Tunable Synthesis of OH^- doped $Bi_xO_yI_z$ Nanoparticles for Enhanced Visible-Light Photocatalytic Degradation of Water Pollutants.

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Reference	Solvent	pH	T (°C)	Reaction time	Morphology	S_{BET} (m^2/g)
Yu and Han et al.	EG	-	Room Temp.	3 hours	Microspheres	-
Duran-Alvarez et al.	EG	-	126 -160	12-18 hours in autoclave.	Microspheres	61.28
Elamin et al.	Tri EG	-	25	20 minutes of sonication	Nanosheets	34.03
Xiao and Zhang et al.	EG	-	160	3 hours	Microplates	28.3
Guin et al.	EG	-	160	12 hours in autoclave. Calcinated for 2 hours at 300-500 °C	Bud and flake type substructures	31.6
Long et al.	EG	-	160	12 hours in autoclave. Calcinated for 2 hours at 200-600 °C	-	-
Pai Wu et al.	HNO_3	1-12	120	10 hours in autoclave	Nanosheets	-
Gongjaun Wu et.al	PEG-6000	5-11	70	45 minutes	Flowerballs (@pH 5 & 8) Nanorods (@pH 11	-
Ma et al.	EG+Ethanol	-	160	24 hours in autoclave	Nanosheets, Nanoplates	34.6
He et al.	Water	-	Room Temp	5 hours	Microspheres	21.4
Pan et al.	Ethanol +Water	-	180	2-24 hours in autoclave	Microspheres	9.78

Table T1: Literature summery.

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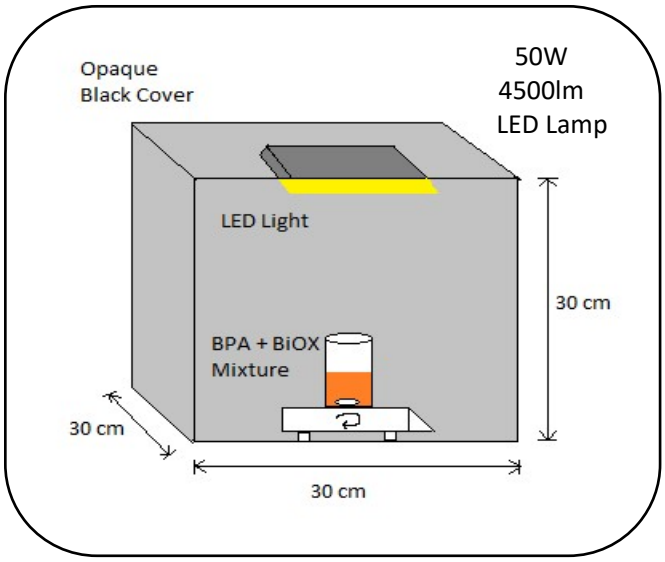

Figure S1: Assembly of photocatalytic batch experiment.

In order to estimate the longevity of the efficiency of $BiOI_{5.5\text{-}70}$ powder against bisphenol A, a repeat cycle experiment was carried out. The particle suspension was kept stable under the dark cover, letting the particle slurry to sediment. The remaining liquid was then replaced by a fresh BPA solution for the second run. However, it is not an accurate procedure as the amount of BPA present in the slurry of the previous cycle could be wrongly estimated, resulting in a different initial concentration of BPA for the next cycle. Hence, in the following figure (Fig. S2 (a)), initial concentration for all the cycles was normalised to 1. Furthermore, XRD of the used catalyst was also carried out (Fig. S2 (b)).

