Improved photocatalytic & disinfection efficiency of 2D BiOCl modified by Ag nanoparticles

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Contents

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Research background

- Energy Shortage
- Solar Energy
- Organic pollutants-AOPs
- Antibiotics- potential threats

Sulfanilamide

- Semiconductors-BiOCl

BiOCl

- ✓p-type semiconductors
- ✓Band gap: ~3.4 eV
- ✓Promising photocatalyst candidate

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Experiments & characterization

- Synthesis process
- XRD, SEM, TEM characterization
- XPS, EDX, Raman Spectra
- Optical absorption property

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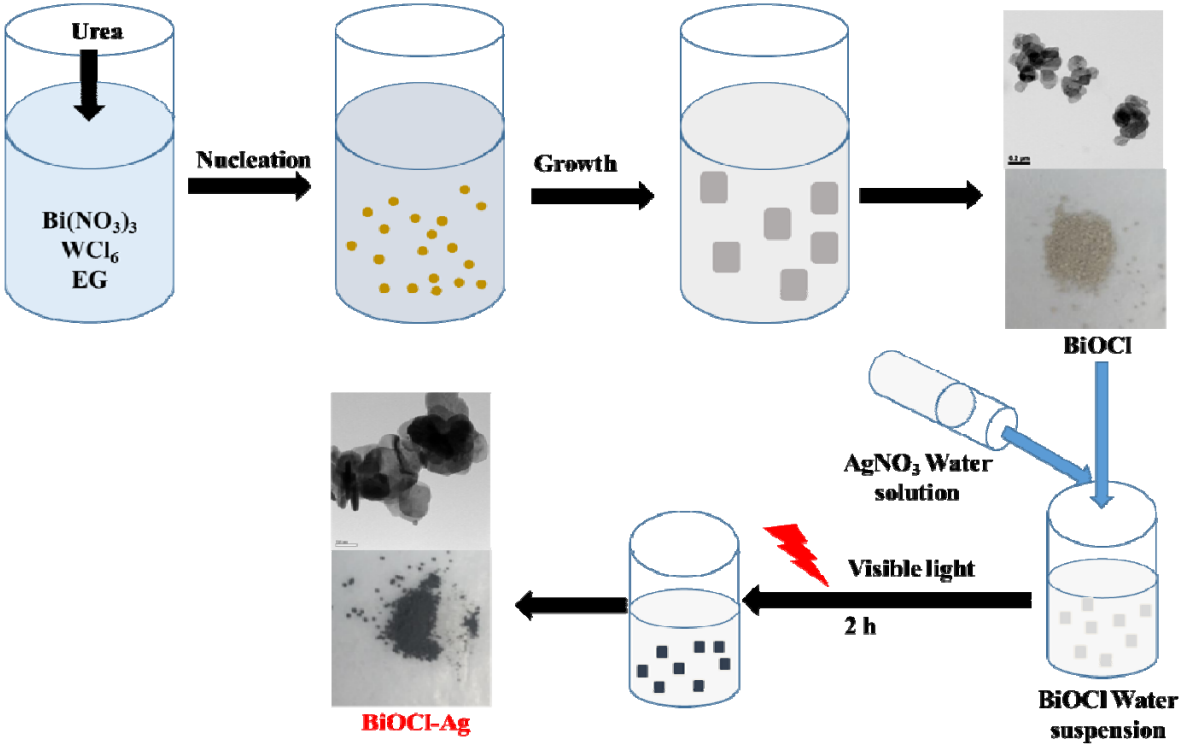
Synthesis process



