**Supporting Information**

**Fig. S1** The RhB concentration as a function of keeping time before UV irradiation over the flower-like product (prepared with 0.06 M CH$_3$COONa)

![RhB concentration graph](image)

**Fig. S2** SEM and XRD patterns of the products prepared with 0.15 M CH$_3$COONa.

![SEM and XRD patterns](image)

**Fig. S3** TG curves of the samples obtained at different CH$_3$COONa concentrations.

![TG curves](image)
**Fig. S4** SEM images of the products after calcination prepared at different CH$_3$COONa concentrations (a) 0, (b) 0.04 M, (c) 0.06 M, (d) 0.10 M, and XRD patterns of the corresponding products. Scale bar: 500 nm.

**Fig. S5** SEM images of hydrothermal precursor prepared at different KOH concentrations: (a) 0.0, (b) 0.04 M, (c) 0.06 M, (d) 0.10 M. Scale bar: 500 nm.
**Fig. S6** The RhB concentration as a function of UV irradiation time over ZrO\(_2\) products prepared at different CH\(_3\)COONa concentrations.

**Preparation of tetragonal ZrO\(_2\) nanoparticles:** Tetragonal ZrO\(_2\) nanoparticles were prepared according to the literature.\(^1\) Initially, 2.58 g ZrOCl\(_2\)-8H\(_2\)O and 4.80 g urea were dissolved in 20.0 mL CH\(_3\)OH under stirring to form a colorless solution. The solution was transferred to a 20-mL Teflon-lined stainless steel autoclave, which was heated to 200 °C and maintained at that temperature for 20 h. The obtained white product was post-treated with sulphuric acid solution (0.167 mmol), and then calcined at 645 °C.

**Fig. S7** TEM image and XRD pattern of tetragonal ZrO\(_2\) nanoparticles.

**Fig. S8** UV-vis absorption spectra of the flower-like product (prepared with 0.06 M CH\(_3\)COONa) and ZrO\(_2\) nanoparticles.