

Supporting Information

Evidence of high rate visible light photochemical decolourisation of Rhodamine B with BiFeO₃ nanoparticles associated with BiFeO₃ photocorrosion.

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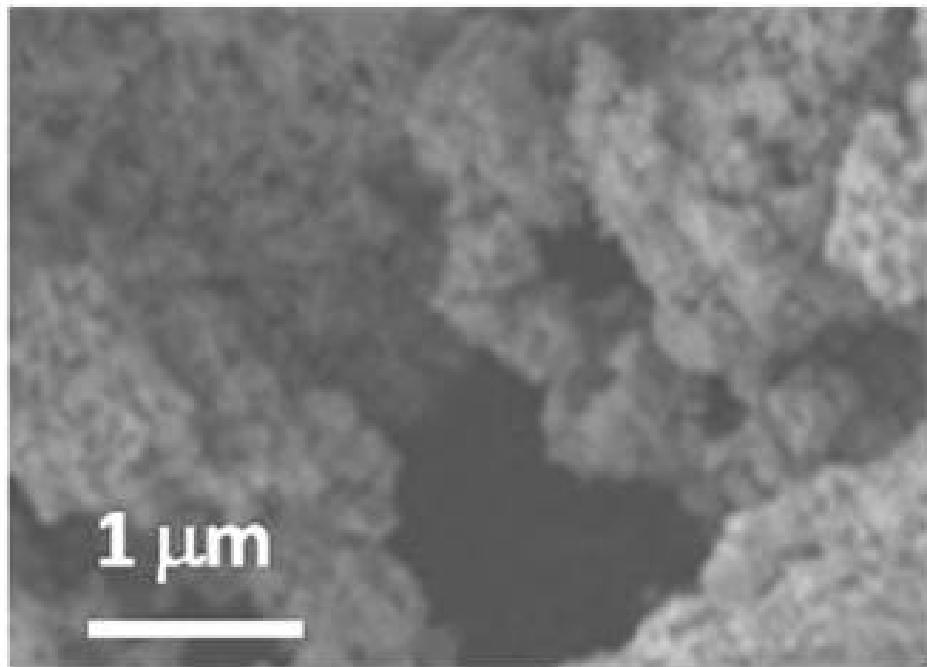


Figure S1. SEM micrograph of loosely formed agglomerates of BiFeO₃ nanoparticles.

The synthesized BiFeO₃ (BFO) powder examined under field emission scanning electron microscopy shown loosely bound agglomerated fine spherical BiFeO₃

nanoparticles. The dry BFO powder sample was dispersed on carbon tape without any conducting layer coating.

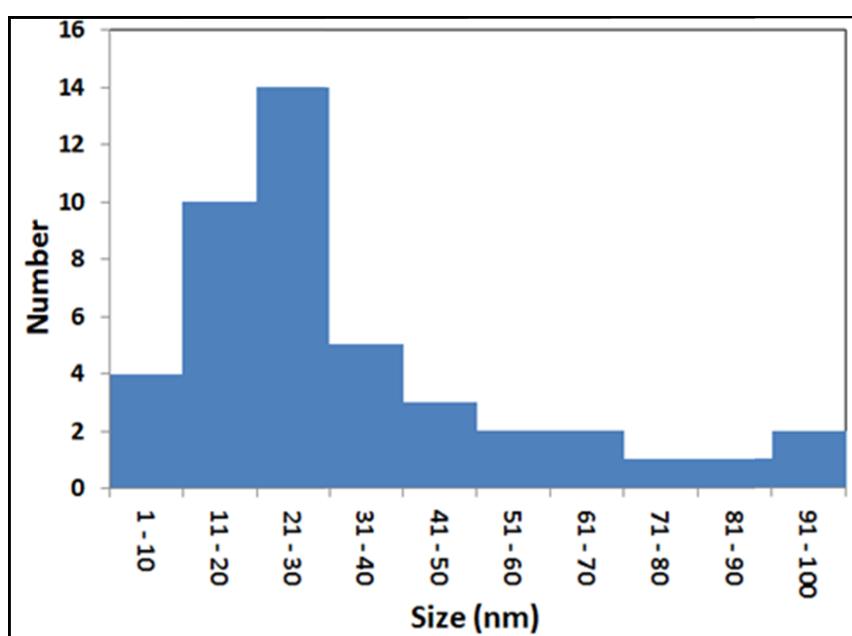


Figure S2. Histogram of as-synthesized BiFeO_3 particles showing particle size distribution.