Synthesis of BiOCl

Synthesis of BiOCl-Ag

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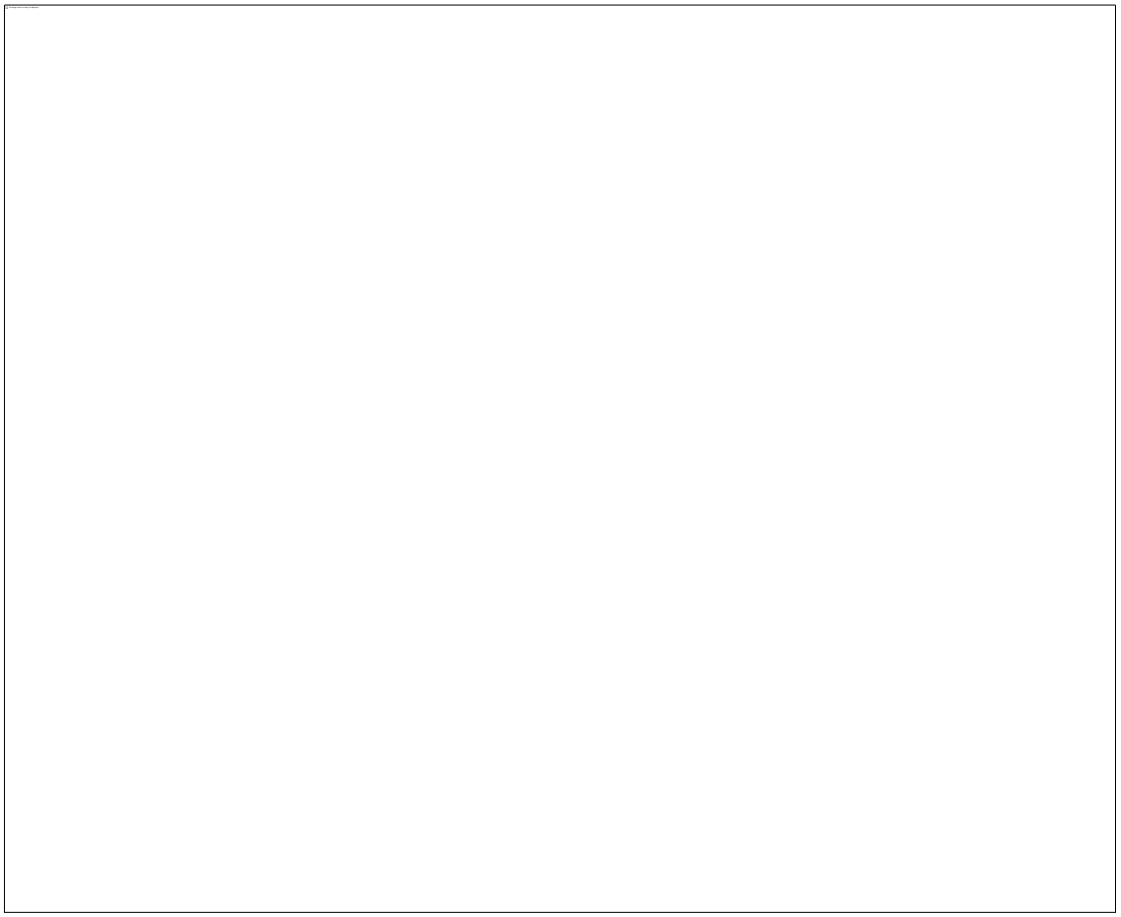
XRD of BiOCl & BiOCl-Ag



- **Ag NPs**

JCPDS No. 04-0783

- **BiOCl**

JCPDS Card No. 06-0249

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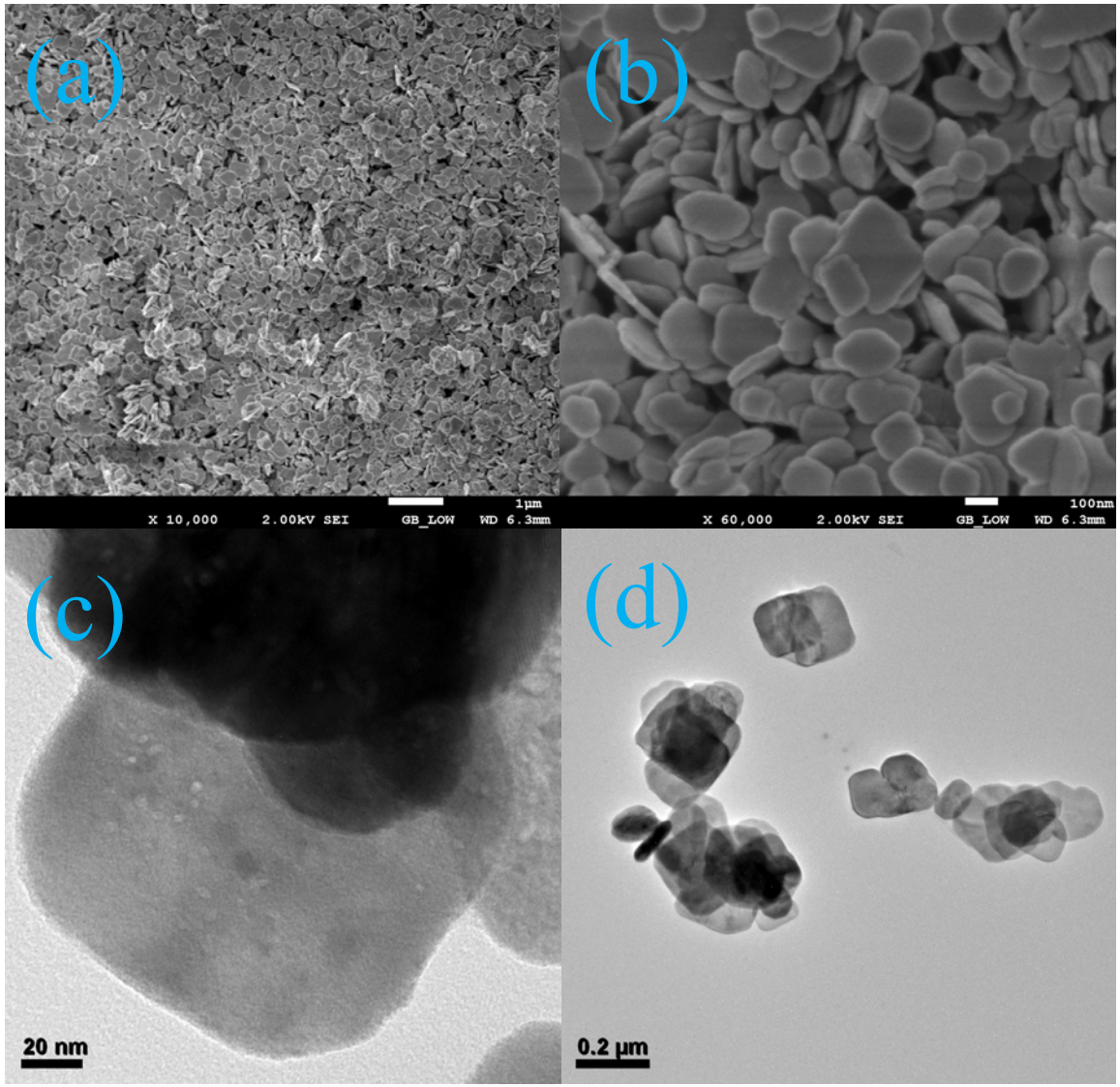
SEM,TEM: BiOCl