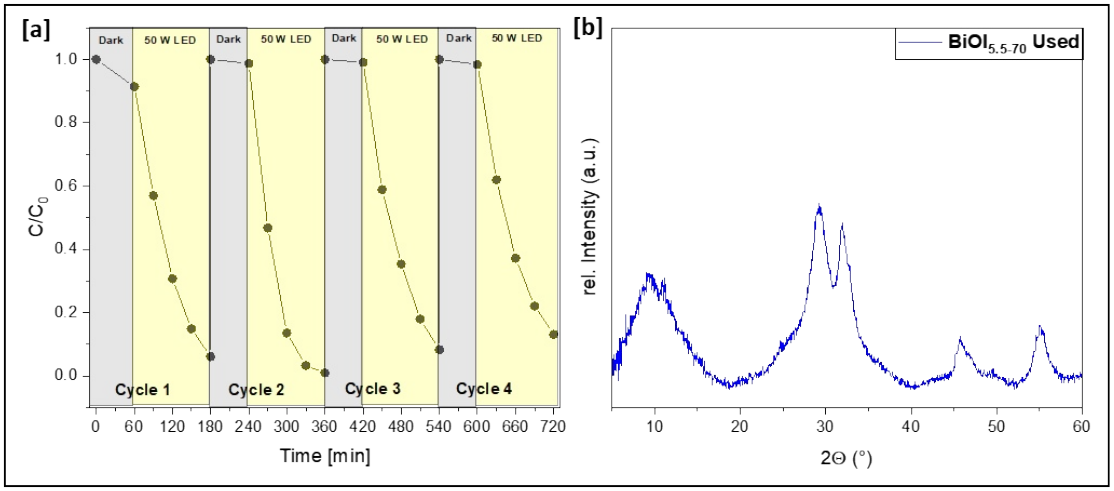

Figure S2: Photocatalytic degradation cycles of BPA (C_0 = 35 mg/l) using BiOI nanoparticles (1 g/l) with repetitive runs without washing and drying (a), XRD diffractogram of the used catalyst (b).

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To check the effect of NaOH on the particle synthesis, a 0.15 M NaOH solution without any potassium iodide was added to the bismuth nitrate-EG solution (following the same procedure as preparing $BiOI_{5.5\text{-}70}$, except KI). A white precipitate was observed. Figure S3 shows the XRD diffractogram of the obtained white powder, while Figure S5 depicts its characterisation results and structure-wise similarity with $BiOI_{5.5\text{-}70}$.

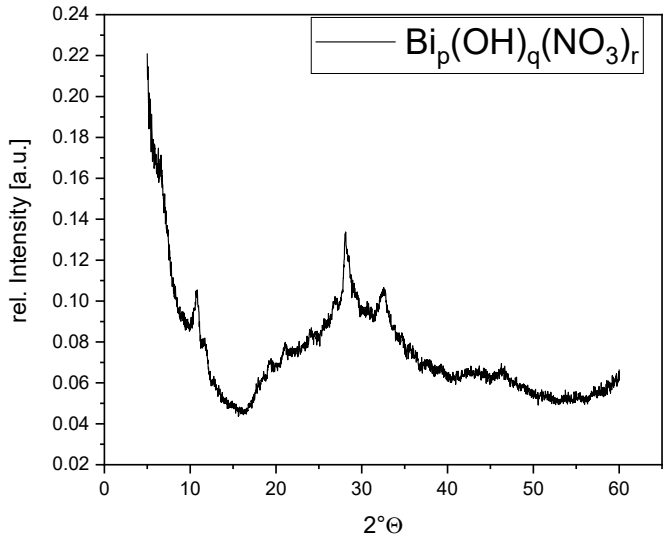

Figure S3: XRD diffractogram of the white powder.

The increase in relative peak intensity of the [1 1 0] plane compared to the [0 1 2] plane (Fig. S4 (a)) indicates the relative growth of that plane with rising pH value. Meanwhile, the relative peak intensity of the [0 0 1] plane compared to the [0 1 2] plane appeared constant until pH 5.5. A sudden fall in relative intensity of both the planes, as mentioned above in $BiOI_{8\text{-}70}$, could possibly resulting from the change in a crystal structure due to the heavy loss of iodine and formation of Bi-O-Bi species.

In the case of temperature variation, however, the growth of [0 0 1] planes and the decline in [1 1 0] planes were observed with increasing temperature (Fig. S4 (b)).

