

Supplementary Information

Efficient quasi-solid-state dye-sensitized solar cells aided by mesoporous TiO₂ beads and a non-volatile gel polymer electrolyte

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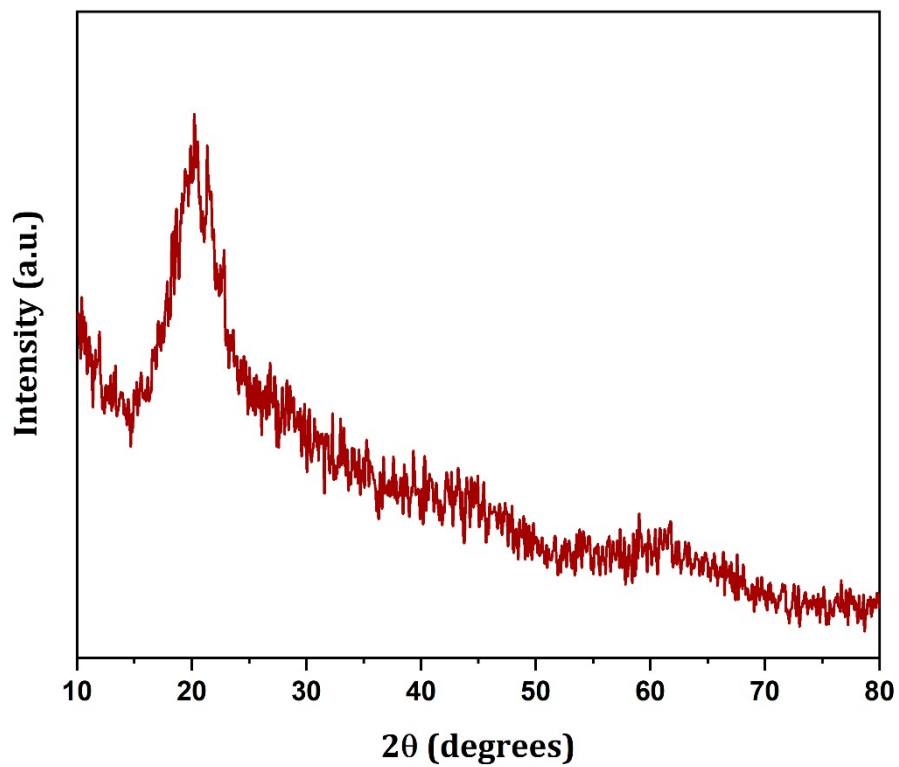


Figure S1. XRD pattern of mesoporous TiO₂ beads after sol-gel and before solvothermal process.

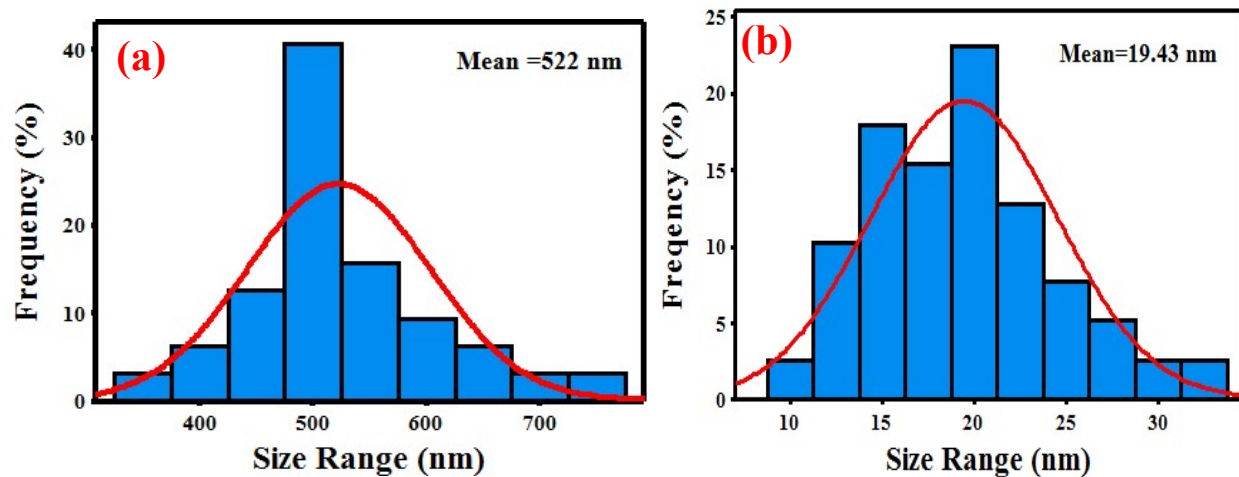


Figure S2. Histograms with distribution fits for TiO₂ nanoparticles (a) and TiO₂ mesoporous beads (b).

