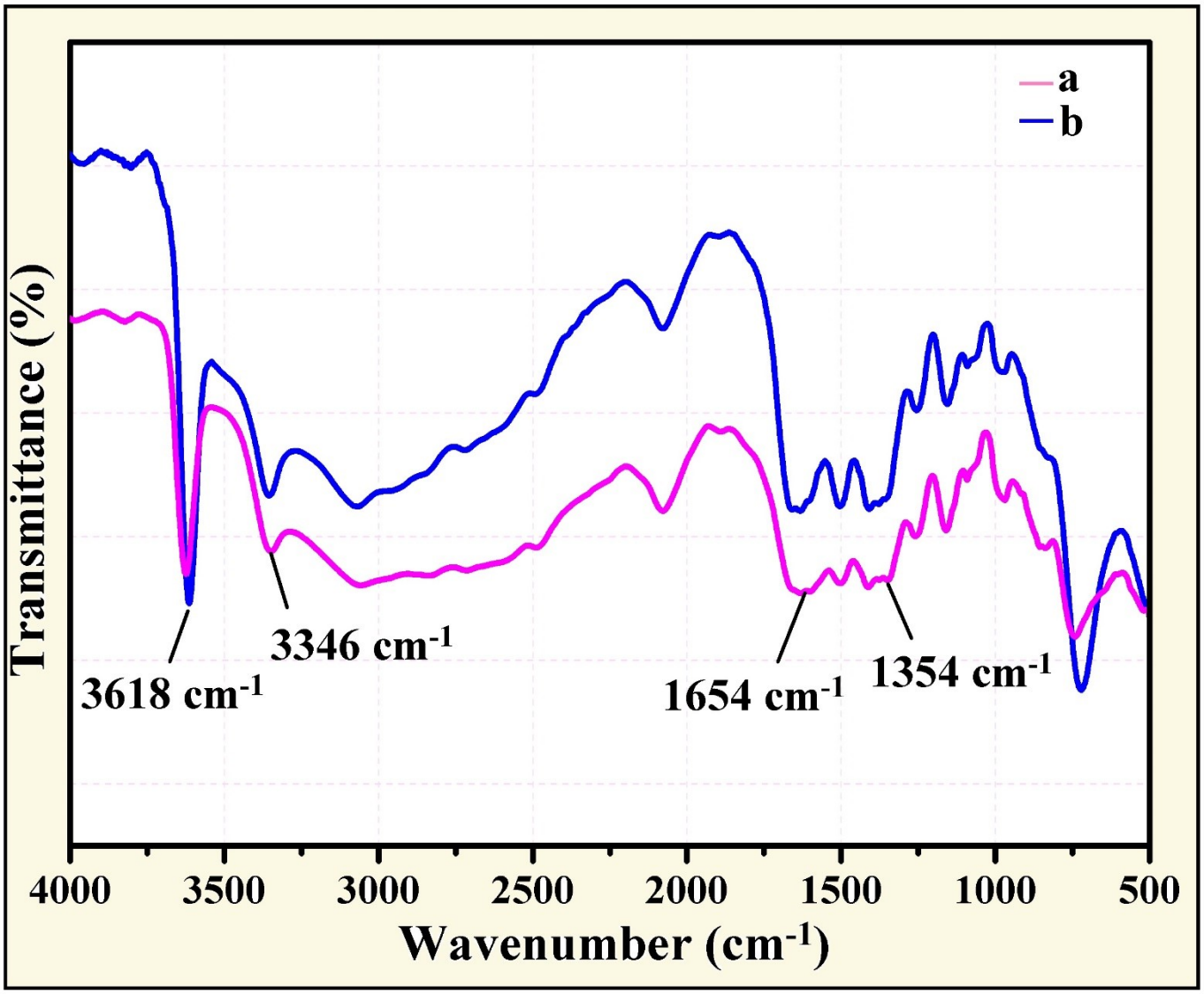

Fig. S9 FT-IR spectra of (a) $Na_xLi_yPr(MoO_4)_2:Tb^{3+}$@Lys and (b) $Na_xLi_yPr(MoO_4)_2:Tb^{3+}$@Arg (x=10 mmol and y=5 mmol)

