**Supplementary Information**

# Role of reactant concentration and identity of added cation in controlling emission from post-synthetically modified terbium incorporated zinc sulfide nanoparticles: an avenue for the detection of lead(II) cations

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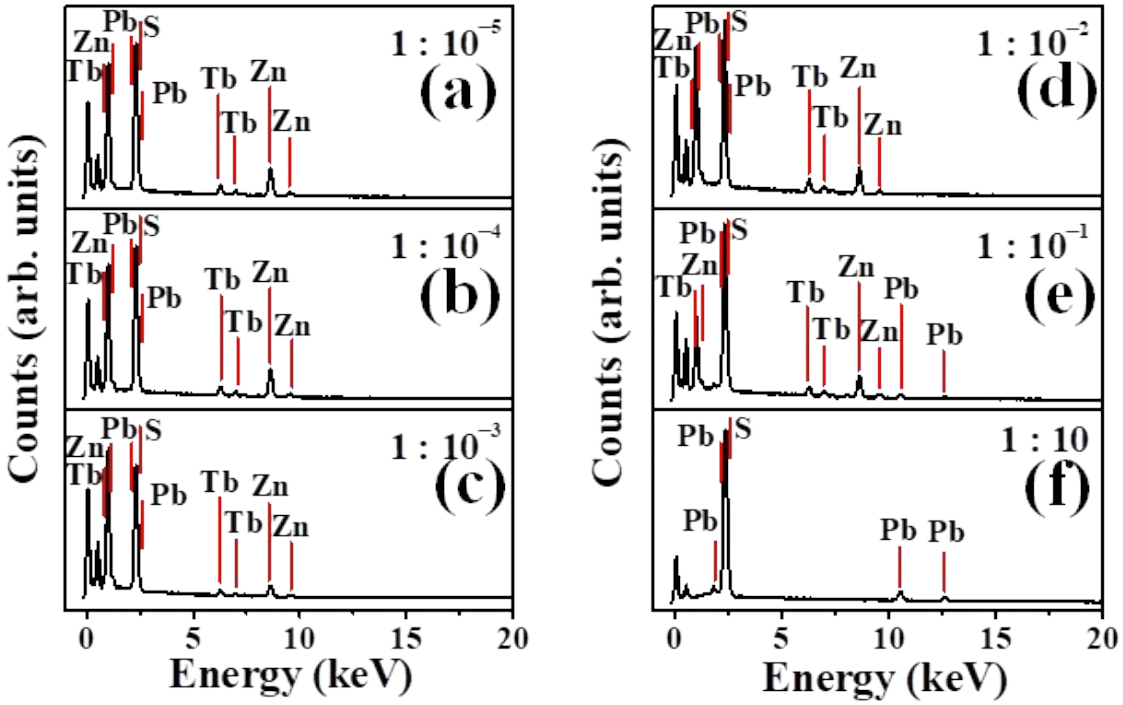


**Figure S1.** The EDS of post-synthetically modified Zn(Tb)S nanoparticles with varying concentrations of $Pb^{2+}$ are shown, with the numbers mentioned in each panel representing [Zn(Tb)S] : [$Pb^{2+}$].

**Table S1.** The elemental composition of the nanoparticles studied.[a]

| | | [Zn(Tb)S] : [$Pb^{2+}$] | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Zn(Tb)S** | **1:10⁻⁵** | **1:10⁻⁴** | **1:10⁻³** | **1:10⁻²** | **1:10⁻¹** | **1:1** | **1:10** |
| **Zn** | 35.9 ± 0.4 | 28.3 ± 5.3 | 32.3 ± 3.1 | 19.6 ± 3.2 | 32.2 ± 2.1 | 34.1 ± 2.4 | ---- | ---- |
| **Tb** | 6.3 ± 0.2 | 4.5 ± 0.4 | 5.4 ± 0.1 | 4.7 ± 0.5 | 6.0 ± 1.0 | 6.8 ± 1.0 | 1.3 ± 0.7 | ---- |
| **S** | 57.8 ± 0.4 | 66.6 ± 5.6 | 61.5 ± 3.1 | 74.4 ± 3.8 | 59.8 ± 2.3 | 48.1 ± 3.6 | 44.8 ± 5.1 | 45.9 ± 1.2 |
| **Pb** | ---- | 0.5 ± 0.1 | 0.8 ± 0.5 | 1.3 ± 0.4 | 2.0 ± 0.1 | 11.1 ± 0.8 | 53.8 ± 4.7 | 54. 2 ± 1.2 |

[a] The numbers were calculated from the elemental analysis obtained from multiple spatial position of the samples, with the values reported as the average and standard deviation.

