**Electronic Supplementary Material (ESI) for**

# Self doping and surface plasmon modification induced visible light photocatalysis of BiOCl

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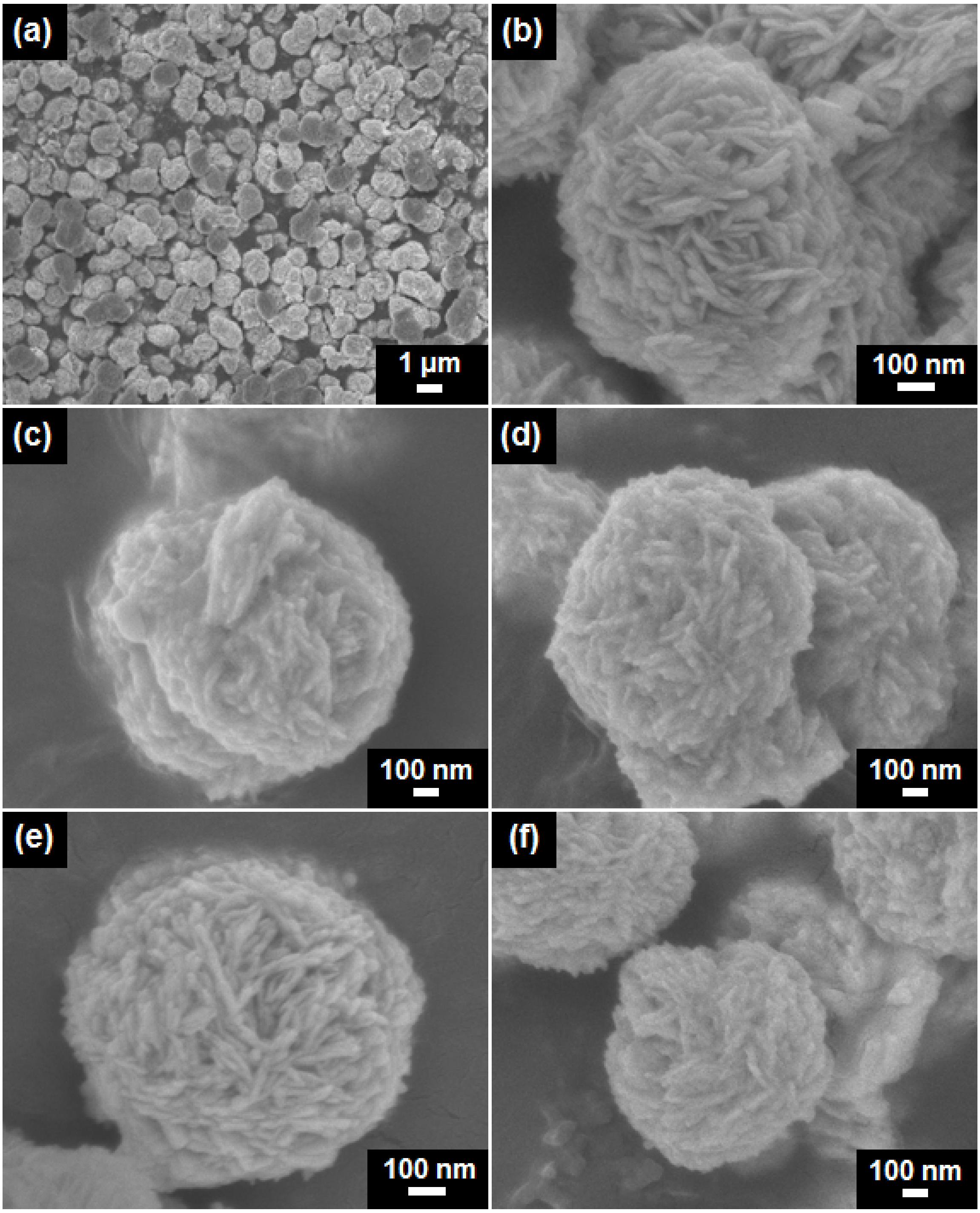