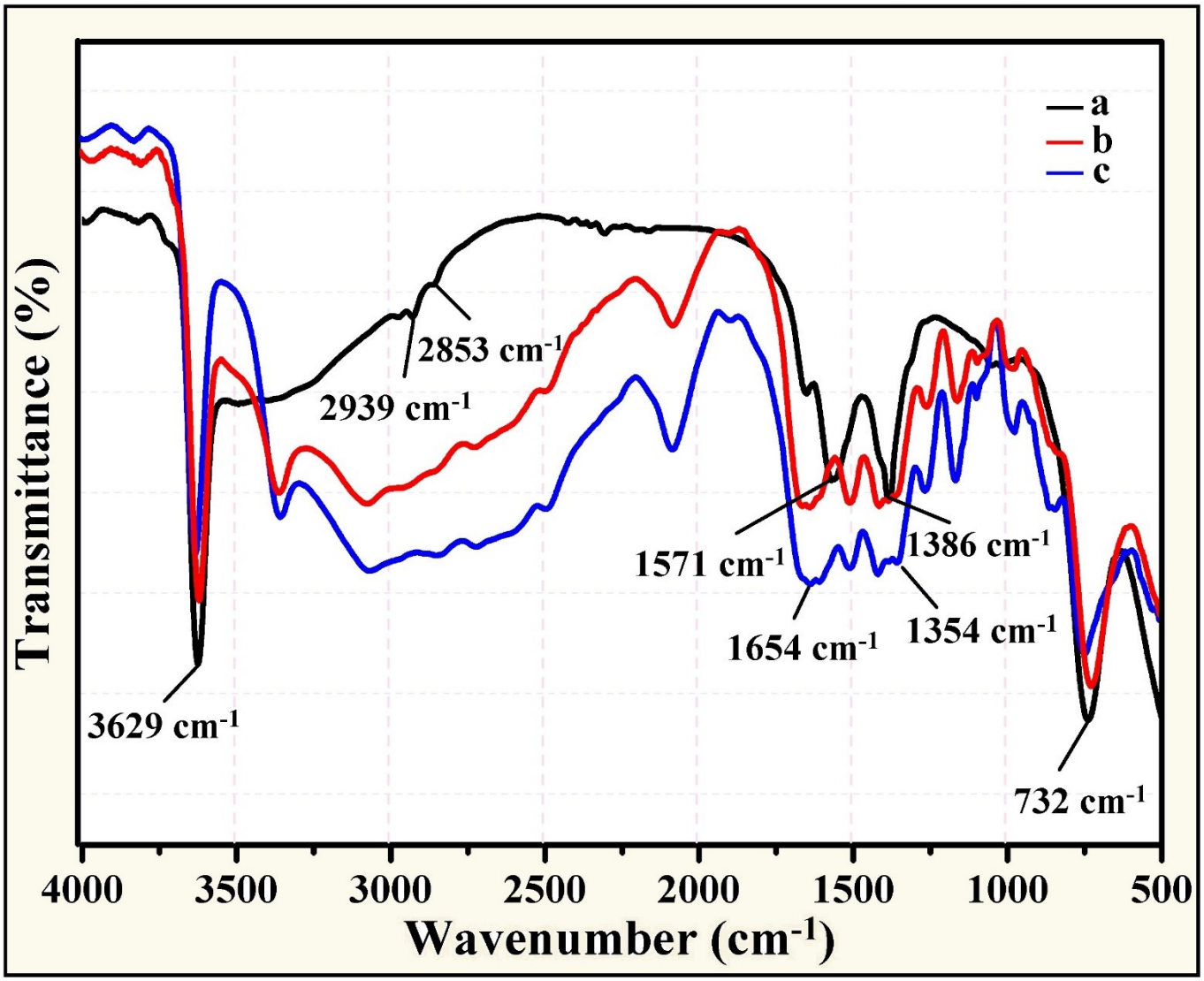

Fig. S10 FT-IR spectra of (a) $Na_xLi_yPr(WO_4)_2:Tb^{3+}$, (b) $Na_xLi_yPr(WO_4)_2:Tb^{3+}$@Arg and (c) $Na_xLi_yPr(WO_4)_2:Tb^{3+}$@Lys (x=10 mmol and y=5 mmol)

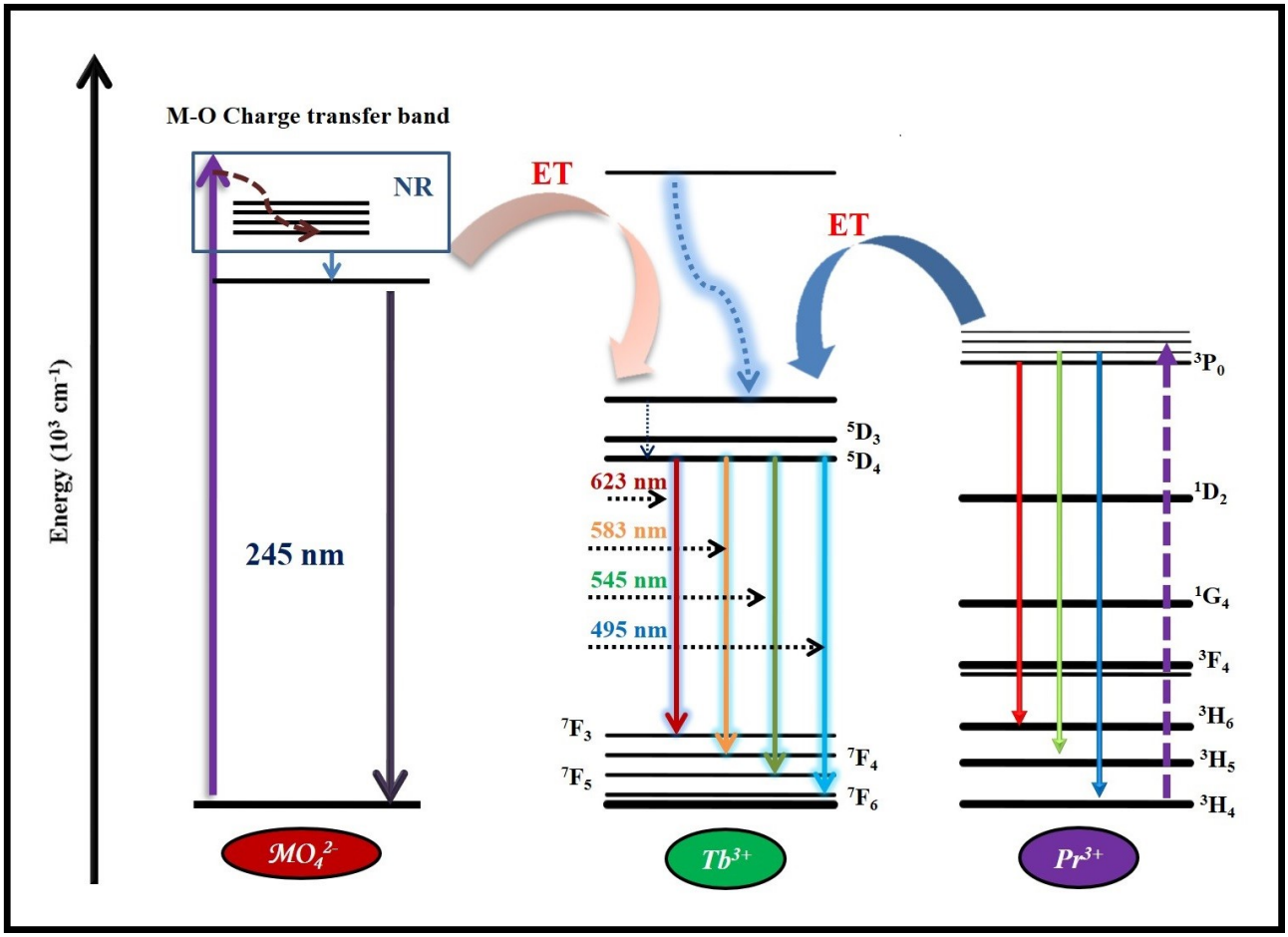

Fig. S11 The plausible energy transfer mechanism involving in photoluminescence emission