**Table S2.** The approximate chemical composition of the nanoparticles studied.[a]

| **System** | **Approximate Chemical Composition** |
|---|---|
| Zn(Tb)S | $Zn_{0.36}Tb_{0.06}S_{0.58}$ |
| [Zn(Tb)S] : [$Pb^{2+}$] = 1:10⁻⁵ | $Zn_{0.28}Tb_{0.05}Pb_{0.01}S_{0.66}$ |
| [Zn(Tb)S] : [$Pb^{2+}$] = 1:10⁻⁴ | $Zn_{0.32}Tb_{0.05}Pb_{0.01}S_{0.62}$ |
| [Zn(Tb)S] : [$Pb^{2+}$] = 1:10⁻³ | $Zn_{0.20}Tb_{0.05}Pb_{0.01}S_{0.74}$ |
| [Zn(Tb)S] : [$Pb^{2+}$] = 1:10⁻² | $Zn_{0.32}Tb_{0.06}Pb_{0.02}S_{0.60}$ |
| [Zn(Tb)S] : [$Pb^{2+}$] = 1:10⁻¹ | $Zn_{0.34}Tb_{0.07}Pb_{0.11}S_{0.48}$ |
| [Zn(Tb)S] : [$Pb^{2+}$] = 1:1 | $Pb_{0.54}Tb_{0.01}S_{0.45}$ |
| [Zn(Tb)S] : [$Pb^{2+}$] = 1:10 | $Pb_{0.54}S_{0.46}$ |