**Fig. S1** SEM images of the self-doped BiOCl and Ag/BiOCl: (a, b) AB0, (c) AB1, (d) AB3, (e) AB5 and (f) AB7.

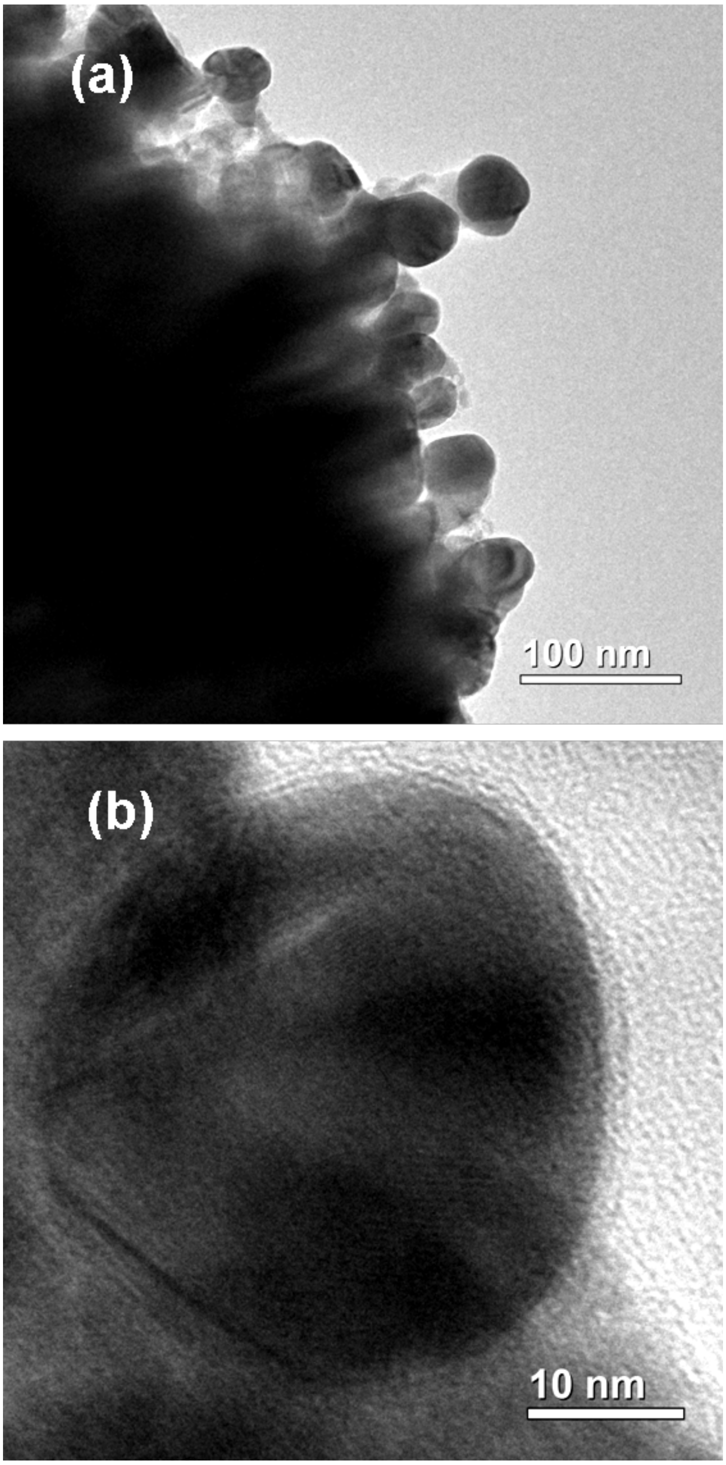
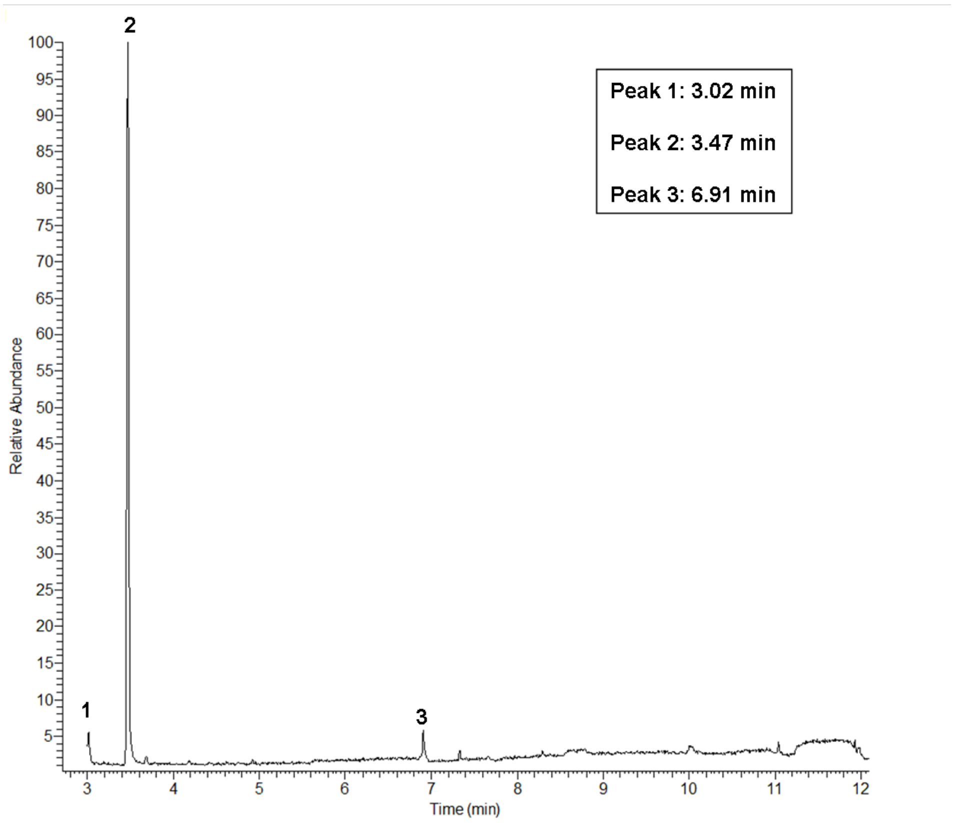
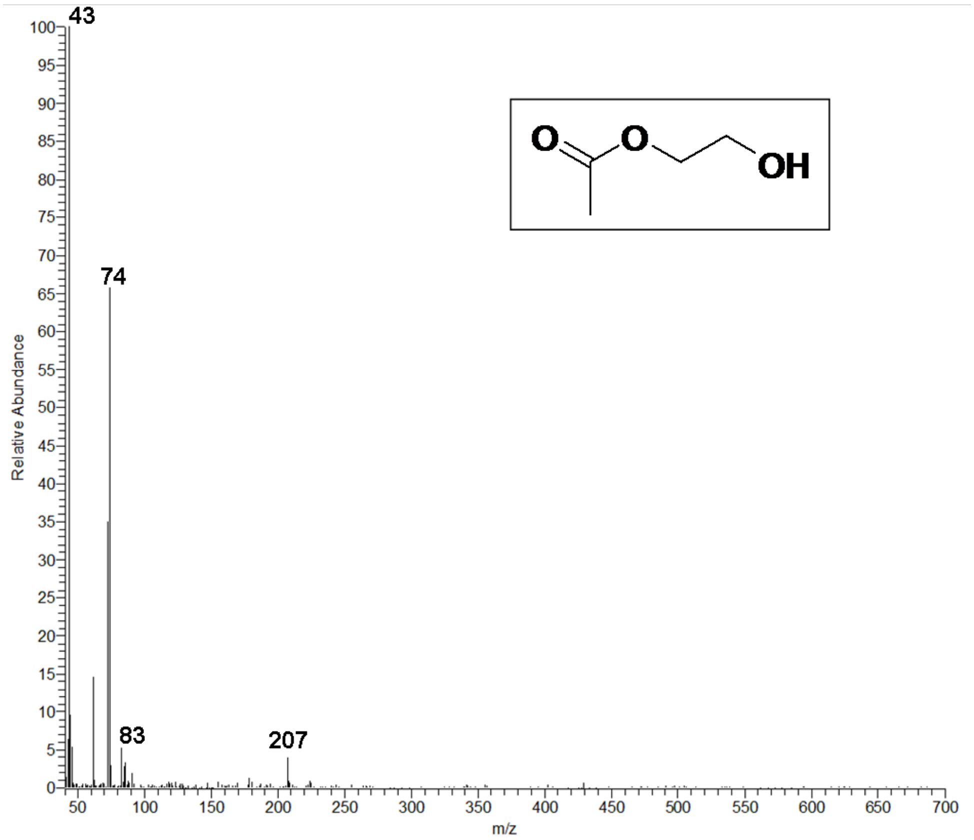


