Electronic Supplementary Document for

Enhanced Photocatalytic Activity of ZnO Nanoparticles Grown on Porous Silica Microparticles

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Section S1. Determination of ZnO deposited on microsized sand substrates.

0.5 to 3 g ZnO NPs grown on sand were treated with HCl at 37% concentration and soaked for 12 hours under slow stirring. Here, ZnO was expected to react with HCl to form $ZnCl_2$ which is water soluble. After 12 hours of reaction, the sand particles were filtered and thoroughly rinsed in distilled water. After drying, the sand particles were weighed and compared with the original weight to determine the amount of ZnO NPs. A calibration curve obtained is shown in Figure S1 where about 32.9 mg of ZnO NPs were form on 1 g of sand. In the experiment, 30 mg ZnO NPs was used attached on 0.912 g of sand particles.

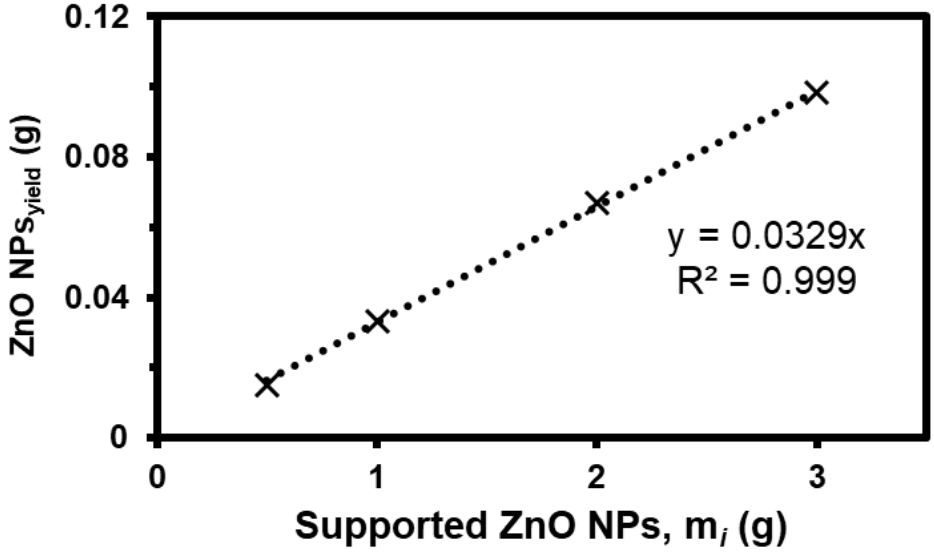

Figure S1. A plot of supported ZnO NPs vs ZnO NPs_{yield}

Section S2. Equilibrium absorption of methylene blue of photocatalysts.

Figure S2 demonstrates the equilibrium absorption of methylene blue on supported and unsupported ZnO NPs photocatalysts. Equilibrium absorption was achieved after 30 minutes in the dark. Also, notice that slightly more absorption occurred in the supported sample due to the sand substrate.

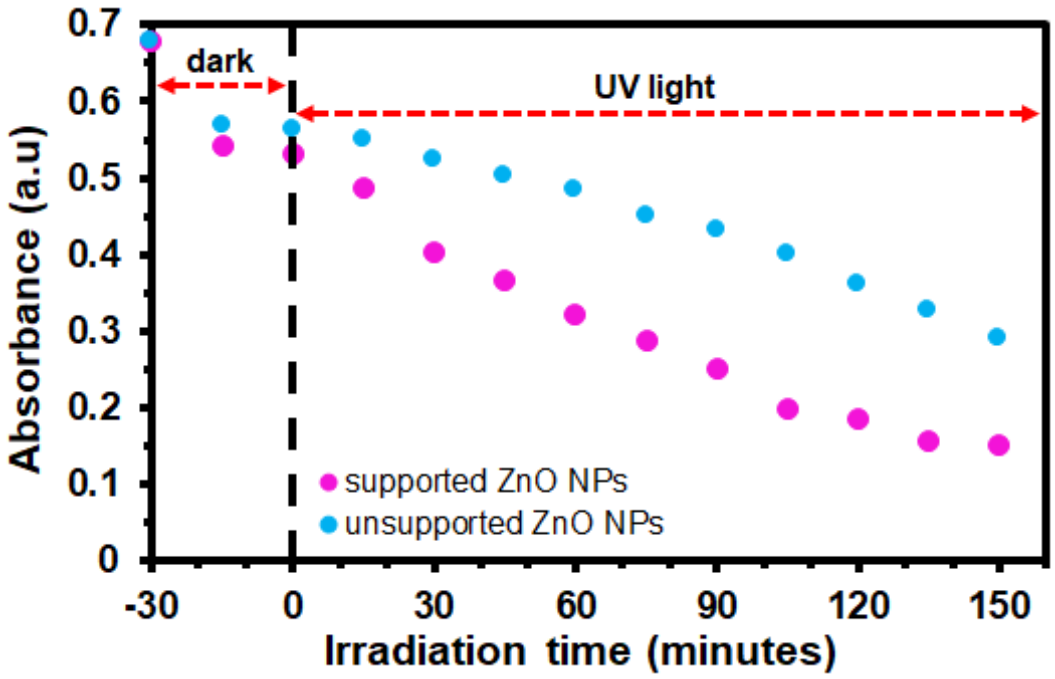

Figure S2. Equilibrium absorption of methylene blue on photocatalysts before photodegradation experiment.