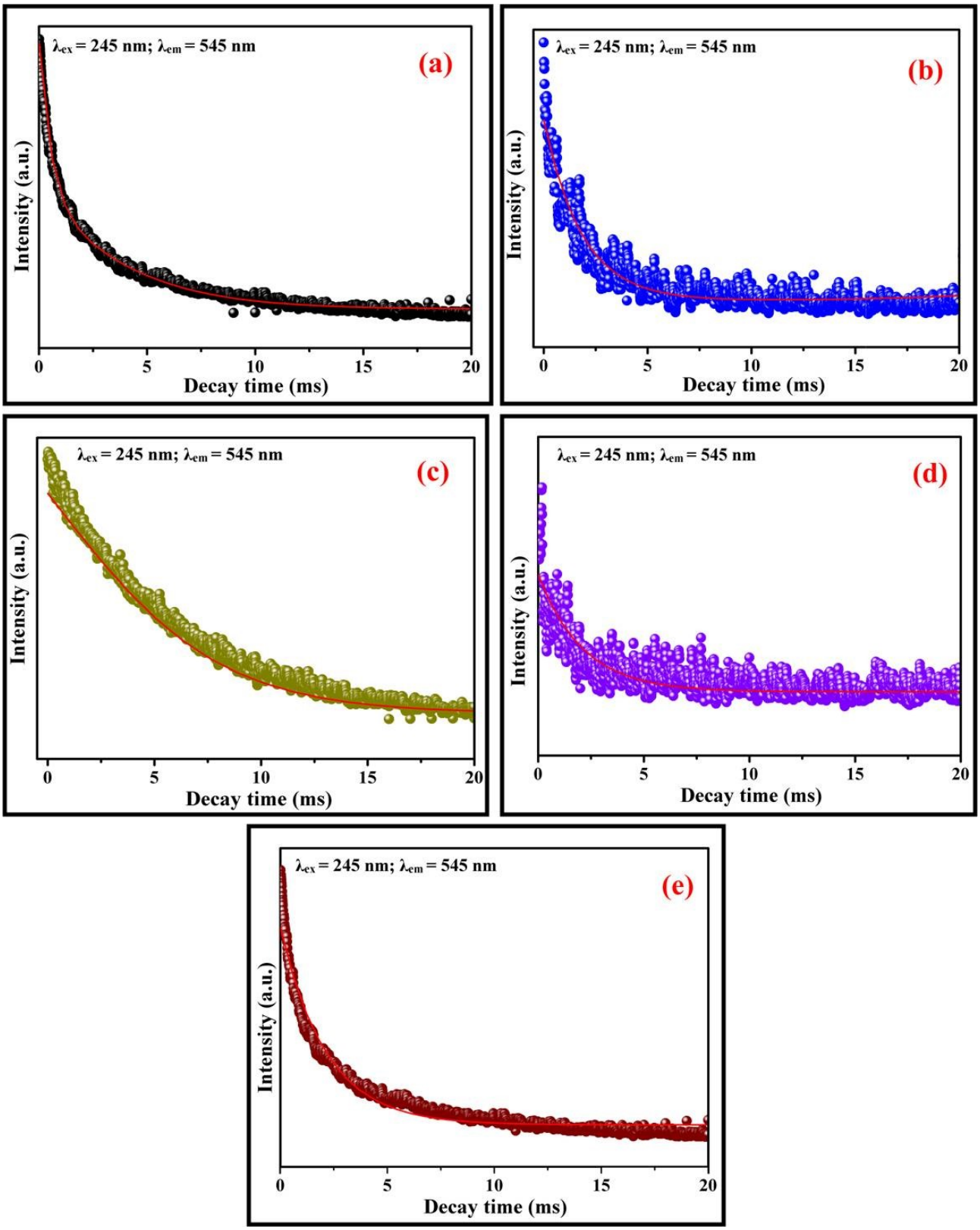

Fig. S12 Decay curves of as-synthesized $Na_xLi_yPr(MoO_4)_2:Tb^{3+}$ nanoparticles with different Li/Na ions concentrations: **(**Where x/y = (a) x=15 mmol y=0 mmol, (b) x=12.5 mmol, y=2.5 mmol, (c) x=10 mmol y=5 mmol, (d) x=5 mmol, y=10 mmol and (e) x=0 mmol, y=15 mmol**)**

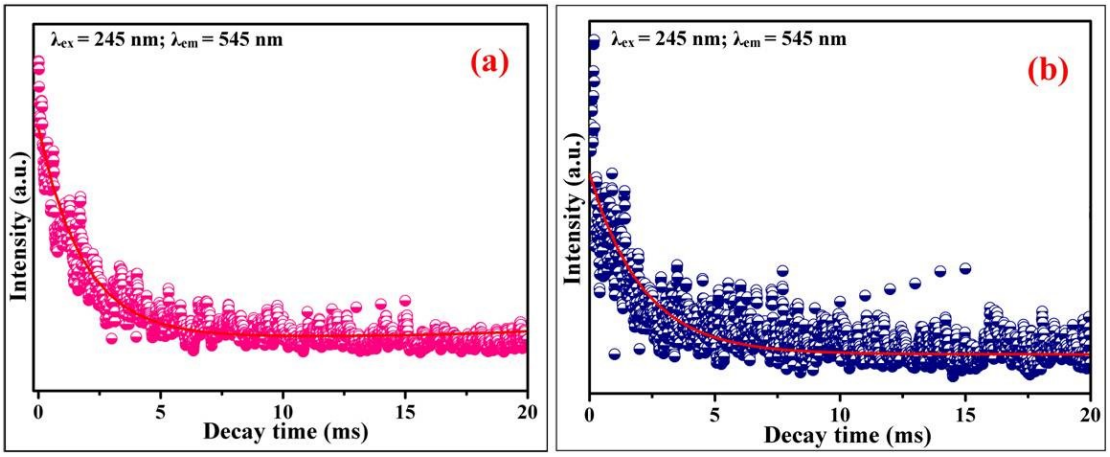

Fig. S13 Decay curves of (a) $Na_xLi_yPr(MoO_4)_2:Tb^{3+}$@Lys and (b) $Na_xLi_yPr(MoO_4)_2:Tb^{3+}$@Arg (x=10 mmol and y=5 mmol)