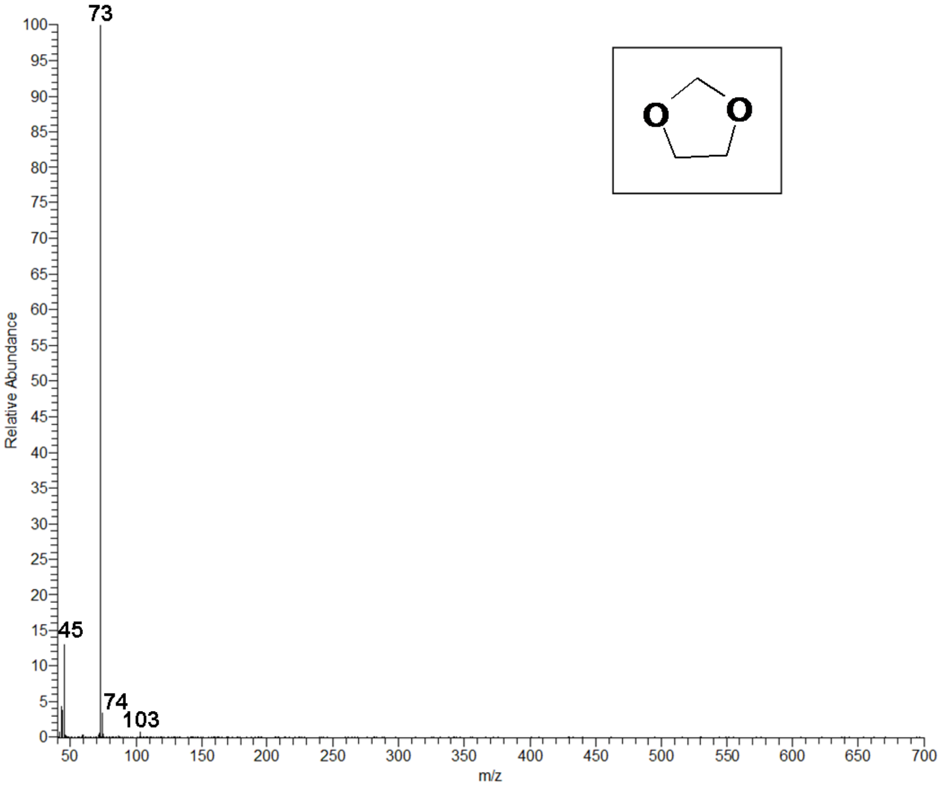

**Fig. S2** TEM (a) and HRTEM (b) images of the AB5.


Relative Abundance
Time (min)
Peak 1: 3.02 min
Peak 2: 3.47 min
Peak 3: 6.91 min
1
2
3