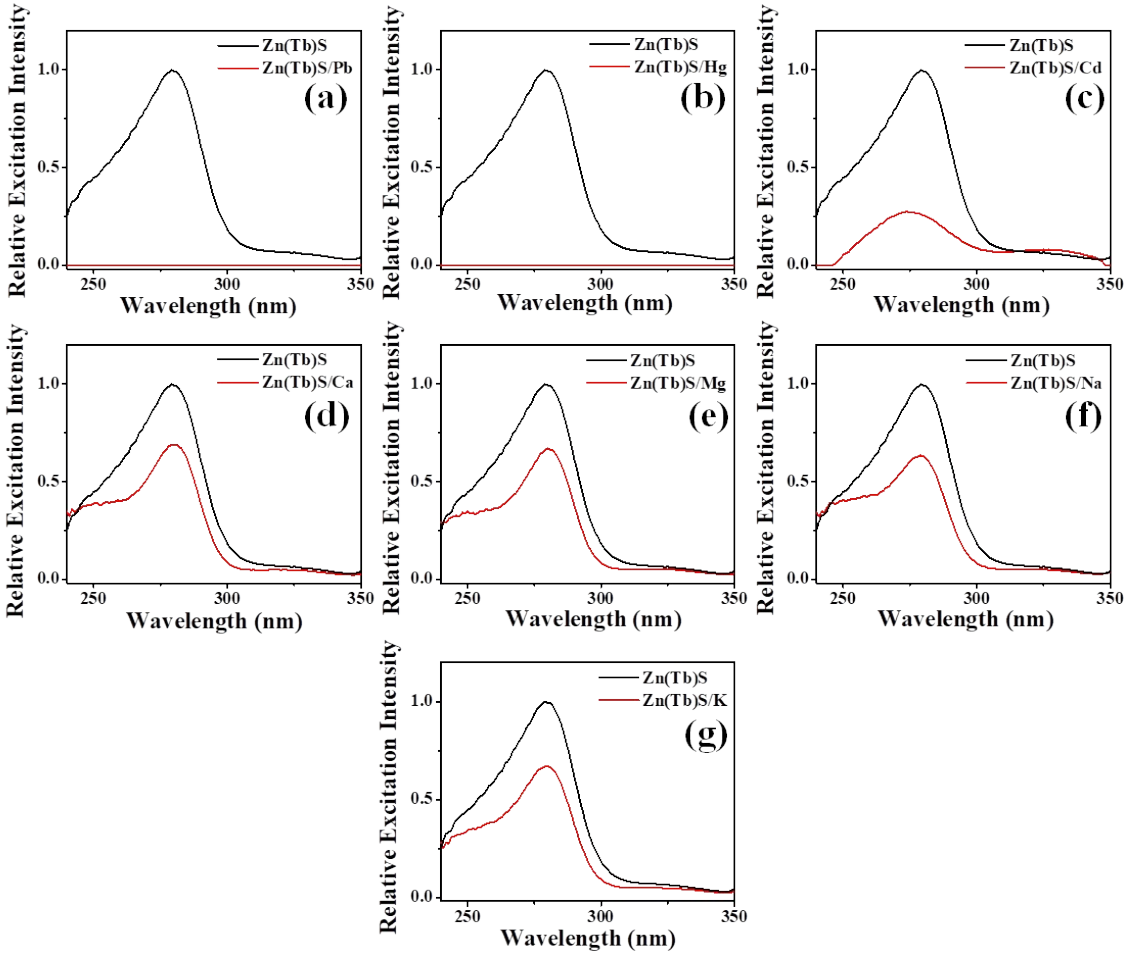


**Figure S2.** The photoluminescence excitation spectra of the Zn(Tb)S nanoparticles those are post-synthetically modified with $M^{n+}$, with [Zn(Tb)S] : [$M^{n+}$] = 1:1. The emission was collected at 400 nm for collecting the excitation spectra.