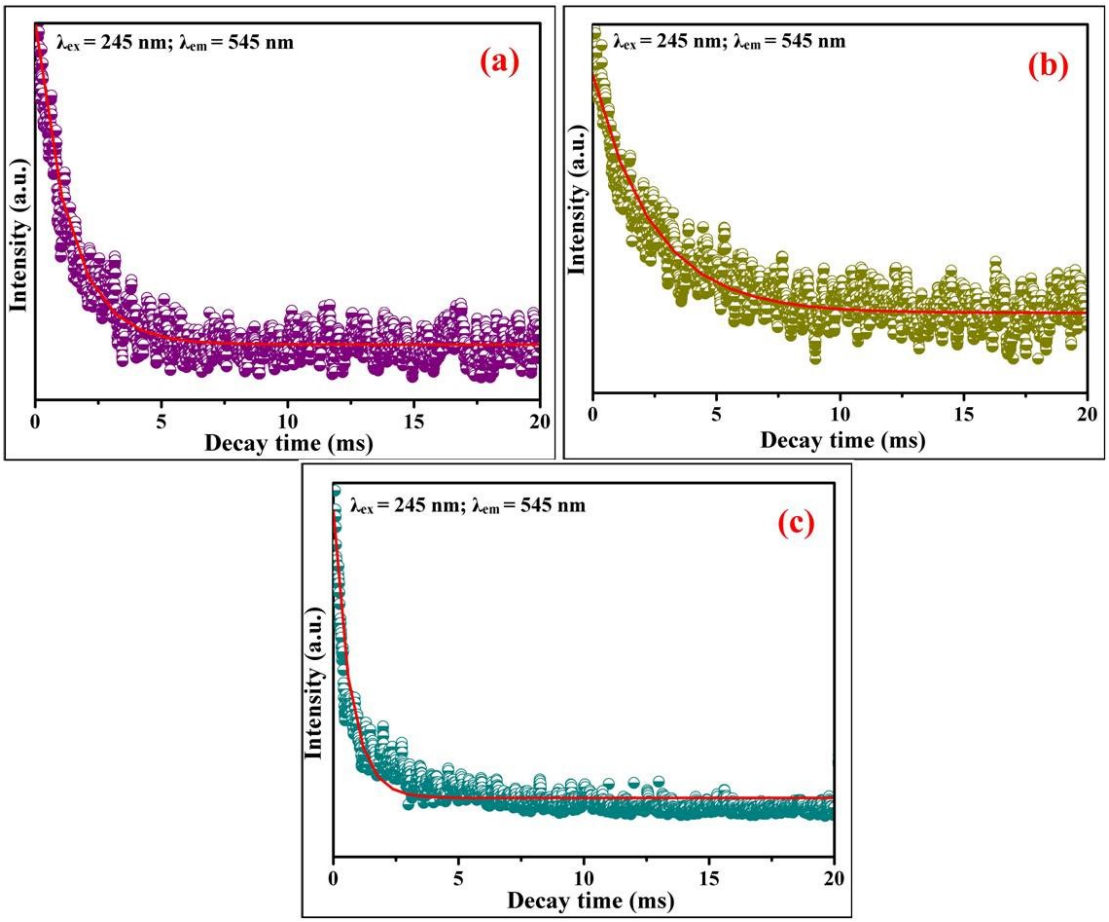

Fig. S14 Decay curves of (a) $Na_xLi_yPr(WO_4)_2:Tb^{3+}$, (b) $Na_xLi_yPr(WO_4)_2:Tb^{3+}$@Lys and (c) $Na_xLi_yPr(WO_4)_2:Tb^{3+}$@Arg (x=10 mmol and y=5 mmol)

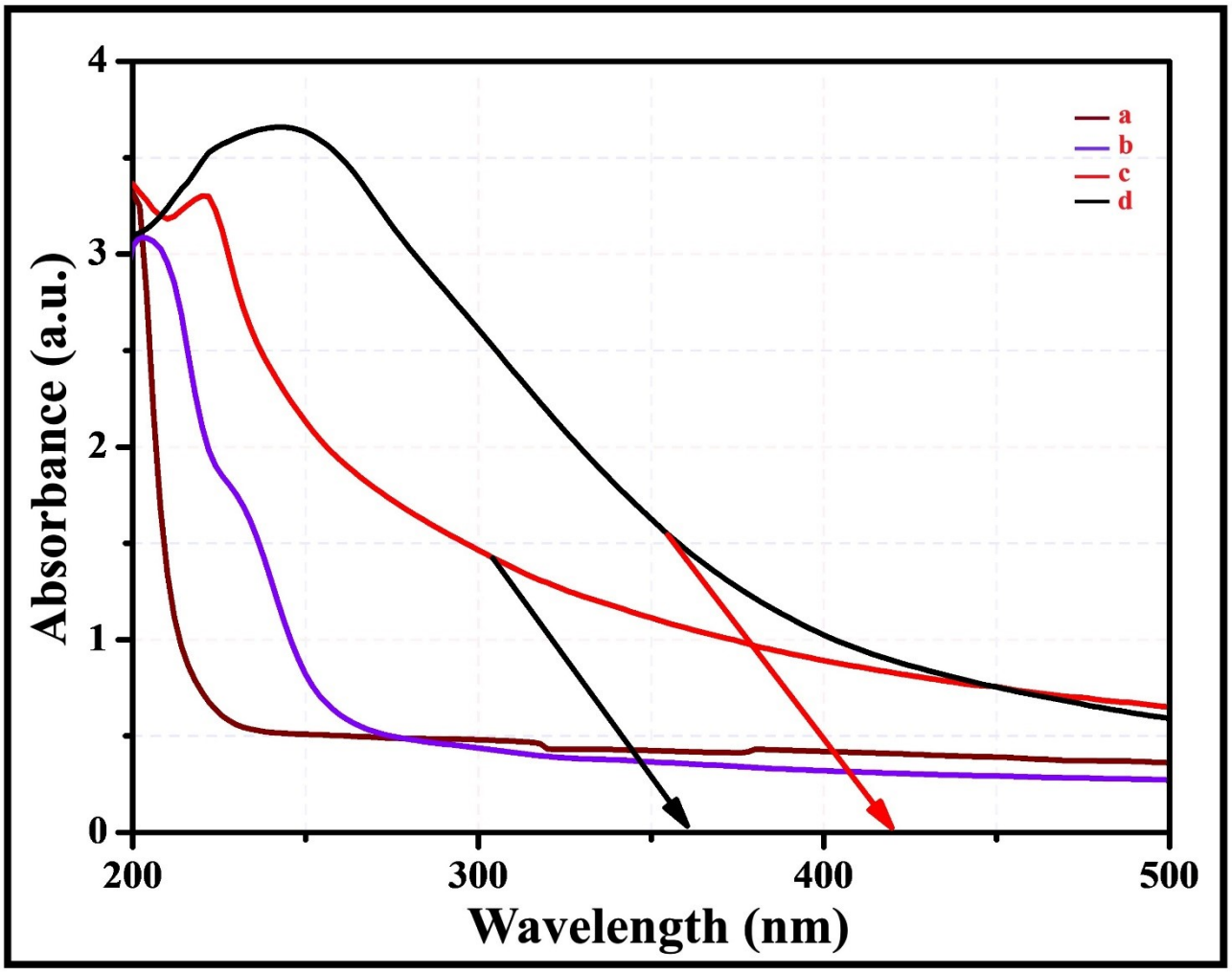

Fig. S15 UV-visible absorption spectra of (a) $Na_xLi_yPr(MoO_4)_2:Tb^{3+}$, (b) $Na_xLi_yPr(WO_4)_2:Tb^{3+}$ (c) $Na_xLi_yPr(MoO_4)_2:Tb^{3+}$@Arg and (d) $Na_xLi_yPr(WO_4)_2:Tb^{3+}$@Arg (x=10 mmol and y=5 mmol)

