Electronic Supplementary Material (ESI) for RSC Advances.

Content of Electronic Supporting Materials:

S2.2.1. Synthesis of Er^{3+}:$Y_3Al_5O_{12}$ as up-conversion luminescence agent

Fig. S1. XRD patterns of (a) Er^{3+}:$Y_3Al_5O_{12}$ (heated-treated at 1100 ºC for 120 min), (b) pure $NaTaO_3$, (c-g) Er^{3+}:$Y_3Al_5O_{12}$/MoS_2-$NaTaO_3$-PdS nanocomposite photocatalyst (with 0.20 wt% MoS_2 and 0.13 wt% PdS contents and different molar ratios ((c) 0.00:1.00, (d) 0.05:1.00, (e) 0.25:1.00, (f) 0.45:1.00 and (g) 0.65:1.00) of Er^{3+}:$Y_3Al_5O_{12}$ and $NaTaO_3$).

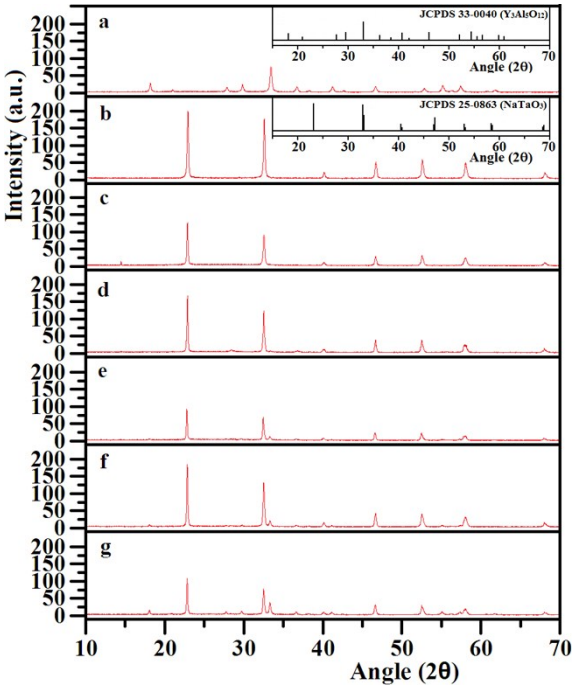
Fig. S2. EDX spectra of (a) Er^{3+}:$Y_3Al_5O_{12}$ powder (heat-treated at 1100 ºC for 120 min), (b) pure $NaTaO_3$ and (c) Er^{3+}:$Y_3Al_5O_{12}$/MoS_2-$NaTaO_3$-PdS nanocomposite photocatalyst (with 0.13 wt% PdS and 0.20 wt% MoS_2 contents and 0.45:1.00 molar ratio of Er^{3+}:$Y_3Al_5O_{12}$ and $NaTaO_3$).

Fig. S3. XPS spectra of Er^{3+}:$Y_3Al_5O_{12}$/MoS_2-$NaTaO_3$-PdS nanocomposite photocatalyst (with 0.13 wt% PdS and 0.20 wt% MoS_2 contents and 0.45:1.00 molar ratio of Er^{3+}:$Y_3Al_5O_{12}$ and $NaTaO_3$).

Electronic Supporting Materials:

S2.2.1. Synthesis of Er^{3+}:$Y_3Al_5O_{12}$ as up-conversion luminescence agent

The Er^{3+}:$Y_3Al_5O_{12}$ was synthesized by the sol-gel method. First, erbium oxide (10 mmol, 2.2715 g) and yttrium oxide (0.334 mmol, 0.0128 g) were dissolved in hot HNO_3 solution (about 60 °C) with magnetic stirring and heated until transparent. Next appropriate amount of aluminum nitrate solution (33.6 mmol, 12.6208 g) and citric acid (168 mmol, 33.9351 g) as chelating agent were added into the mentioned mixture solution (molar ratio of citric acid: metal ion is 3:1), respectively. The solution was continued to be stirred and heated at 50-60 °C until the transparent sol was successfully formed. Then, the transparent sol was heated at 80 °C for 24 h and became the gel, which was ground into good homogeneous powders. For removing residual organic components and nitrate ions the powers were heated at 500 °C for 50 min, and then continued to heat to 1100 °C and kept for 2.0 h and finally permitted to cool down to the room temperature in atmosphere. After fully grinding, the nano-sized Er^{3+}:$Y_3Al_5O_{12}$ powders were obtained.