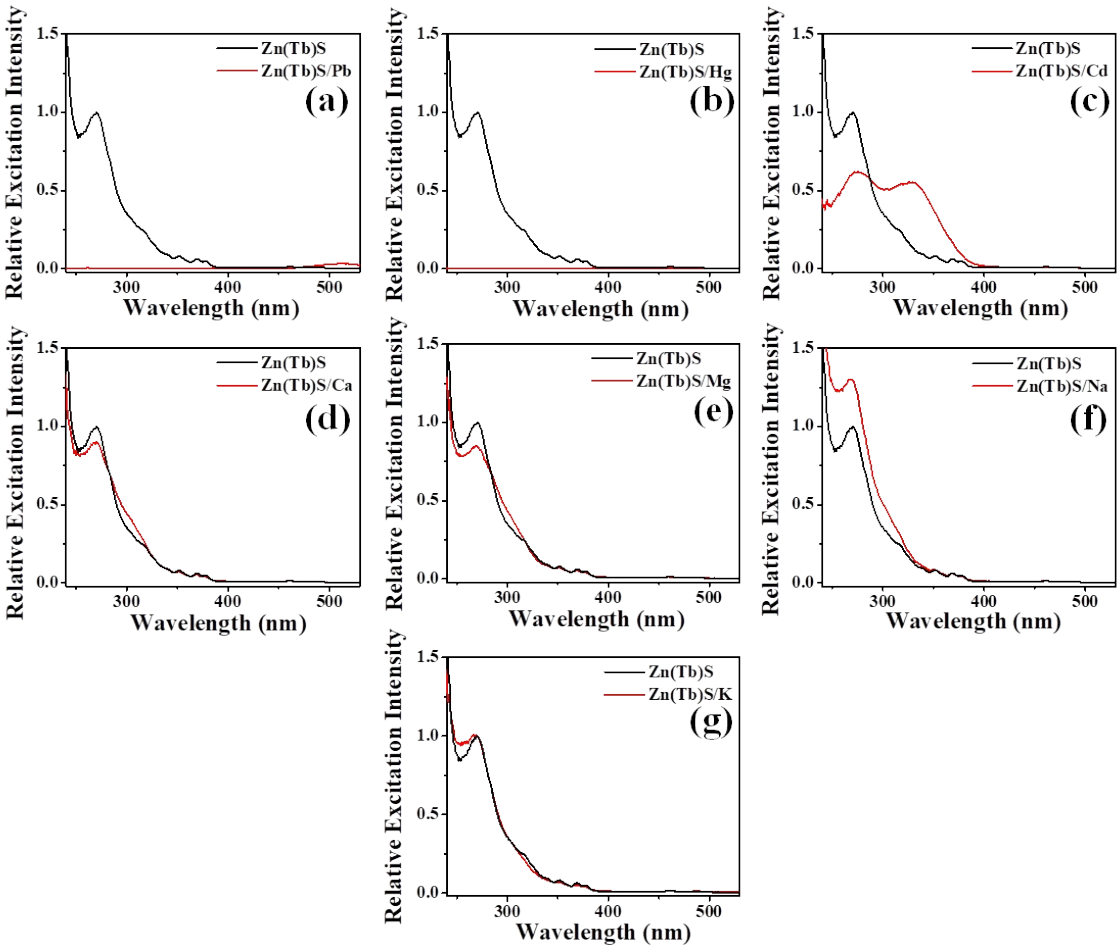


**Figure S3.** The photoluminescence excitation spectra of the Zn(Tb)S nanoparticles those are post-synthetically modified with $M^{n+}$, with [Zn(Tb)S] : [$M^{n+}$] = 1:1. The emission was collected at 545 nm for collecting the excitation spectra.