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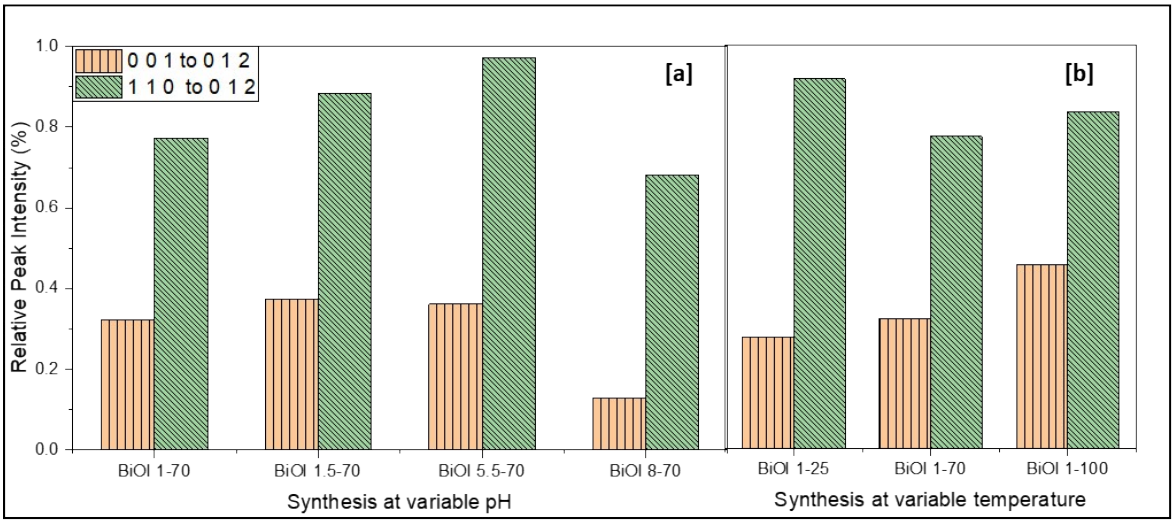

Figure S4: Comparison of peak intensities of the [0 0 1] plane and [1 1 0] plane with the [0 1 2] plane.

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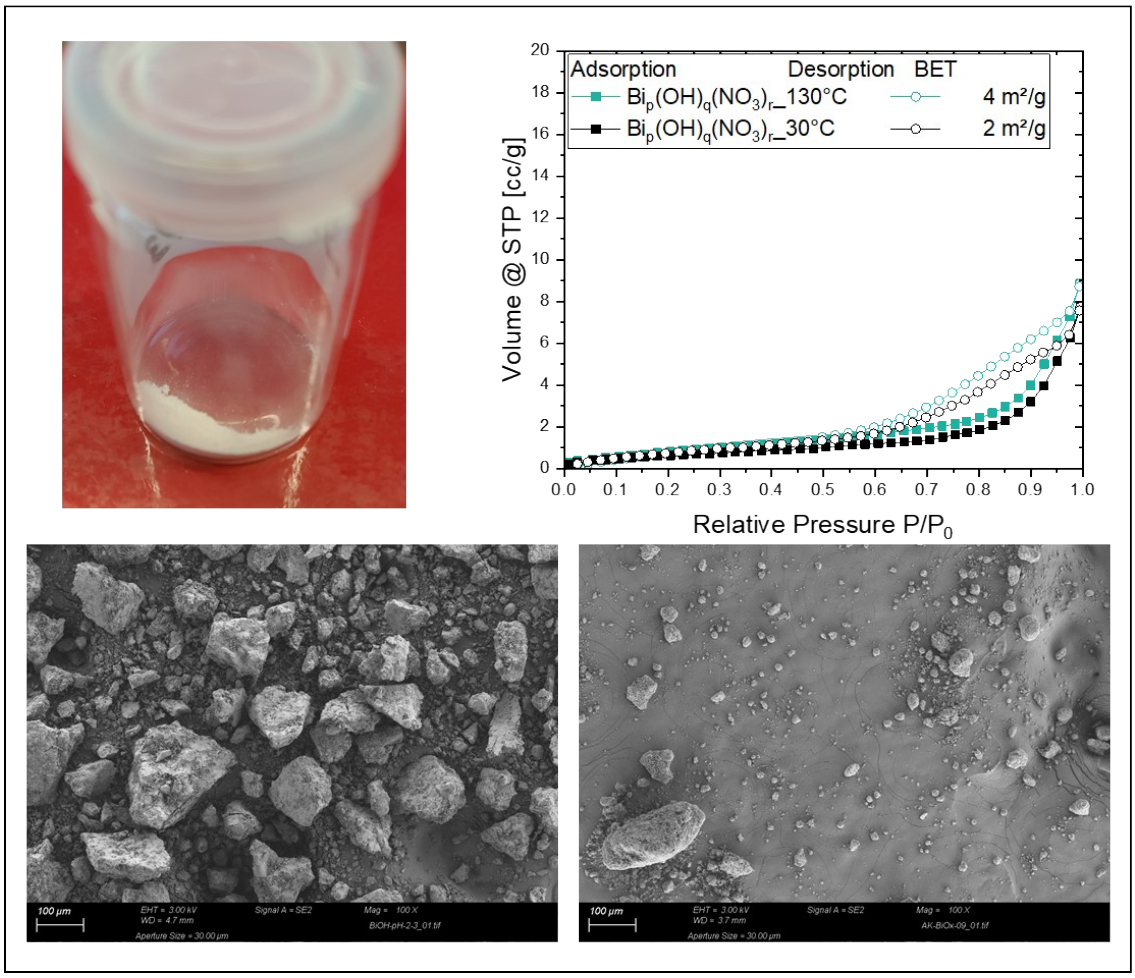

