

## Enhanced Photocatalytic Activity of Modified Black Phosphorus-incorporated PANi/PAN Nanofibers

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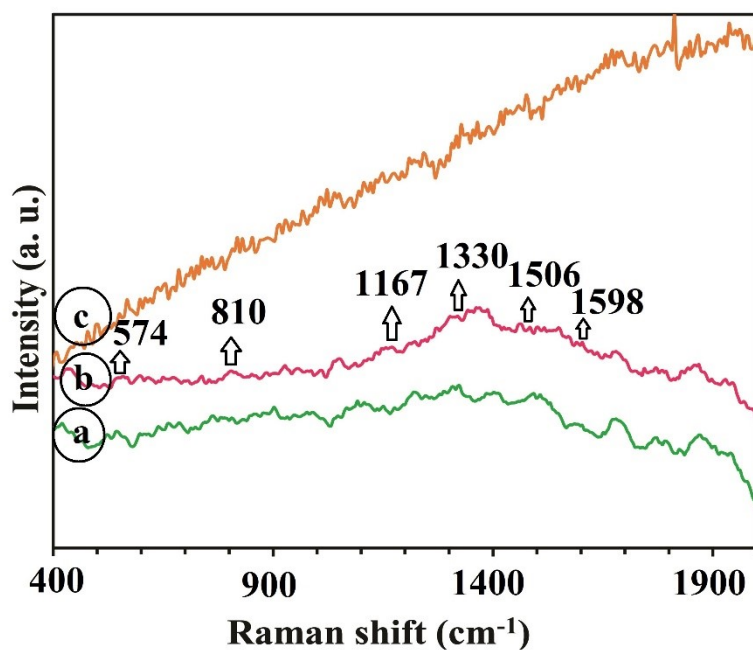
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### Chemicals and instruments