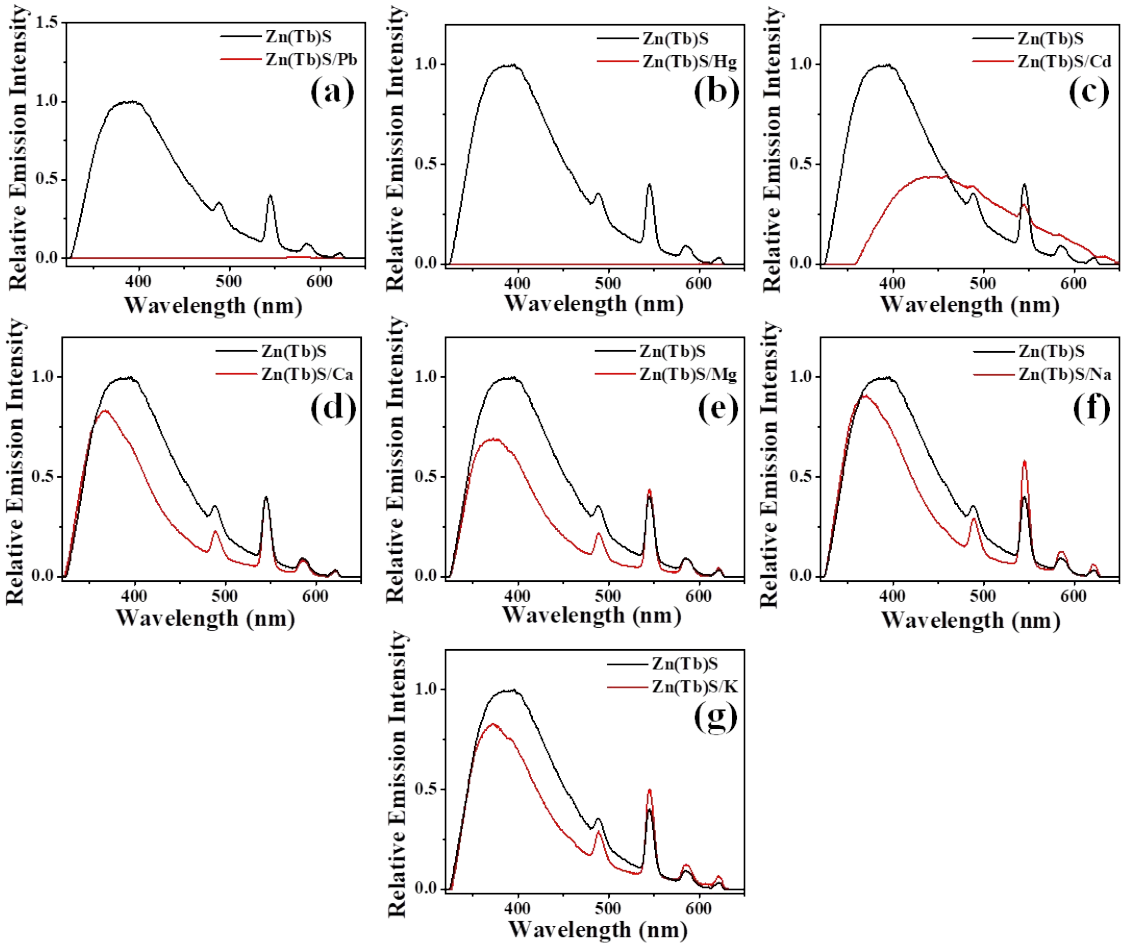


**Figure S4.** The photoluminescence emission spectra of the Zn(Tb)S nanoparticles those are post-synthetically modified with $M^{n+}$, with [Zn(Tb)S] : [$M^{n+}$] = 1:1. The emission was collected exciting the nanoparticles at 280 nm.