Figure S5: Clockwise from the top, white coloured powder was obtained with the synthesis without adding KI, Adsorption-Desorption isotherm of the white powder, SEM image of $BiOI_{5.5\text{-}70}$ and white powder.

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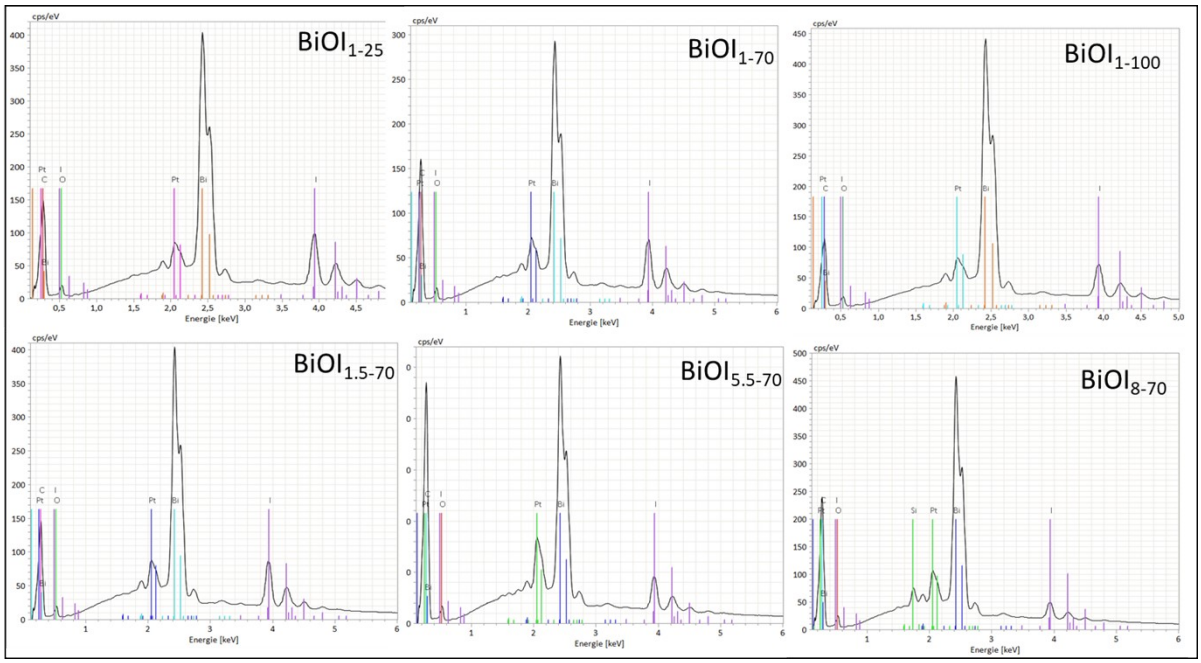

Figure S6: EDX composite spectra of synthesized nanoparticles.