Nanodiscs

Size: ~200 nm

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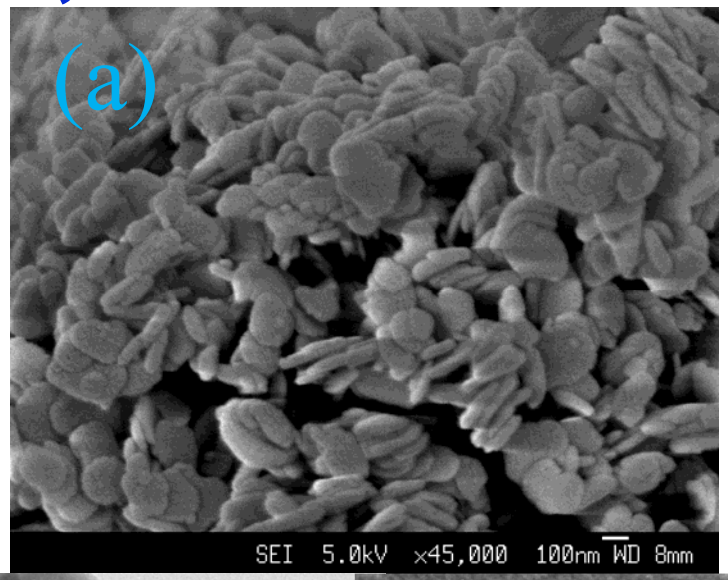
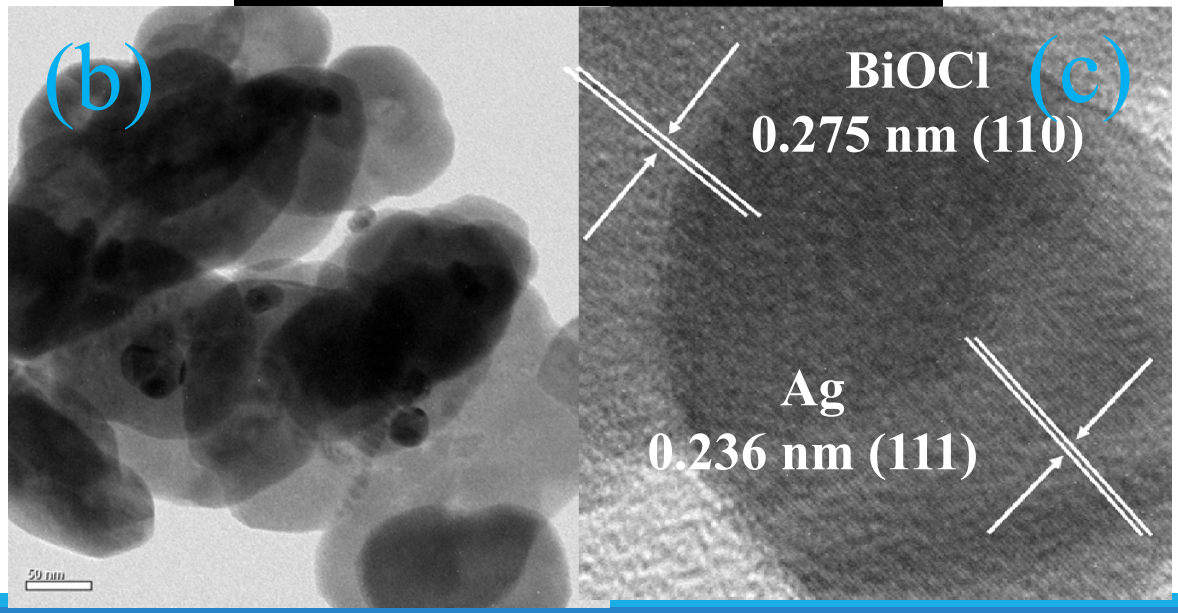
SEM,TEM: BiOCl-Ag