Section S3. Crystallite size and crystal orientation of unsupported and supported ZnO NPs.

Analysis of crystallite size and preferential crystal orientation was made on the XRD results shown in Figure 1 in the manuscript. The crystallite size was estimated based on the Scherrer equation. Table S1 shows the experimental peak intensities of the samples normalized to the ZnO (101) reflection plane intensity.

Table S1. The ratio of intensity XRD ZnO peak of supported ZnO NPs, unsupported ZnO NPs and standard diffraction pattern of ZnO NPs

ZnO Peak	Supported ZnO NPs		Unsupported ZnO NPs		Standard ZnO Powder	
	Center, 2θ (^{o})	I/I_{101}	Center, 2θ (^{o})	I/I_{101}	Center, 2θ (^{o})	I/I_{101}
100	31.89	0.52	31.80	0.59	31.76	0.61
002	34.55	0.56	34.46	0.69	34.41	0.37
101	36.29	1	36.28	1	36.25	1
110	56.72	0.07	56.62	0.29	56.59	0.38
103	62.98	0.15	62.89	0.23	62.85	0.30

It appeared there was a slight orientation preference to the (100), (002) and (101) planes for the supported ZnO NPs samples when compare to the standard ZnO powder sample. As for the unsupported samples, little variation was observed in comparison to the standard sample. The crystallite size estimated using the Scherrer equation is shown in Table S2.

Table S2. Mean crystallite size (D_s) is given by Scherrer equation for supported and unsupported ZnO NPs

ZnO Peak	Supported ZnO NPs			Unsupported ZnO NPs		
	FWHM (^{o})	Center, 2θ (^{o})	D_s (nm)	FWHM (^{o})	Center, 2θ (^{o})	D_s (nm)
100	0.13	31.90	67.34	0.36	31.81	23.78
002	0.17	34.55	50.10	0.27	34.46	32.04
101	0.17	36.29	52.75	0.38	36.28	23.20
110	0.08	56.73	123.32	0.41	56.62	22.90
103	0.16	62.99	60.70	0.46	62.90	21.19

Here, the crystallites size estimated for supported ZnO NPs were generally bigger than those estimated for unsupported sample.

Section S4. Degradation of methylene blue due to UV light irradiation.

The effect of UV light on the degradation of methylene blue was studied by exposing 5 mg/L solution to UV light without photocatalyst. The time evolution of the UV-vis spectra is shown in Figure S3. It was evident that degradation of methylene blue due to UV light was negligible.

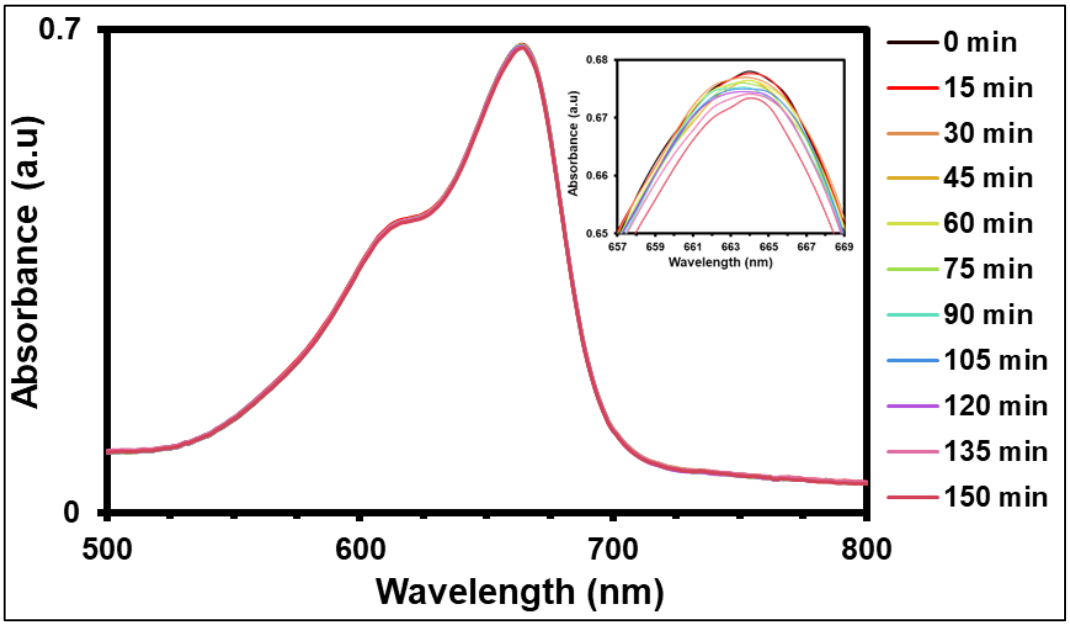

Figure S3. Time evolution of the methylene blue UV-vis characteristic absorption peak at 664 nm due UV light exposure. The inset shows a close up view of the absorption peak.