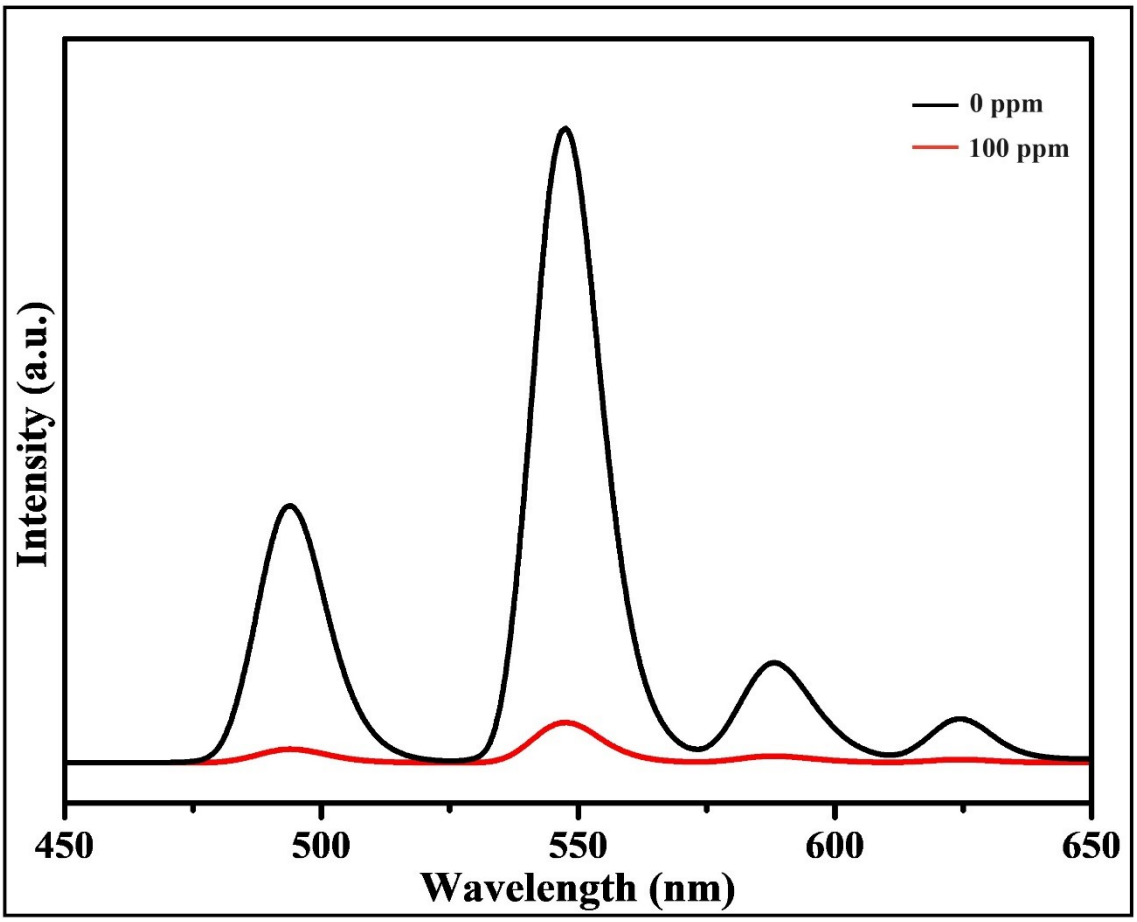

Fig. S16 PL spectra of (a) $Na_xLi_yPr(MoO_4)_2:Tb^{3+}$@Arg and (b) $Na_xLi_yPr(MoO_4)_2:Tb^{3+}$@Arg + 100 ppm of PA