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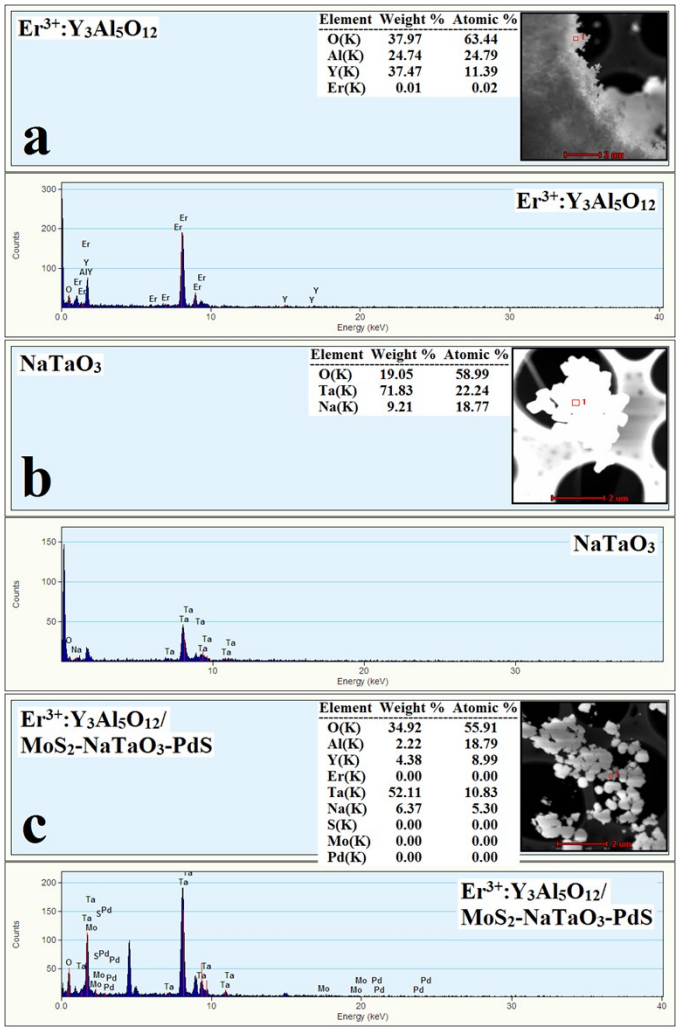
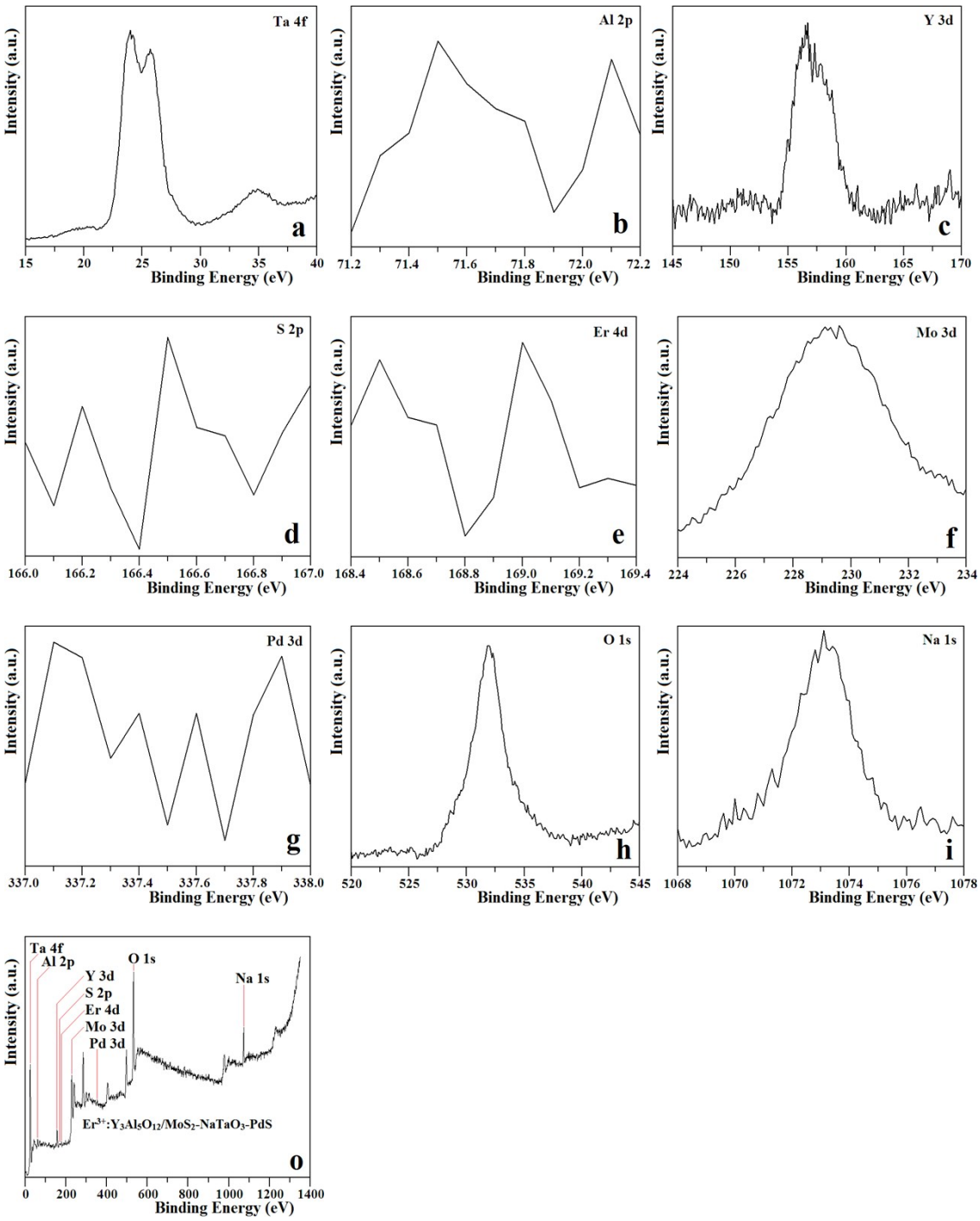


Fig. S2. EDX spectra of (a) Er^{3+}:$Y_3Al_5O_{12}$ powder (heat-treated at 1100 ºC for 120 min), (b) pure $NaTaO_3$ and (c) Er^{3+}:$Y_3Al_5O_{12}$/MoS_2-$NaTaO_3$-PdS nanocomposite photocatalyst (with 0.13 wt% PdS and 0.20 wt% MoS_2 contents and 0.45:1.00 molar ratio of Er^{3+}:$Y_3Al_5O_{12}$ and $NaTaO_3$).



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