From the high resolution Transmission Electron Micrograph (TEM), a histogram of the particle size distribution was manually derived from the measurement of all the particles in the micrograph and indicates the particle size ranges from 10 nm – 100 nm and has highest frequency of occurrence at 20 nm. The BFO nanoparticles were suspended in DI water and dispersed by sonication for 30 minutes prior examinations under TEM with the aid of copper grid.

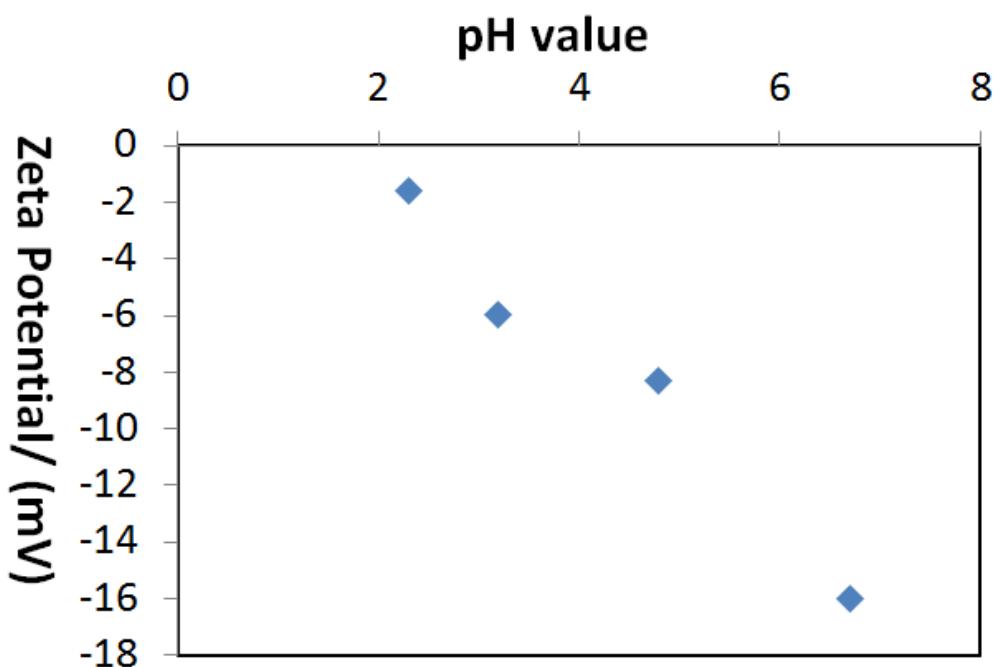


Figure S3. Zeta potential measurements indicating a reduction in surface charge with a decrease in pH.

Zeta potential measurement of BFO nanoparticles was performed at various pH values in the DI water. At normal pH values of DI water (pH 6.7), the zeta potential value of BFO nanoparticles is -16mV and changing the pH to strongly acidic (pH 2.2) reduces the zeta potential to -1.62mV, and the isoelectric point was extrapolated to be at pH 2. This indicates that BFO nanoparticles surface charge reduces as the pH value is lowered towards zero surface charges at pH 2.