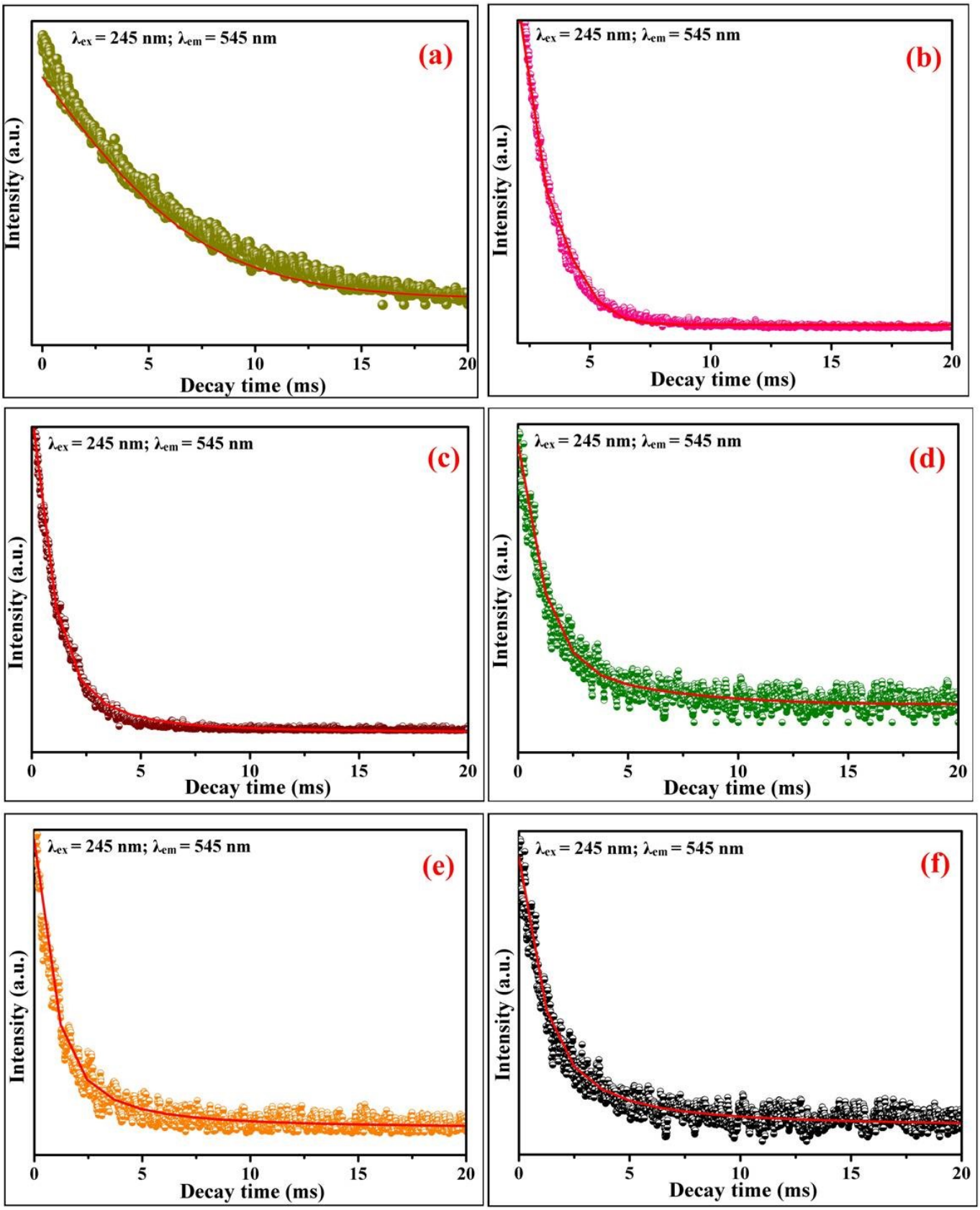

Fig. S17 Time-resolved decay dynamics of $Na_xLi_yPr(MoO_4)_2:Tb^{3+}$@Arg (x=10 mmol and y=5 mmol) after excitation at 245 nm in the presence of PA ions (0, 20, 40, 60, 80 and 100 ppm)

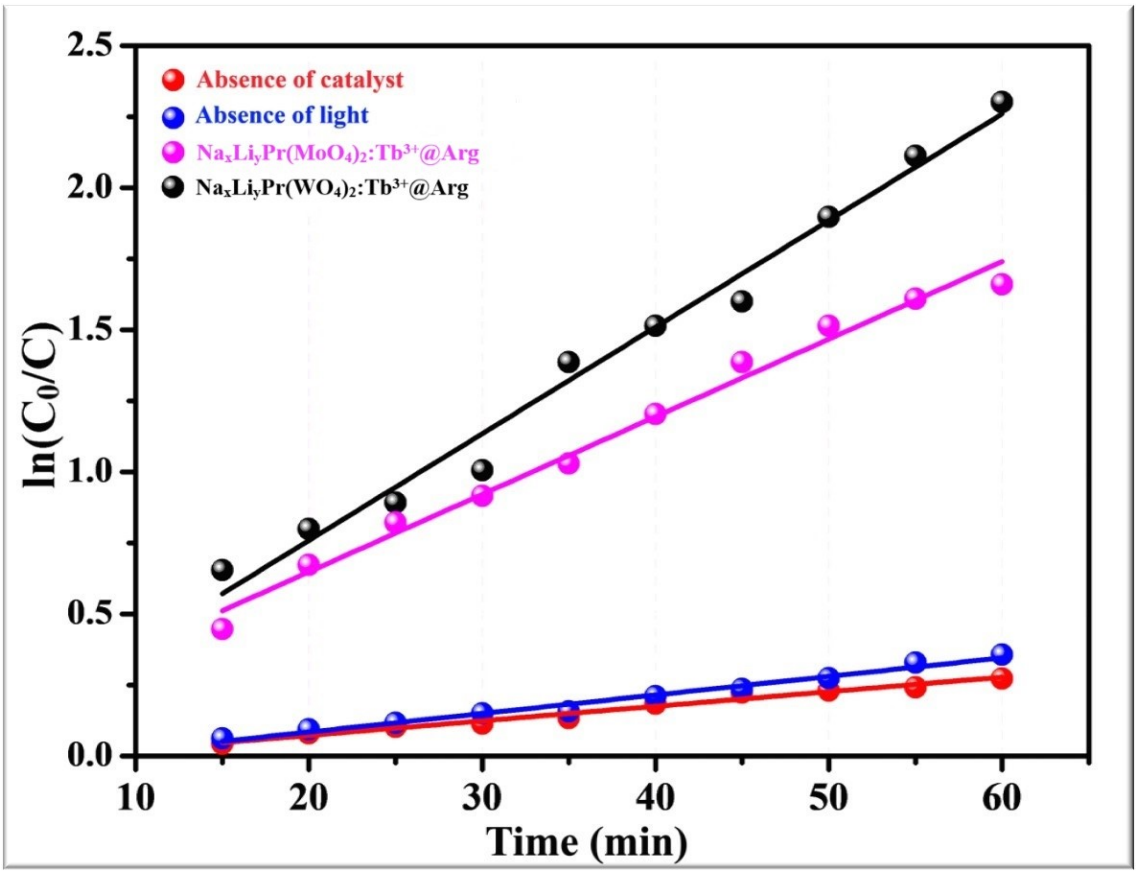

Fig. S18 Pseudo-first order plots of photodegradation of PA by $Na_xLi_yPr(WO_4)_2:Tb^{3+}$@Arg and $Na_xLi_yPr(MoO_4)_2:Tb^{3+}$@Arg (x=10 mmol and y=5 mmol) nanocatalysts under UV light irradiation