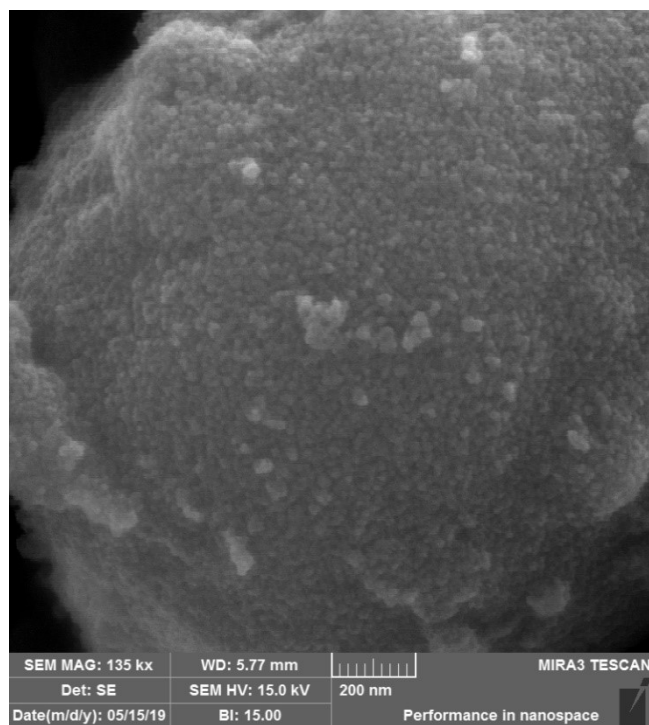


Figure S3. FESEM images of TiO₂ nanoparticles as reference sample.

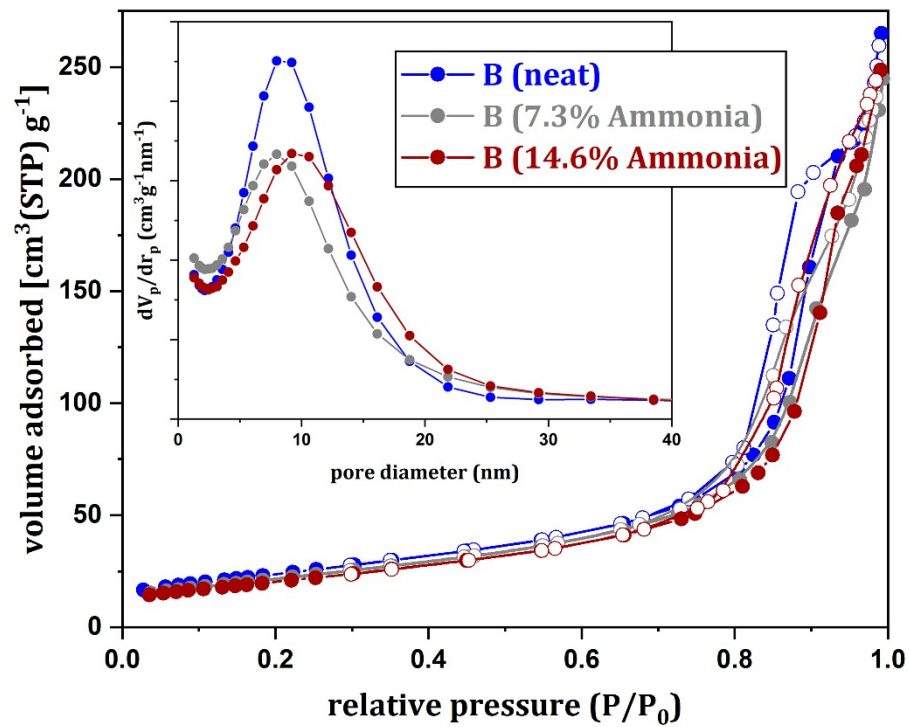


Figure S4. Isotherm plots of N_2 gas adsorbed-desorbed versus relative pressure increases for synthesized mesoporous TiO_2 beads with different ammonia contents in solvothermal process.

Inset shows the corresponding plots of pore size distribution.

Table S1. N₂ adsorption–desorption metrics of different samples, extracted from **Figure S4**.