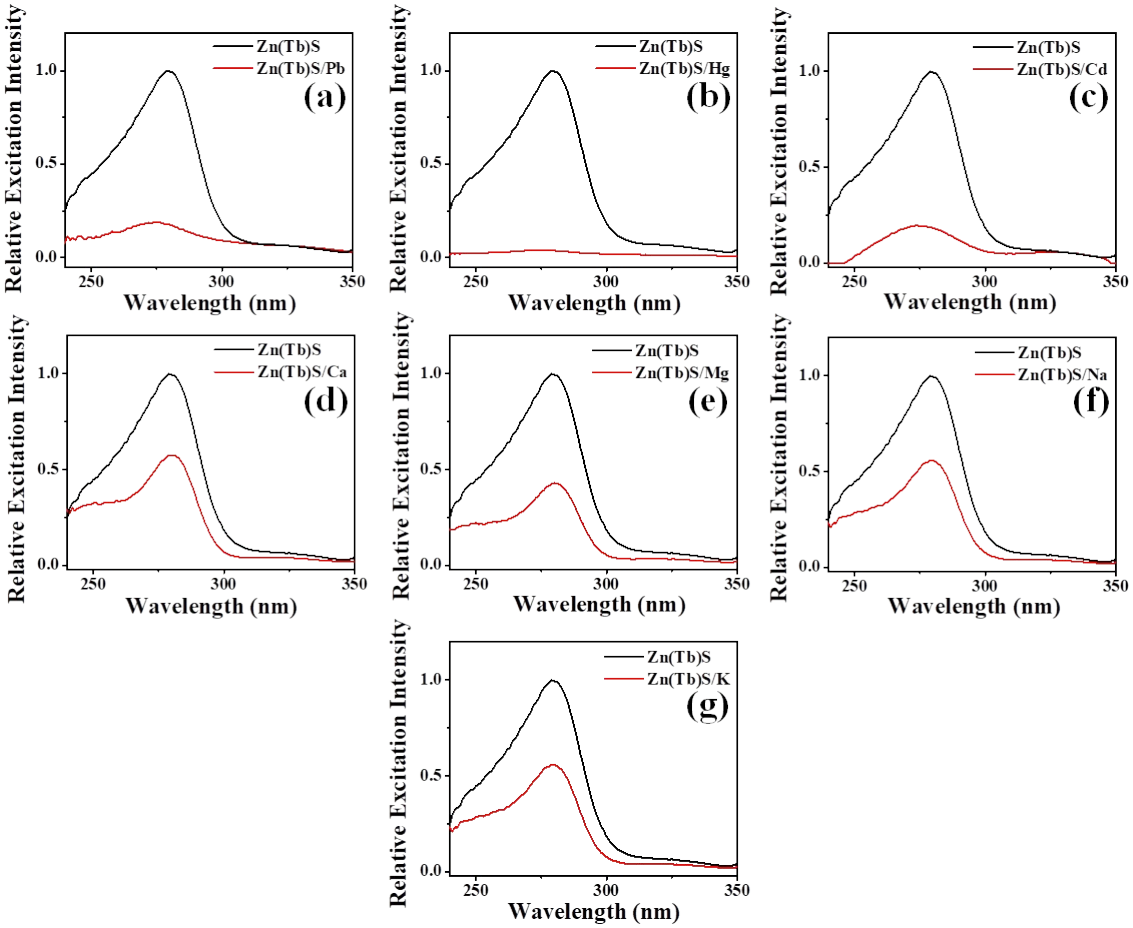


**Figure S5.** The photoluminescence excitation spectra of the Zn(Tb)S nanoparticles those are post-synthetically modified with $M^{n+}$, with [Zn(Tb)S] : $[M^{n+}] = 1{:}10^{-2}$. The emission was collected at 400 nm for collecting the excitation spectra.

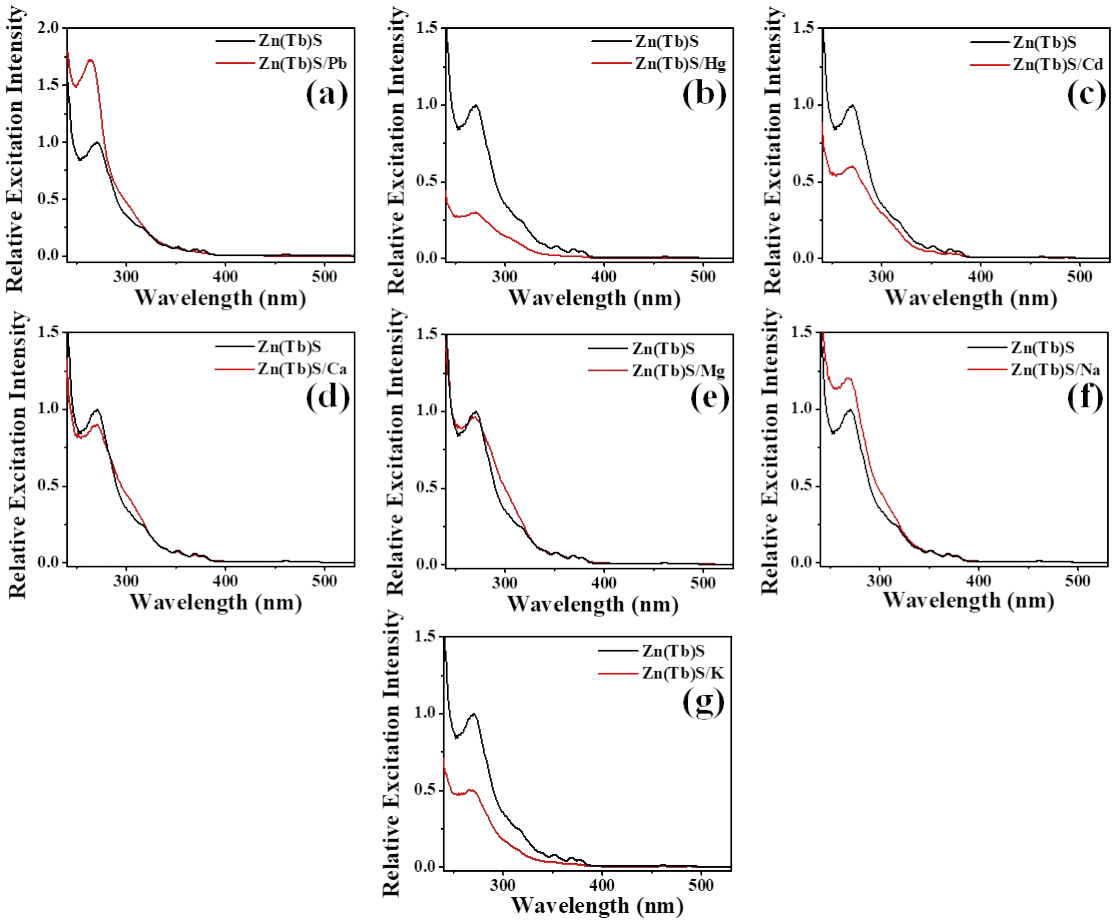


**Figure S6.** The photoluminescence excitation spectra of the Zn(Tb)S nanoparticles those are post-synthetically modified with $M^{n+}$, with [Zn(Tb)S] : $[M^{n+}] = 1{:}10^{-2}$. The emission was collected at 545 nm for collecting the excitation spectra.