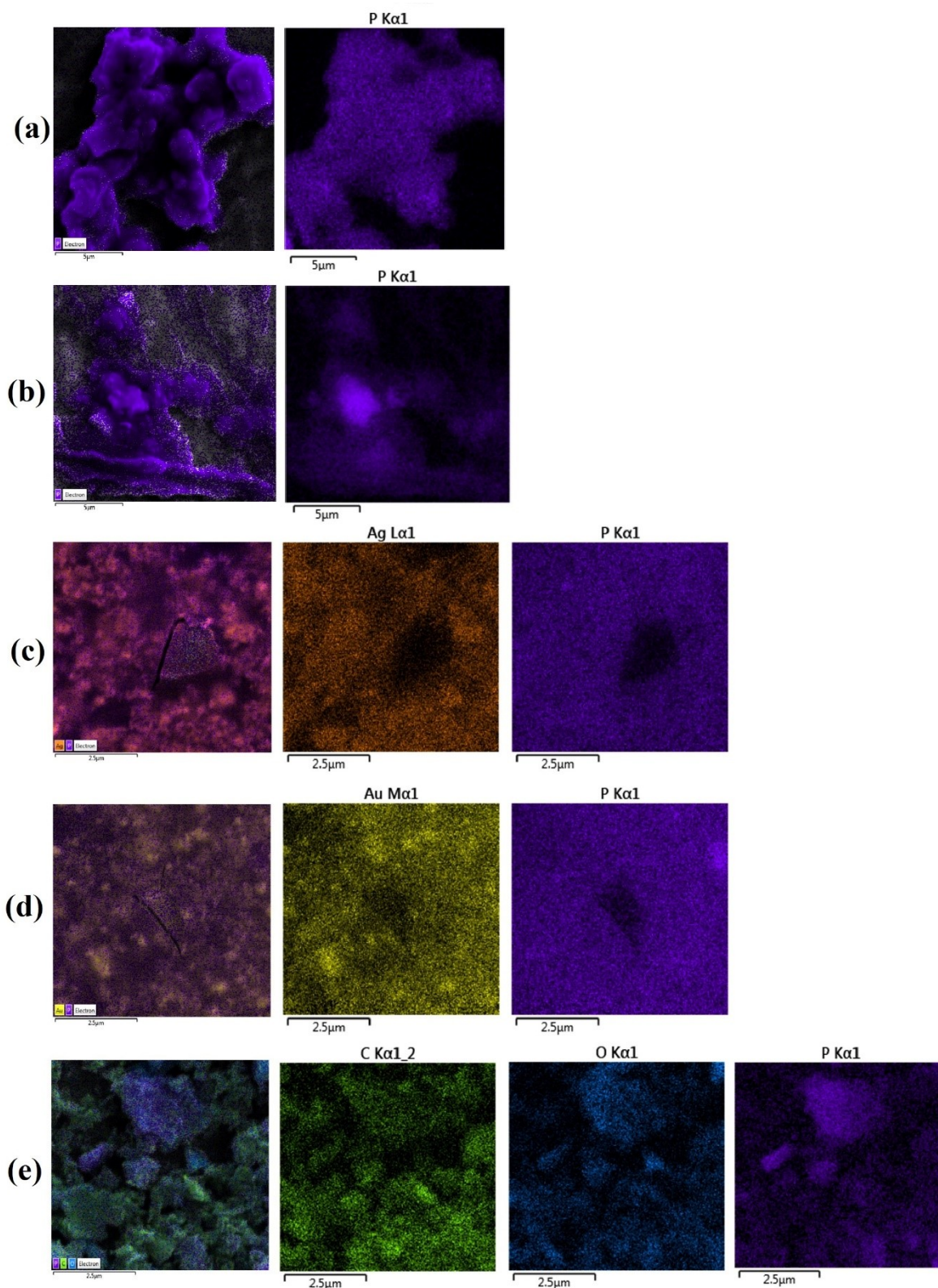
Ethylenediamine, ethanol, silver nitrate (AgNO<sub>3</sub>), methylene blue (MB), methyl orange (MO), benzoquinone (BQ), tertiary butyl alcohol (TBA), and ethylenediaminetetraacetic acid (EDTA), and chloroauric acid (HAuCl<sub>4</sub>) were purchased from Merck company. Polyaniline (PANi, Mw=150,000 Da) was procured from Sigma-Aldrich. Indian red phosphorus (RP) with a purity of 99% was received. Dried *N,N*-dimethylformamide (DMF) was purchased from Amertat Shimi company and polyacrylonitrile (PAN, Mw=150,000 Da) was received from Iran Polymer and Petrochemical Institute.

Rayleigh WQF-510A and Bruker-Equinox 55 ATR were applied for recording the Fourier-transform infrared (FT-IR) spectra of the powdered form of photocatalysts and photocatalytic composite NFs, respectively. A Rayleigh UV-1600 spectrophotometer was used for collecting the UV-Vis spectra and reading the absorbance of organic dyes. Raman spectra were recorded on a TAKRAM Raman microscope with a laser of 785 nm. A powder X-ray diffraction (PXRD) spectroscopy (Rigaku Ultima IV, wavelength 1.541866) was used to characterize the crystalline structure of the photocatalytic powders. The thermal stability of photocatalytic powders and electrospun nanofibers (NFs) was investigated by a Mettler Toledo TG/DSC device at a heating rate of 10 °C/min and a temperature range of 23°C to 950 °C under an argon atmosphere. A field emission scanning electron microscope (FESEM) (MIRA3, Tescan) along with an energy dispersive x-ray (EDX) spectroscope was applied to investigate the surface morphology and elemental composition of the photocatalytic powders and NFs. The electrospun NFs were fabricated by an electrospinning machine with 2 two-way nozzles