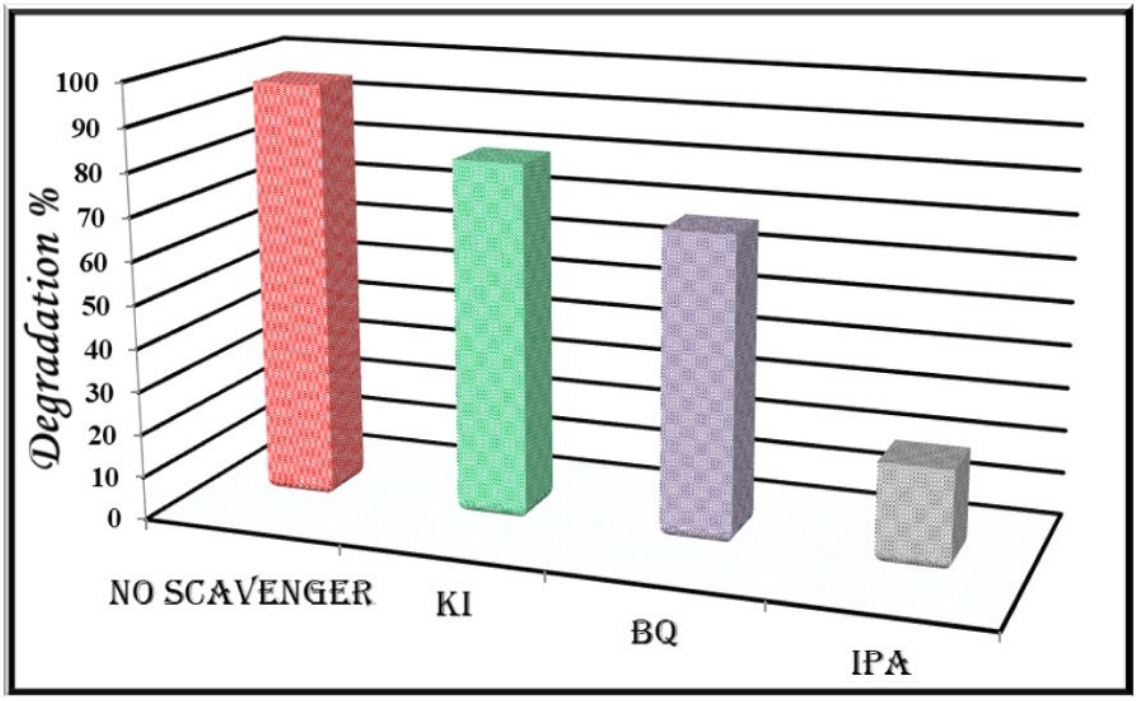

Fig. S19 Scavenger tests of the PA degradation

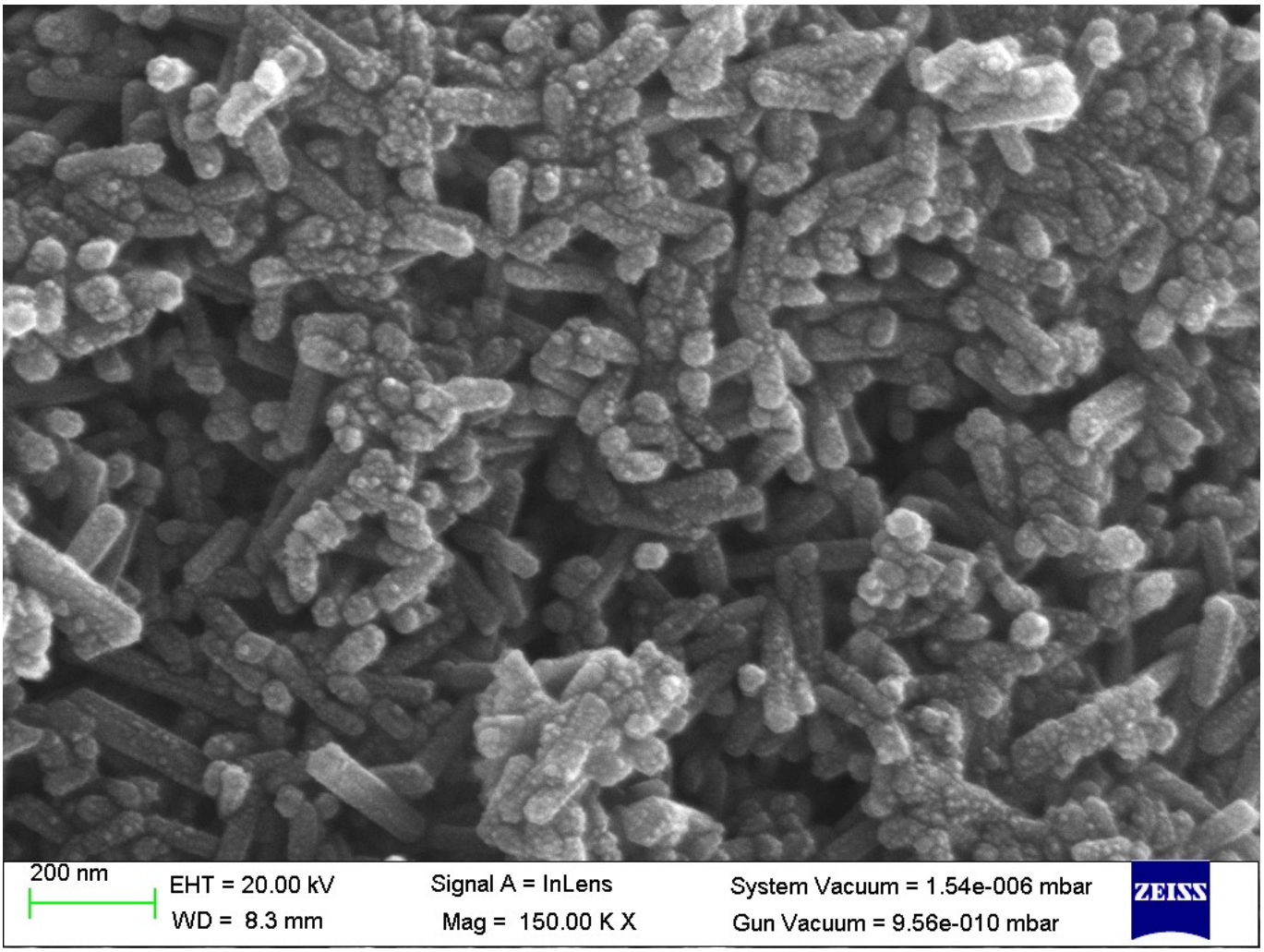

Fig. S20 FE-SEM micrograph of $Na_xLi_yPr(WO_4)_2:Tb^{3+}$@Arg (x=10 mmol and y=5 mmol) after photodegradation of PA