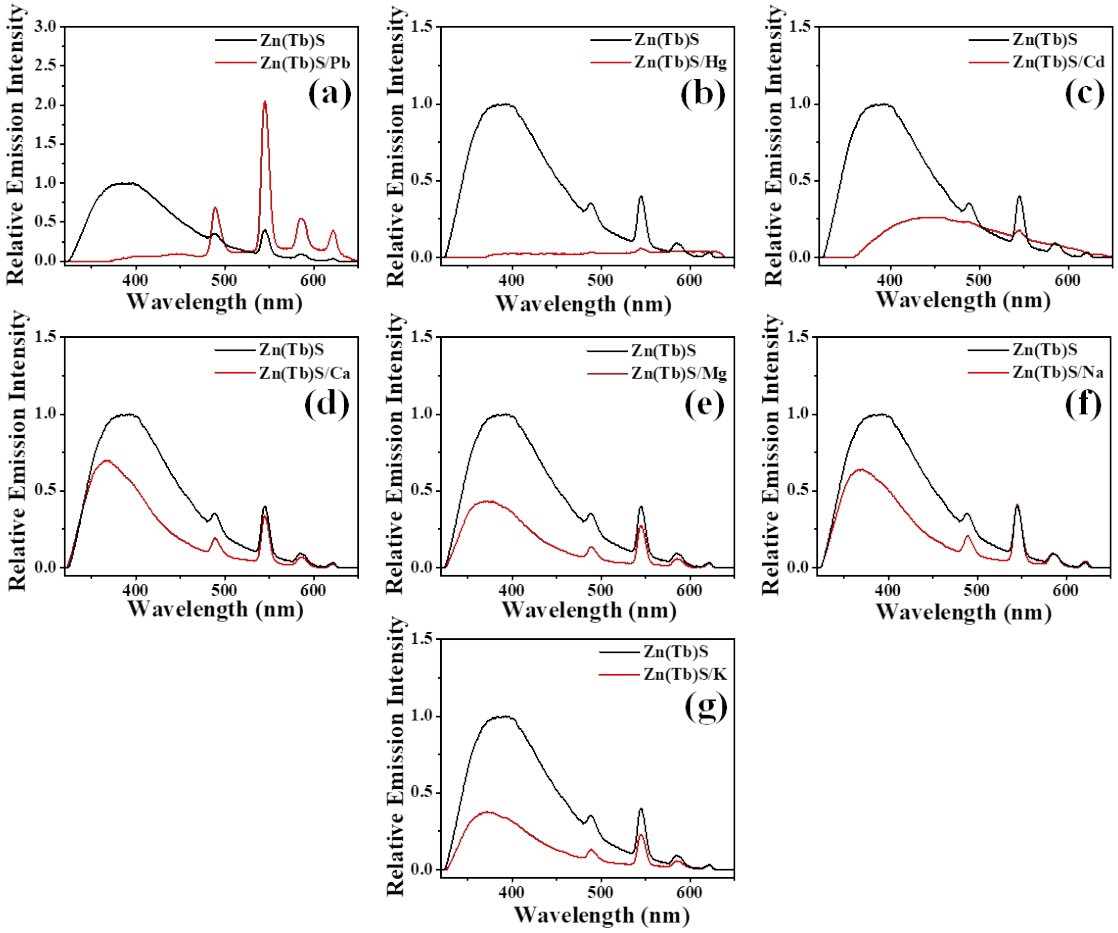


**Figure S7.** The photoluminescence emission spectra of the Zn(Tb)S nanoparticles those are post-synthetically modified with $M^{n+}$, with [Zn(Tb)S] : $[M^{n+}] = 1{:}10^{-2}$. The emission was collected exciting the nanoparticles at 280 nm.