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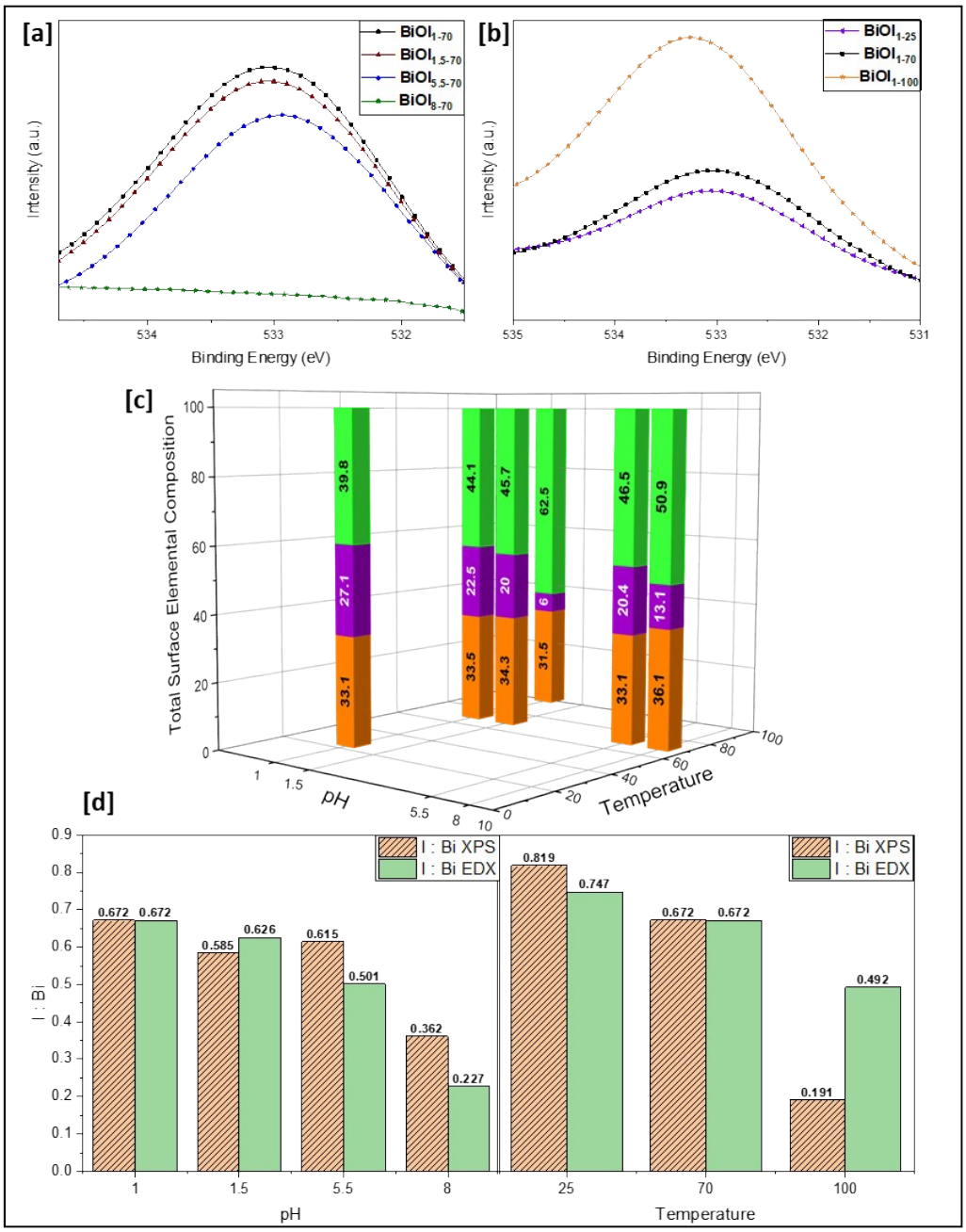

Figure S7: XPS spectrum of O 1s (peak 533 eV) (a, b), Surface elemental composition (c), and XPS to EDX comparison of I : Bi ratio (d) of the synthesized products.