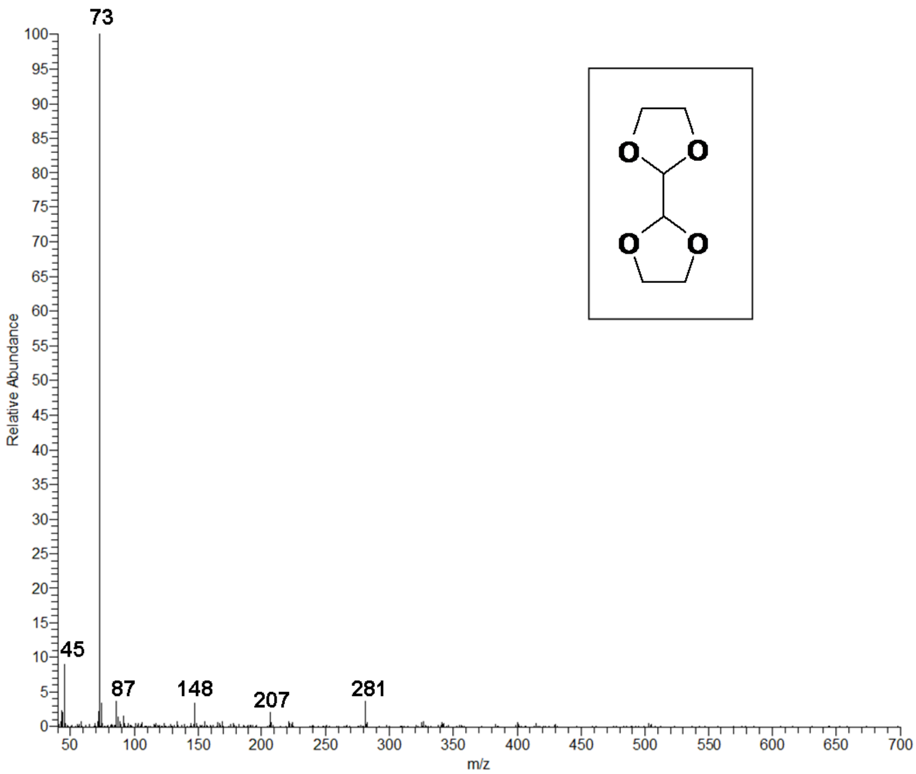
**(a)**


Relative Abundance
m/z
43
74
83
207
O
O
OH

**(b)**




**(c)**




**(d)**

**Fig. S3** (a) GC chromatogram of the final reaction solution, b) Mass spectrum for the product at 3.02 min; c) Mass spectrum for the product at 3.47 min; d) Mass spectrum for the product at 6.91 min.

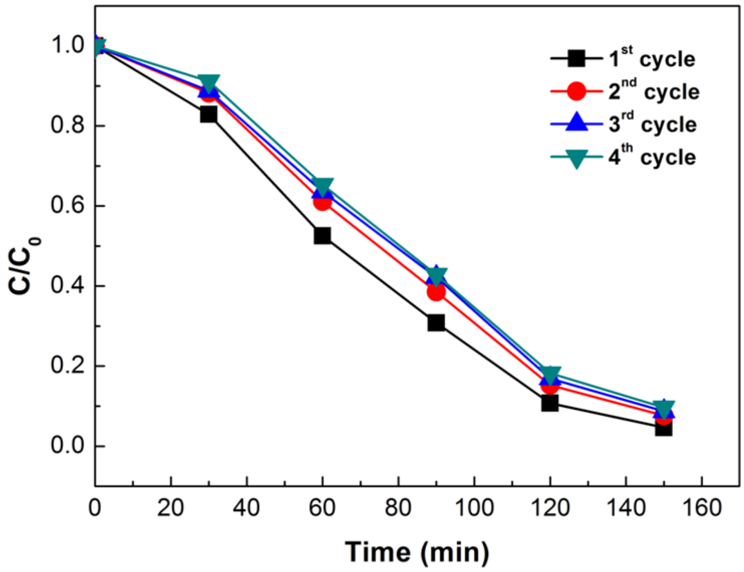



**Fig. S4** Recycling test on the AB5 sample for MO photodegradation under visible light irradiation.

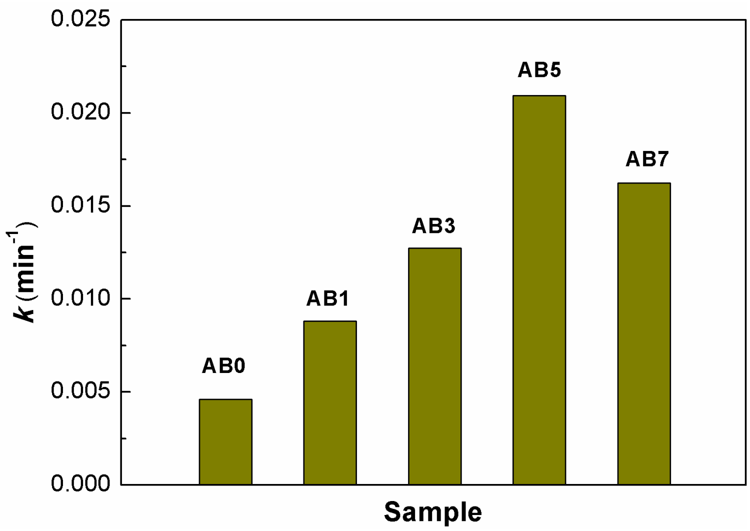



**Fig. S5** The apparent reaction rate $k$ ($min^{-1}$) of the self-doped BiOCl and Ag/BiOCl on the degradation of MO under visible light irradiation ($\lambda > 420$ nm).