Sample	S _{BET} (m ² g ⁻¹)	V _P (Cm ³ g ⁻¹)	\bar{D}_P (nm)	r _p (nm)
B (neat)	85.00	0.40	19.05	8.04
B (7.3% ammonia)	78	0.36	18.66	8.12
B (14.6% ammonia)	72.8	0.38	21.04	9.91

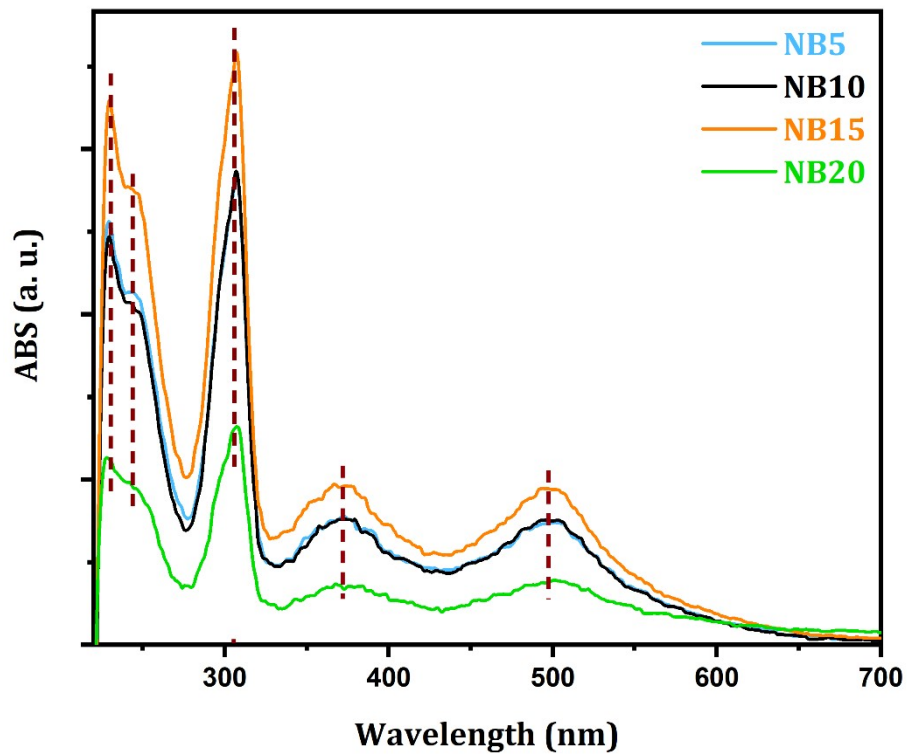


Figure S5. UV-vis absorption spectra of N719-dye molecules desorbed from surface of TiO₂ nanoparticle photoanodes with 5, 10, 15 and 20 wt.% contents of mesoporous TiO₂ beads.

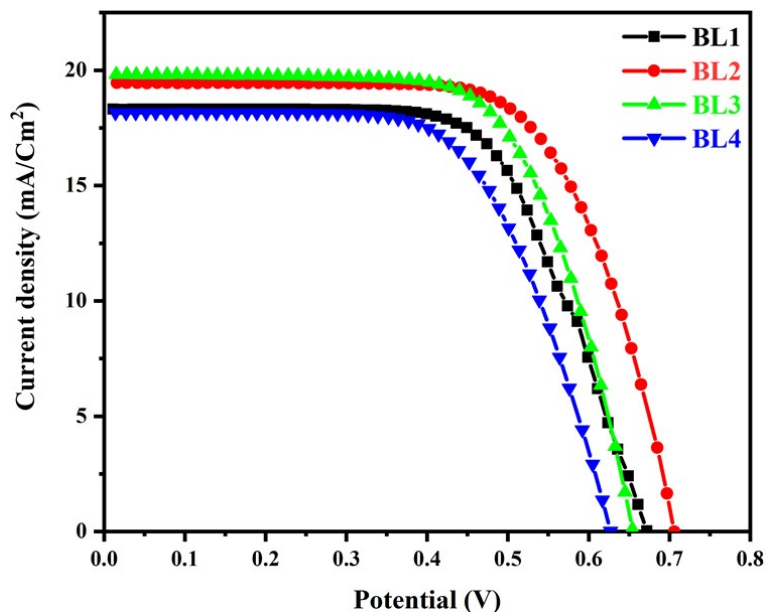


Figure S6. Photocurrent density versus voltage (J-V) curves of DSSCs made of double layer photoanodes based on mesoporous TiO₂ beads (B) with different thicknesses in the presence of liquid polymer electrolyte. The photovoltaic metrics were recorded with a scanning rate of 50 mV s⁻¹ under AM 1.5 illumination.

Table S2. Photovoltaic metrics of fabricated DSSCs in the presence of liquid electrolyte,

Photoanode Architecture	Photoanode Thickness (μm)	J_{SC} (mA/cm^2)	V_{OC} (V)	FF	Efficiency (%)
B	13.4	18.3	0.67	0.64	7.93
	18.5	19.5	0.70	0.67	9.28
	21.7	19.8	0.65	0.67	8.70
	26.8	18.2	0.62	0.63	7.25

extracted from **Figure S6**.