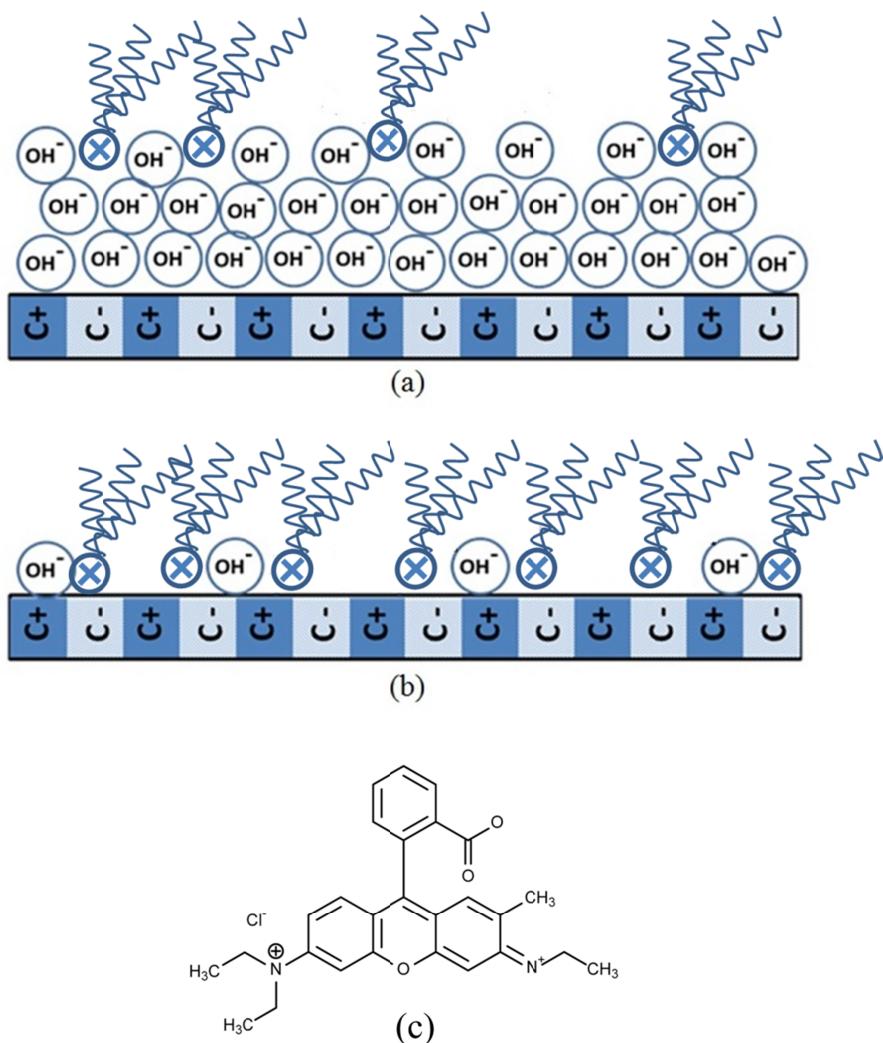


Figure S4. Illustration of ions interaction in the suspension containing the cationic RhB dye molecules with the random polarization surface of BFO particles; (a) at pH 6.7, presence of negative charge ions overcrowded at BFO particle surface preventing direct adsorption of RhB dye molecule on BFO surface, (b) at pH 2, RhB dye molecules adsorbed at the surface of the BFO particles, (c) molecular structure of Rhodamin B dye with bulky molecular structure at the back of cationic attachment site.

The measured zeta potential of BFO particle surface is -16mV, hence the surface of BFO particles are overcrowded due to development of the negative charge co-ions screening on the BFO particle by OH⁻ ions presence in the

suspension as the dye was dissolved in DI water. In this instance, the RhB dye molecules were prevented from attaching the BFO surface and evidenced by minimum amount of RhB photodecolourisation. As the pH value brought down to 2, the BFO particle surface reached iso-electric point allowing RhB dye molecules adsorbed at BFO surfaces, and this is evidenced by high amount of RhB dye photodecolourisation.