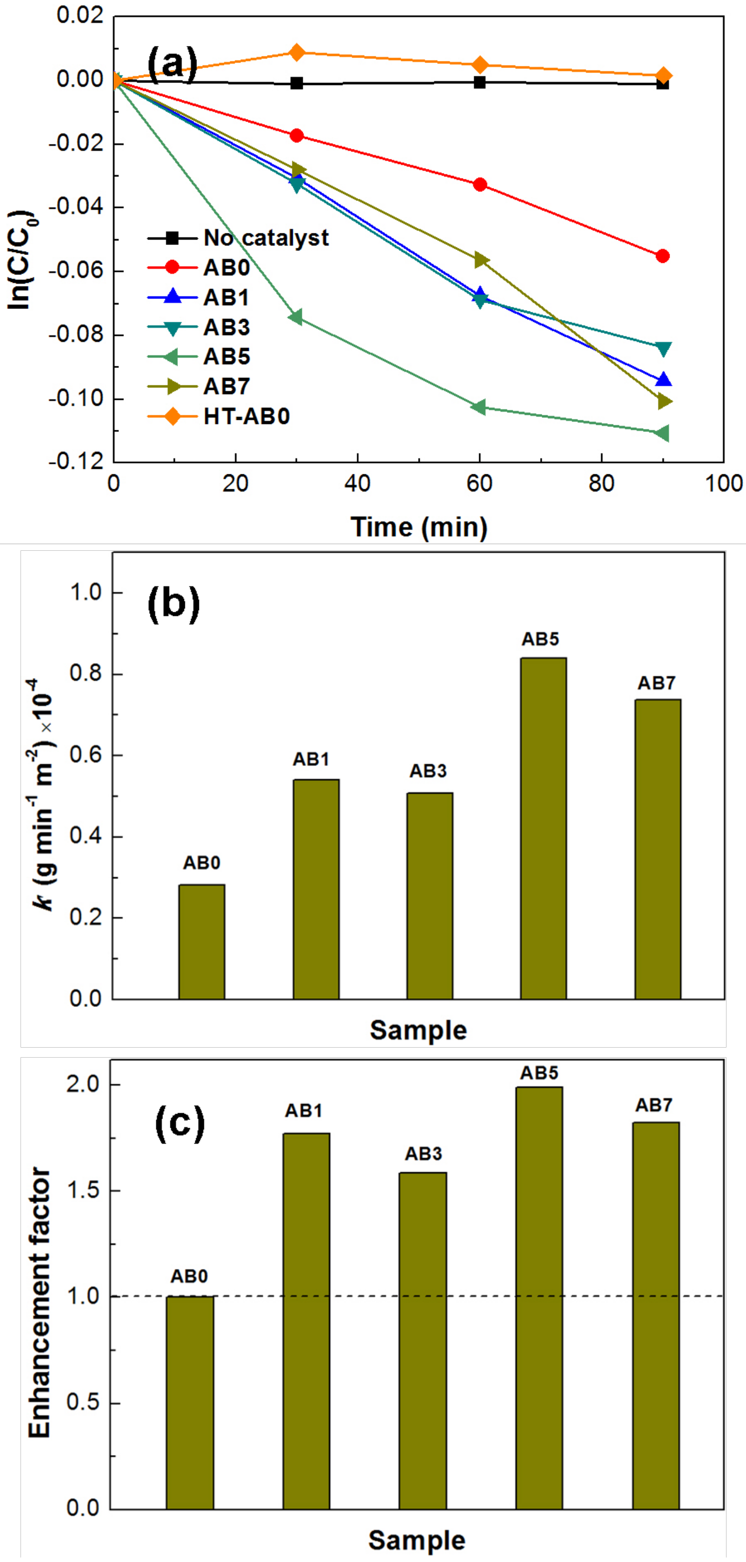



**Fig. S6** (a) Photocatalytic activity of the BiOCl and Ag/BiOCl on the degradation of SA (10 mg $L^{-1}$) under visible light irradiation (λ > 420 nm). (b) Photoactivity enhancement factor ($k_{Ag/BiOCl}/k_{BiOCl}$) of Ag/BiOCl. (c) The apparent reaction rate normalized with the surface areas ($k'$) of the self-doped BiOCl and Ag/BiOCl.