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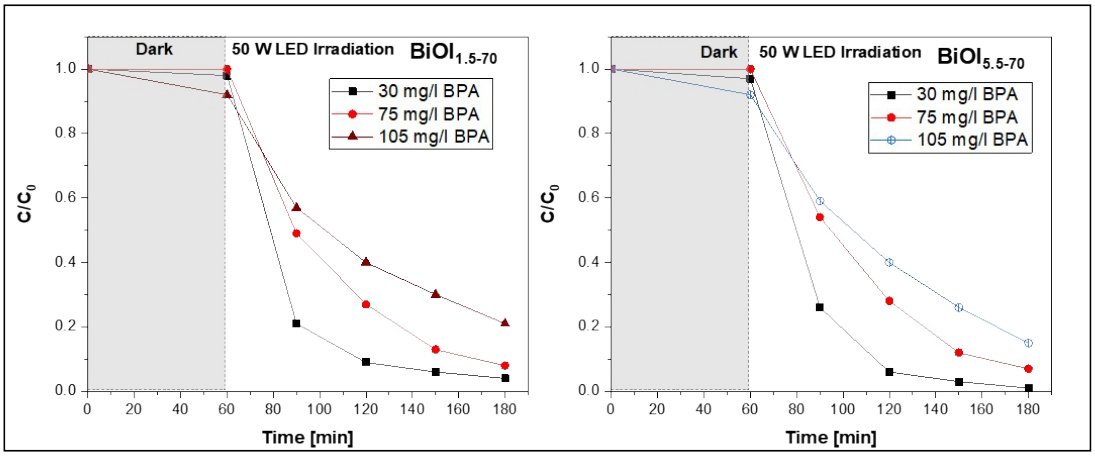

Figure S8: Photocatalytic activity of $BiOI_{1.5\text{-}70}$ and $BiOI_{5.5\text{-}70}$ with variable initial concentration of BPA.

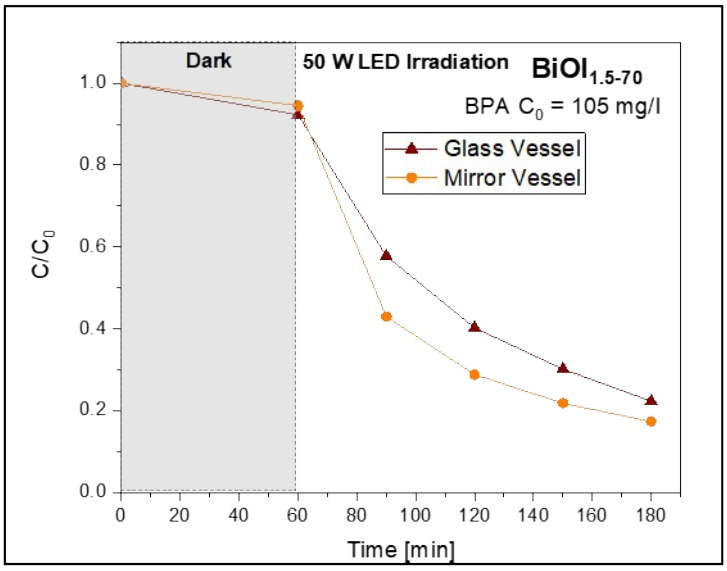

Figure S9: Effect of enhancement of luminosity on the photocatalytic activity of $BiOI_{1.5\text{-}70}$.

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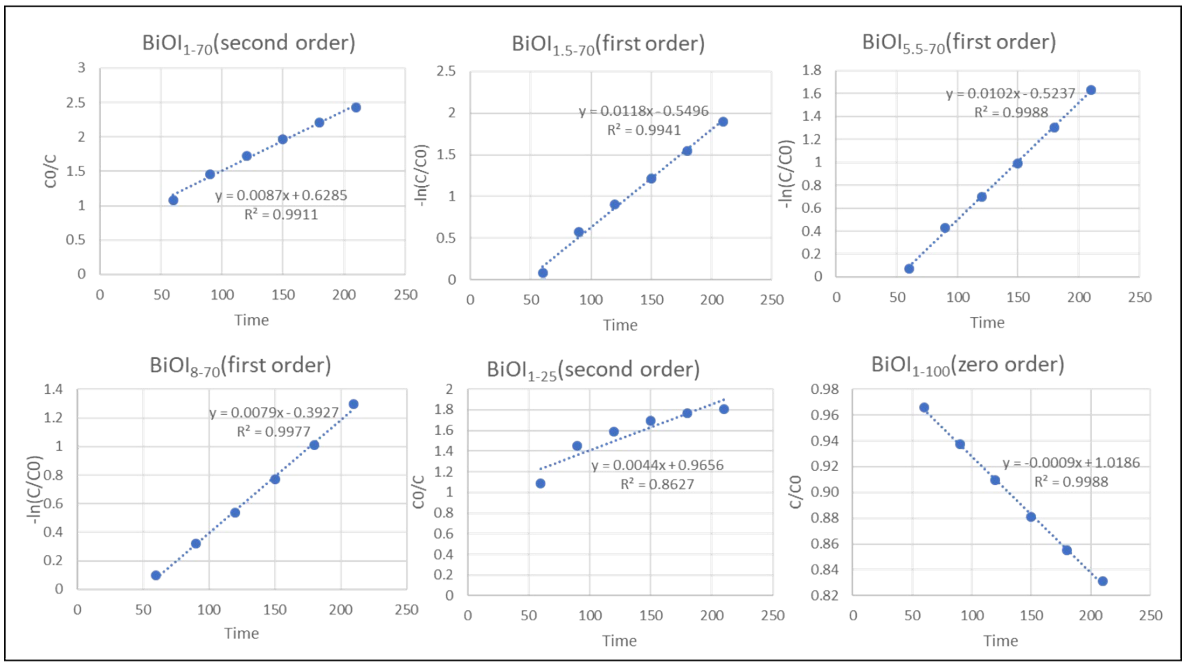