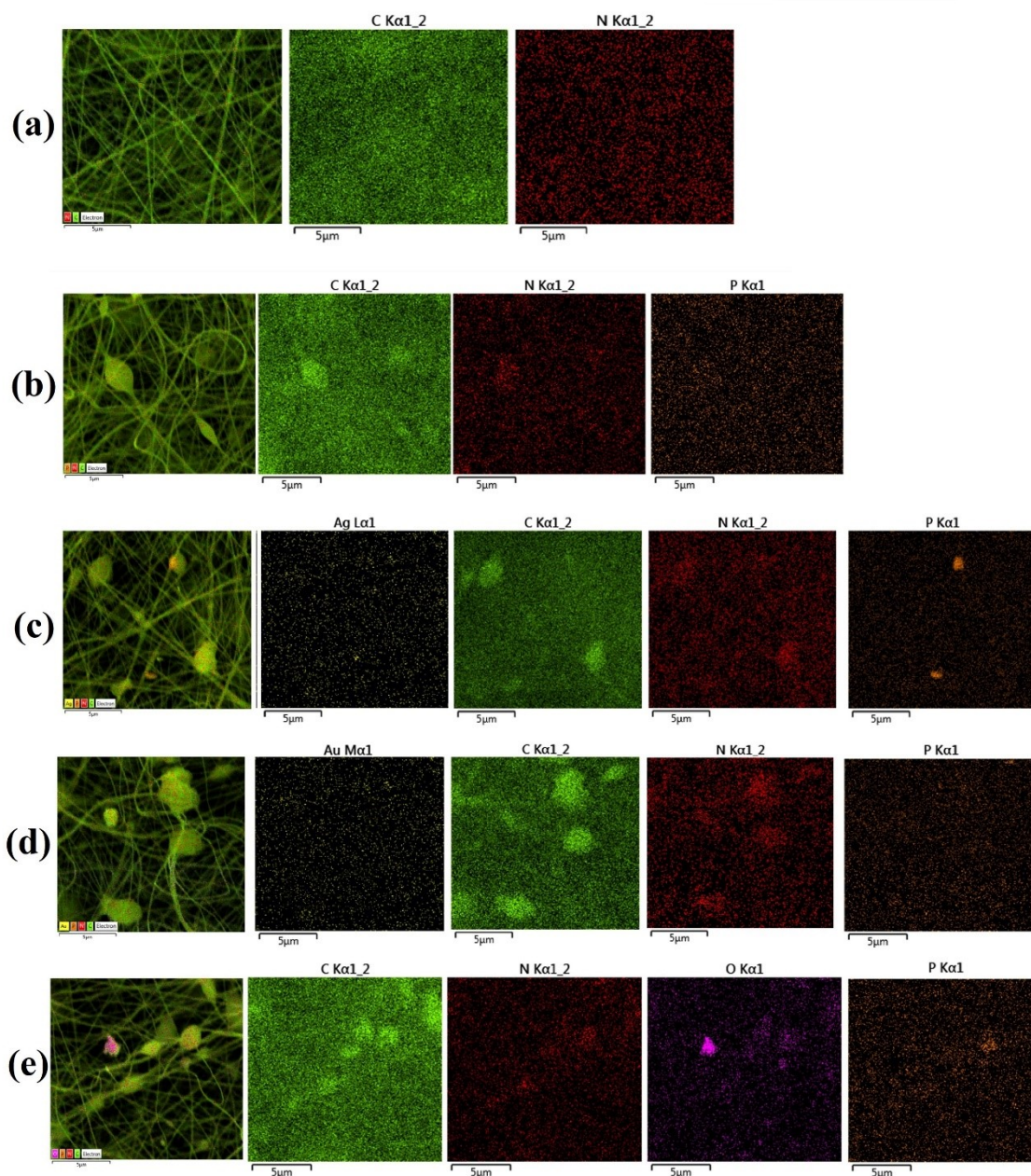
(NanoAZma). A tensile test was performed using a tensile test machine (Hounsfield, H10KS) to measure the mechanical strength of the NFs. Emission measurements were performed on a Cary Eclipse fluorescence spectrophotometer (Agilent, model G9800A). The wettability of NFs was revealed by measurement of water contact angles of a water drop (10  $\mu$ L) on the NFs using a contact angle Goniometer and Tensiometer (Jikan CAG-10) at room temperature. A closed chamber equipped with Xenon lamps of 50 W was used for photocatalytic experiments.



