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Nitrogen doped $BiFeO_3$ with enhanced magnetic properties and photo-Fenton catalytic activity for degradation of bisphenol A under visible light

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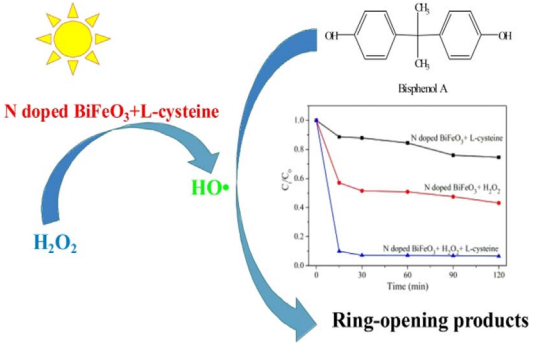
HIGHLIGHTS

- N doped $BiFeO_3$ have been synthesized using melamine as the N precursor.
- The band gap and saturation magnetization of N doped $BiFeO_3$ is tunable.
- N doped $BiFeO_3/H_2O_2$ shows enhanced efficient degradation of bisphenol A.
- Addition of L-cysteine can further enhanced photodegradation performance.
- A mechanism of bisphenol A degradation was proposed.

GRAPHICAL ABSTRACT



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ABSTRACT

In the present work, N doped $BiFeO_3$ (N-BFO) nanoparticles have been synthesized via a sol-gel rapid calcination technique using melamine ($C_3H_6N_6$) as the N precursor. It is found that N-doping could effectively narrow the band gap of BFO, which obviously enhanced the visible light adsorption capability. Meanwhile, N-doping could lead to significant increase in the magnetization of BFO. Particularly, the saturation magnetization (M_s) was increased up to 0.35 emu/g (as compared to that of pure BFO: 0.07 emu/g) when 12.5 mmol N doping precursor was used (12.5N-BFO). The catalytic performance of N-BFO nanoparticles was evaluated through the degradation of bisphenol A (BPA) under visible light irradiation. 12.5N-BFO was found to be an efficient catalyst of BPA, and the addition of H_2O_2 (10 mmol/L) or H_2O_2 (10 mmol/L)/L-cysteine (0.25 mmol/L) can further enhance the degradation efficiency up to 60% and 94% within 120 min, respectively. The 12.5N-BFO nanoparticles were very stable during photocatalytic processes and their photo-Fenton catalytic activity can be retained even after three recycling processes.