Figure S10: curve fitting for determination of order of the reaction.

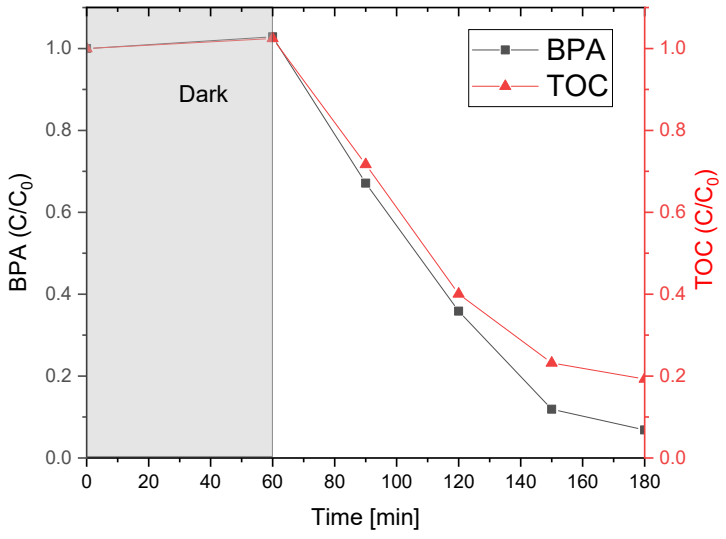

Figure S11: Degradation of total organic carbon with BPA (C_0 = 30 mg/l)

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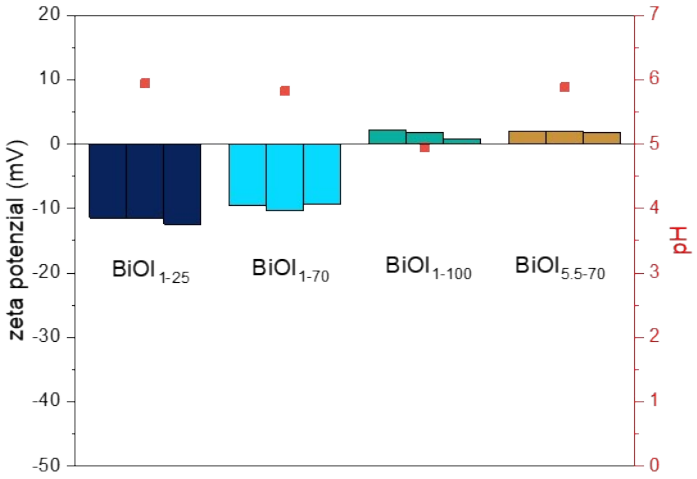

Figure S12: Zeta Potential of $BiOI_{1\text{-}25}$, $BiOI_{1\text{-}70}$, $BiOI_{1\text{-}100}$, and $BiOI_{5.5\text{-}70}$

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Photocatalytic performance tests for pure-phase white powder ($Bi_p(OH)_q(NO_3)_r$) under identical experimental conditions was carried out. The results (Fig. S13 (c)) show no activity of the white powder ($Bi_p(OH)_q(NO_3)_r$) against BPA. Furthermore, white powder was physically mixed with $BiOI_{1\text{-}70}$ in mass ratios of 1:10 and 3:10 (For 100 ml, 105 mg/l BPA, 0.1 g of $BiOI_{1\text{-}70}$ and 0.01/0.03 g of white powder was mixed together in the beaker). The photocatalytic tests conducted under identical reaction conditions showed only a marginal enhancement in photoactivity (Fig. S13(c)).