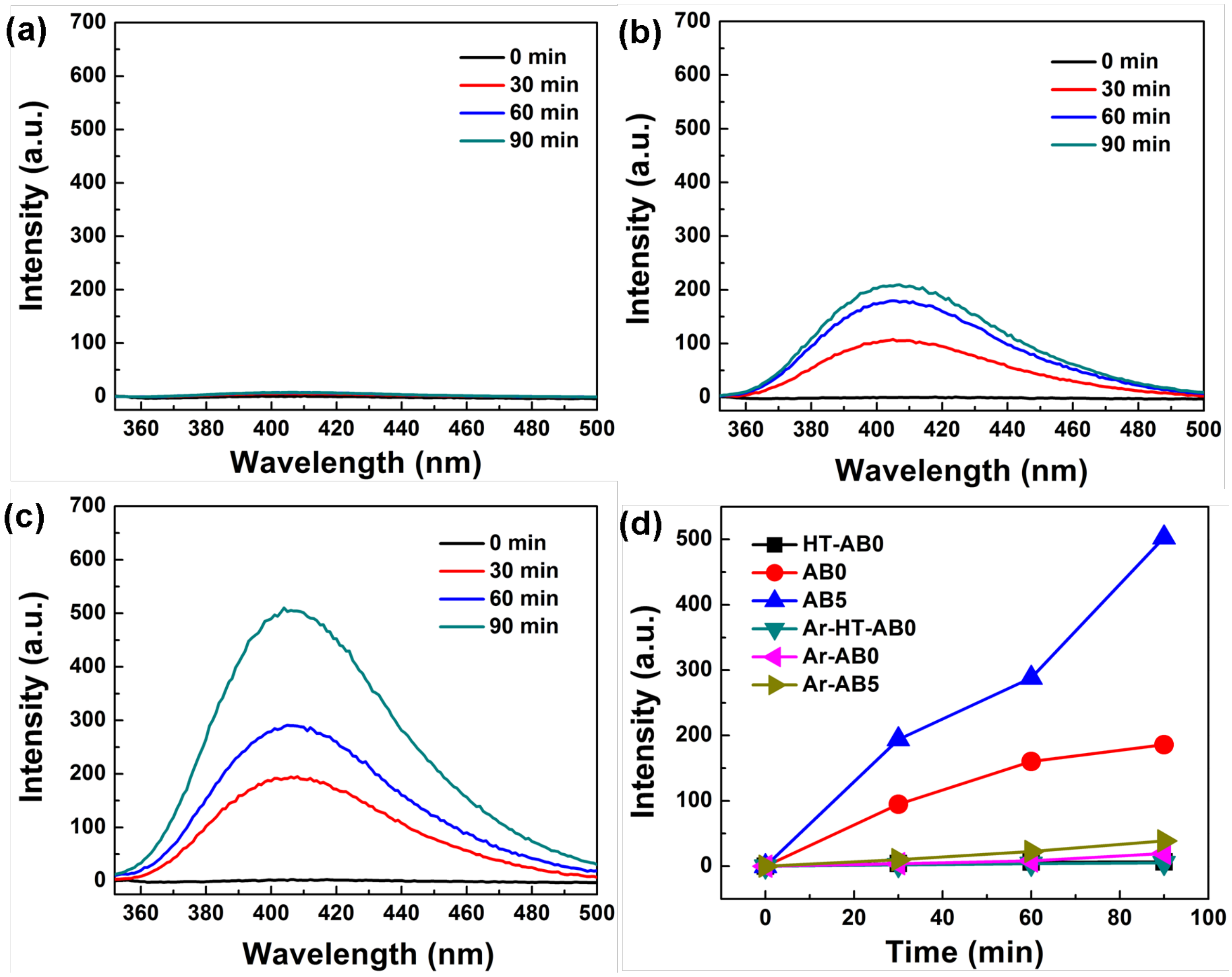



**Fig. S7** Detection of $H_2O_2$ in the HT-AB0 (a), AB0 (b) and AB5 (c) dispersions under visible light irradiation. (d) Comparison of PL intensity for $H_2O_2$ detection in different catalytic systems.