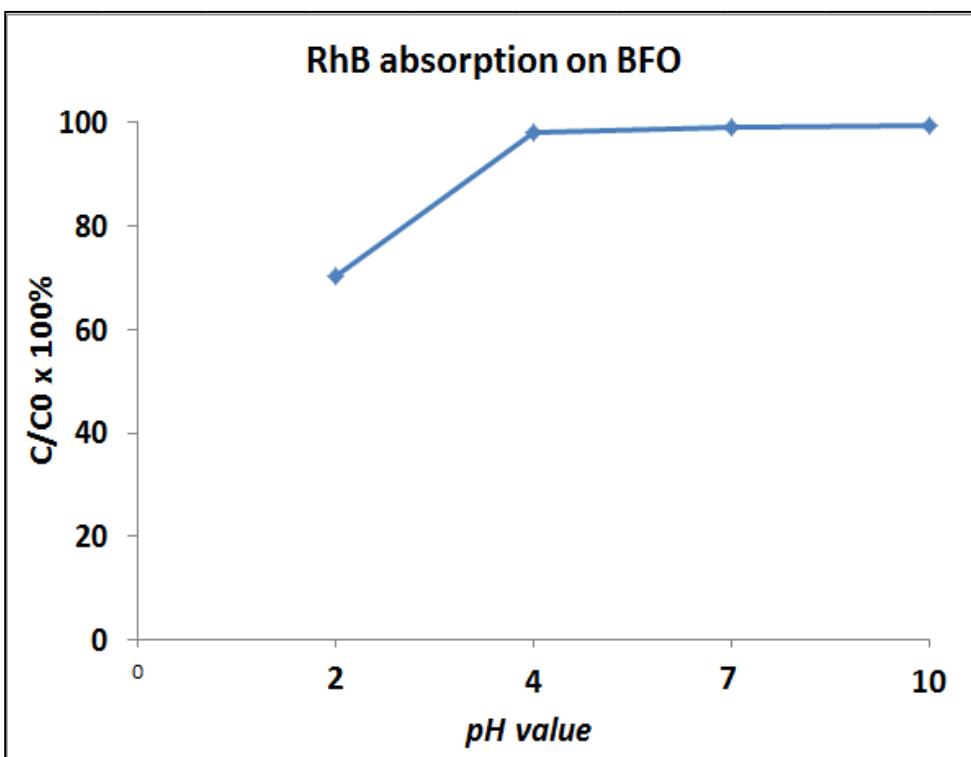


Figure S5. Absorption of RhB molecules on BFO particle surface without solar simulator illumination at various pH values.

BFO nanoparticles were mixed at 0.01 wt% concentration into RhB dye solution of various pH values (2, 4, 7 and 10) under dark condition and 2 hours constant stirring. The BFO-RhB dye suspension was centrifuged to separate the dye and BFO particle follow by absorption measurement with UV-Vis Spectrophotometer to obtain the absorption intensity of the RhB dye solution. As pH value lowered, the RhB dye solution color intensity dropped (decolorize) indicating that the dye molecules were absorbed on the BFO particle surface, and no redox reaction occurred under dark environment. RhB dye molecule

absorbed the most on BFO particle surface at pH 2 environment and resulted in more RhB molecules degradation.

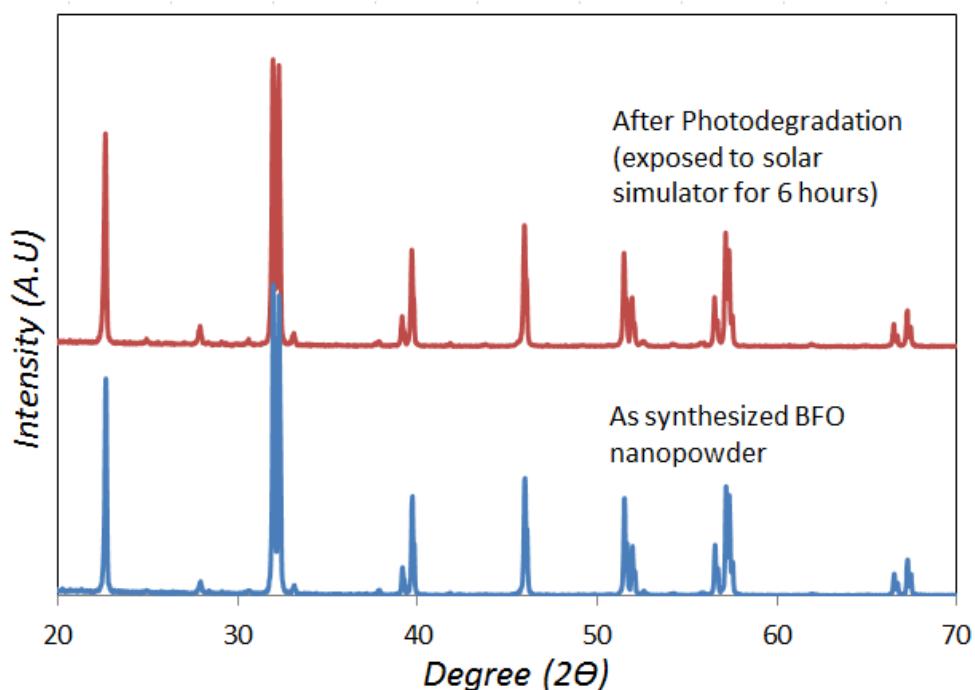


Figure S6. XRD patterns of BiFeO₃ before and after illumination indicating no noticeable change.

After 6 hours of illumination under solar simulator with RhB dye solution, the BFO powder were extracted by centrifugation method and washed before placed in X-Ray Diffractometer. The BFO phases for both before and after exposure under solar simulator showed no noticeable changes in their bulk crystallinity. This is due to the nature of the X-ray diffraction technique that produces data averaged over the full penetration of the x-rays used in the bulk of material and is not surface sensitive. Hence, the change on BFO powder is

hypothesized to be on the particle surface and is evidenced by the XPS measurement.