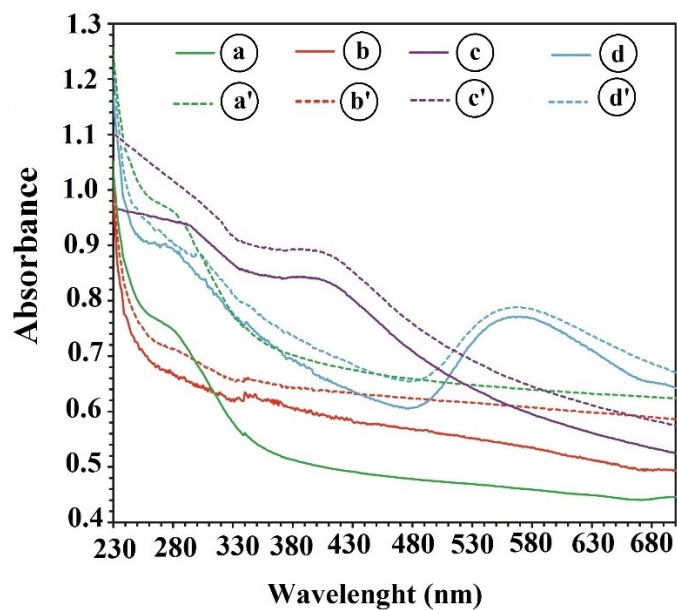
**Fig. S1.** The Raman spectra of PANi/PAN NFs (a), PANi polymer (b), and PAN NFs (c).



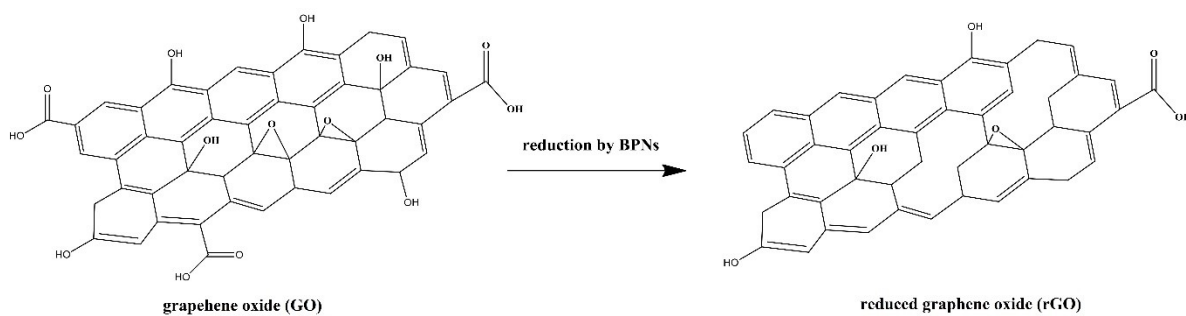
**Fig. S2.** The elemental mapping of bulk BP (a), BPNs (b), BPNs@Ag (c), BPNs@Au (d), and BPNs@GO (e).



**Fig. S3.** The elemental mapping of PANi/PAN NFs (a), BPNs-loaded PANi/PAN NFs (b), BPNs@Ag-loaded PANi/PAN NFs (c), BPNs@Au-loaded PANi/PAN NFs (d), and BPNs@GO-loaded PANi/PAN NFs (e).



**Fig. S4.** The absorption changes of water dispersions of (a) BPNs in 7 days, (a') BPNs in 1 day, (b) BPNs@GO in 7 days, (b') BPNs@GO in 1 day, (c) BPNs@Ag in 7 days, (c') BPNs@Ag in 1 day, (d) BPNs@Au in 7 days, and (d') BPNs@Au in 1 day in exposed to air and natural light.



**Fig. S5.** Reduction of GO by BPNs.