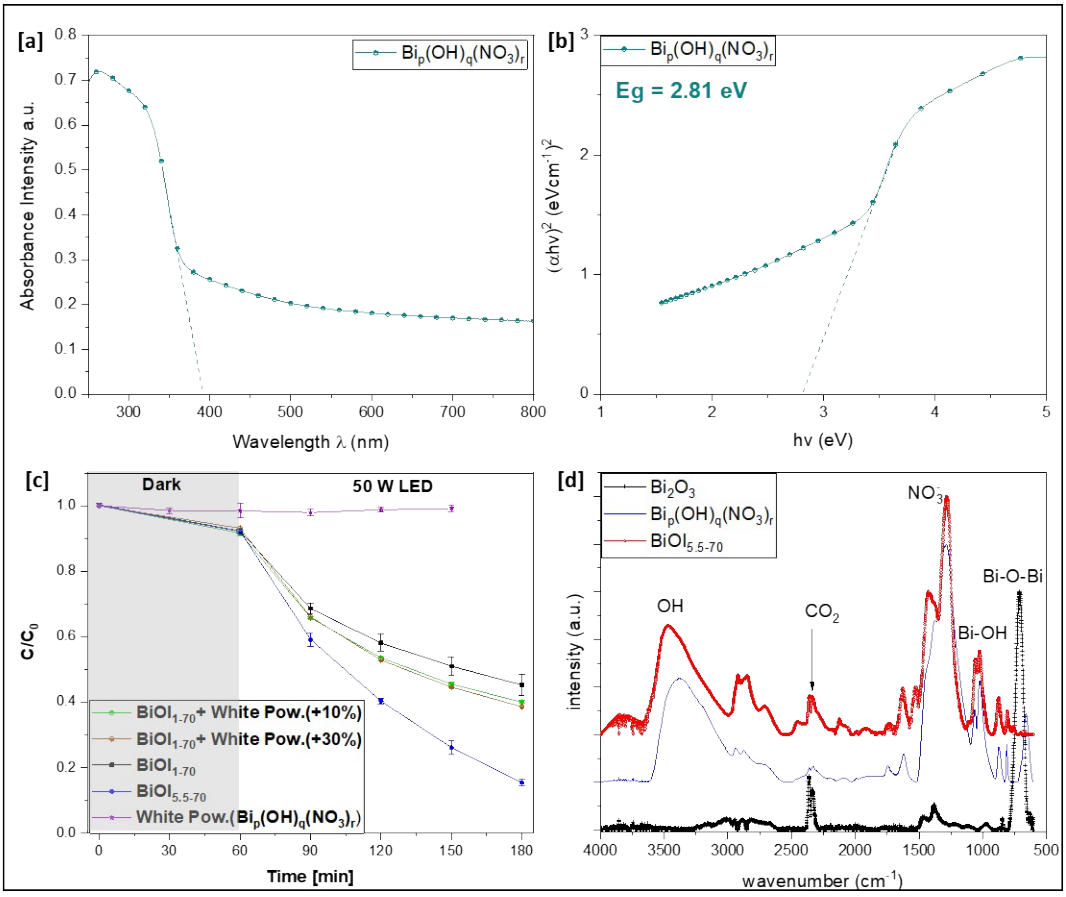

Figure S13: UV-vis DRS absorbance spectrum and bandgap energy (Eg) of white powder ($Bi_p(OH)_q(NO_3)_r$) (a, b), Photocatalytic activity of pure white powder and its physical mixing with $BiOI_{1\text{-}70}$. (c), and FTIR spectra of Bi_2O_3 (Commercial), white powder, and $BiOI_{5.5\text{-}70}$ (d).