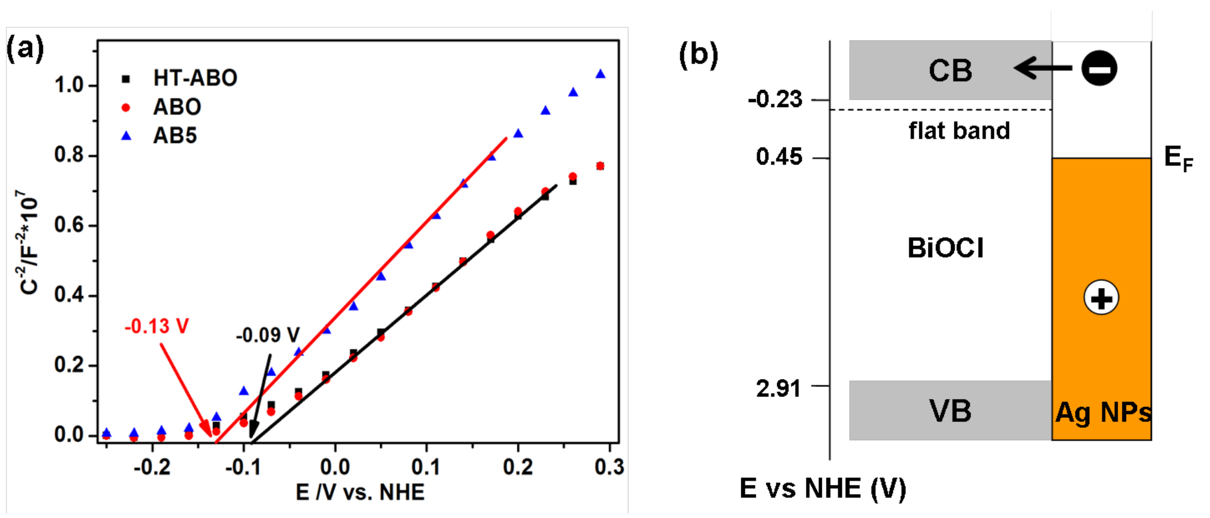



**Fig. S8** (a) Mott-Schottky plots of the different sample electrodes and (b) Energy level diagram of the AB5 sample.

**Table S1** Textural and photocatalytic properties of the different samples

| sample | $A_{\mathrm{BET}}$ ($m^2\ g^{-1}$) | MO degradation in 150 min (%) | $k$ (× $10^{-3}$, $min^{-1}$) | $k'$ (× $10^{-4}$, g $min^{-1}$ $m^{-2}$)$^a$ |
|---|---|---|---|---|
| AB0 | 21.4 | 51% | 4.6 | 2.1 |
| AB1 | 19.8 | 73% | 8.8 | 4.4 |
| AB3 | 18.9 | 86% | 12.7 | 6.7 |
| AB5 | 14.3 | 96% | 20.9 | 14.7 |
| AB7 | 14.9 | 91% | 16.2 | 10.9 |

[a] The $k'$ values were $k$ values normalized with the surface areas.

**Table S2** Kinetic analysis of the emission decay of the different samples [a]

| sample | $A$ | $B_1$ | $\tau_1$ (ns) | $B_2$ | $\tau_2$ (ns) | $\chi^2$ | $\langle\tau\rangle$ (ns) | $k$ ($ns^{-1}$) |
|---|---|---|---|---|---|---|---|---|
| AB0 | 0.126 | 0.1247 | 0.31 | $1.815\times10^{-2}$ | 2.75 | 6.775 | 0.63 | 1.59 |
| AB5 | 0.144 | 0.2270 | 0.17 | $2.140\times10^{-2}$ | 2.40 | 4.074 | 0.37 | 2.70 |

[a] The data in each curve was fitted to multiexponential functions ( $f(t) = A + \sum_{i=1}^{N} B_i e^{-t/\tau_i}$ ), with preexponential factors ($B_i$), characteristic lifetimes ($\tau_i$) and a background ($A$). The average lifetime of a multiexponential decay is expressed as $\langle\tau\rangle = \sum_{i=1}^{N} c_i \tau_i$ , where $c_i$ is the relative concentration in a multiexponential decay ( $c_n = \dfrac{B_n}{\sum_{i=1}^{N} B_i}$ ).[1,2]

**Reference:**

1. S. Sarkar, A. Makhal, T. Bora, S. Baruah, J. Dutta and S. K. Pal, *Phys. Chem. Chem. Phys.*, 2011, **13**, 12488.

2. J. R. Lakowicz, *Principles of Fluorescence Spectroscopy*, Kluwer Academic/Plenum Publishers, New York, 2nd edn, **1999**.