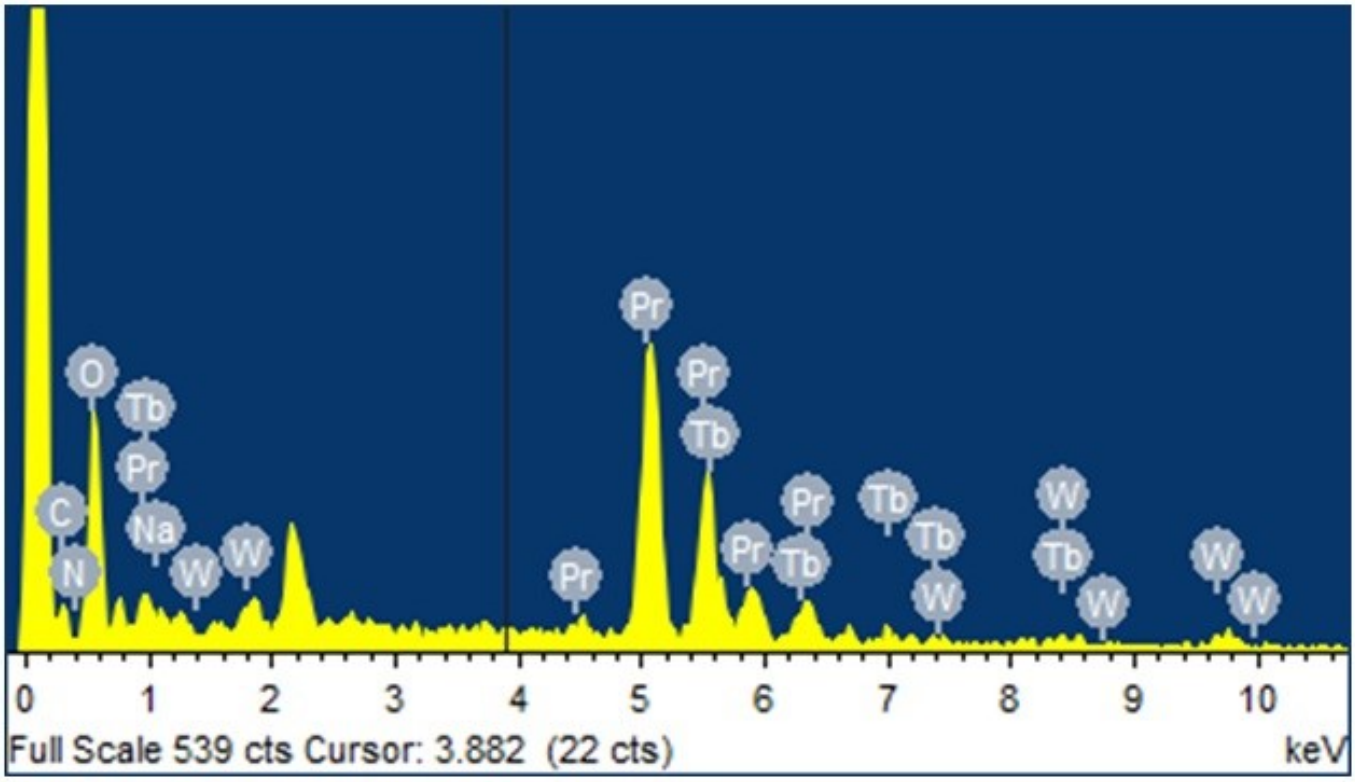

Fig. S21 EDS micrograph of $Na_xLi_yPr(WO_4)_2:Tb^{3+}$@Arg (x=10 mmol and y=5 mmol) after photodegradation of PA

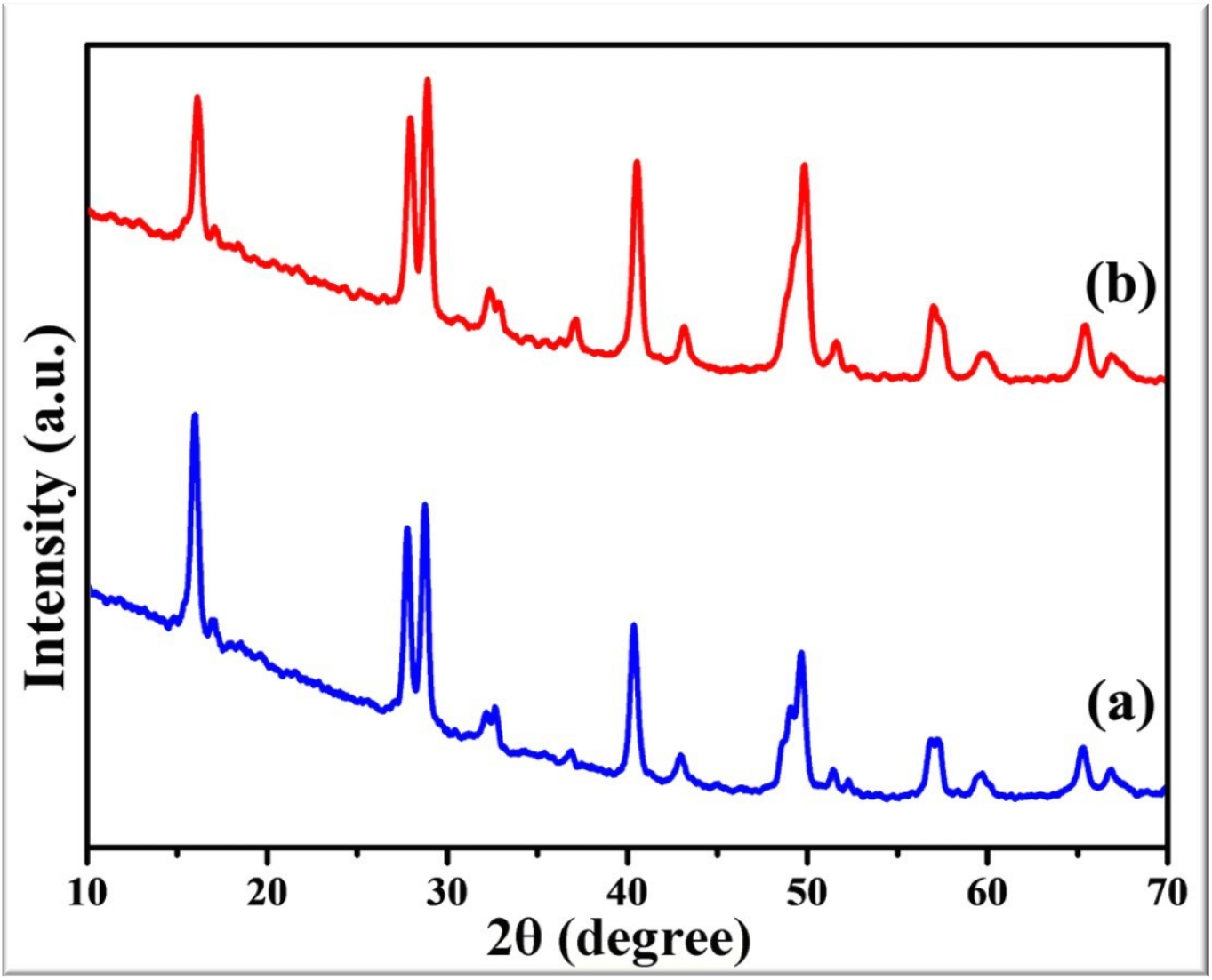

Fig. S22 XRD spectrum of $Na_xLi_yPr(WO_4)_2:Tb^{3+}$@Arg (x=10 mmol and y=5 mmol) (a) before and (b) after photodegradation of PA