- Ag NPs: 10-20 nm
- No change of morphology



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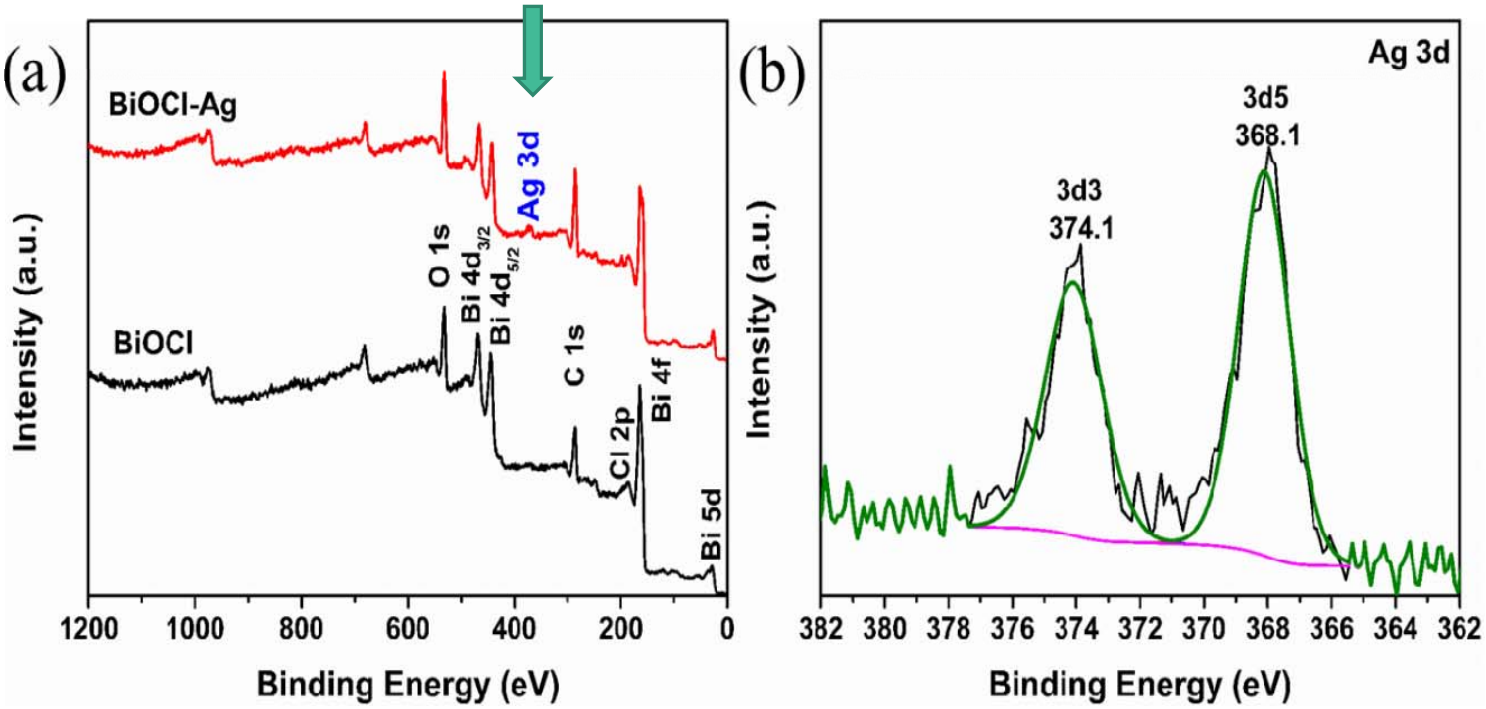
XPS characterization



- **High purity**
- **Appearance of Ag peaks**
- **Ag content 1.862%**

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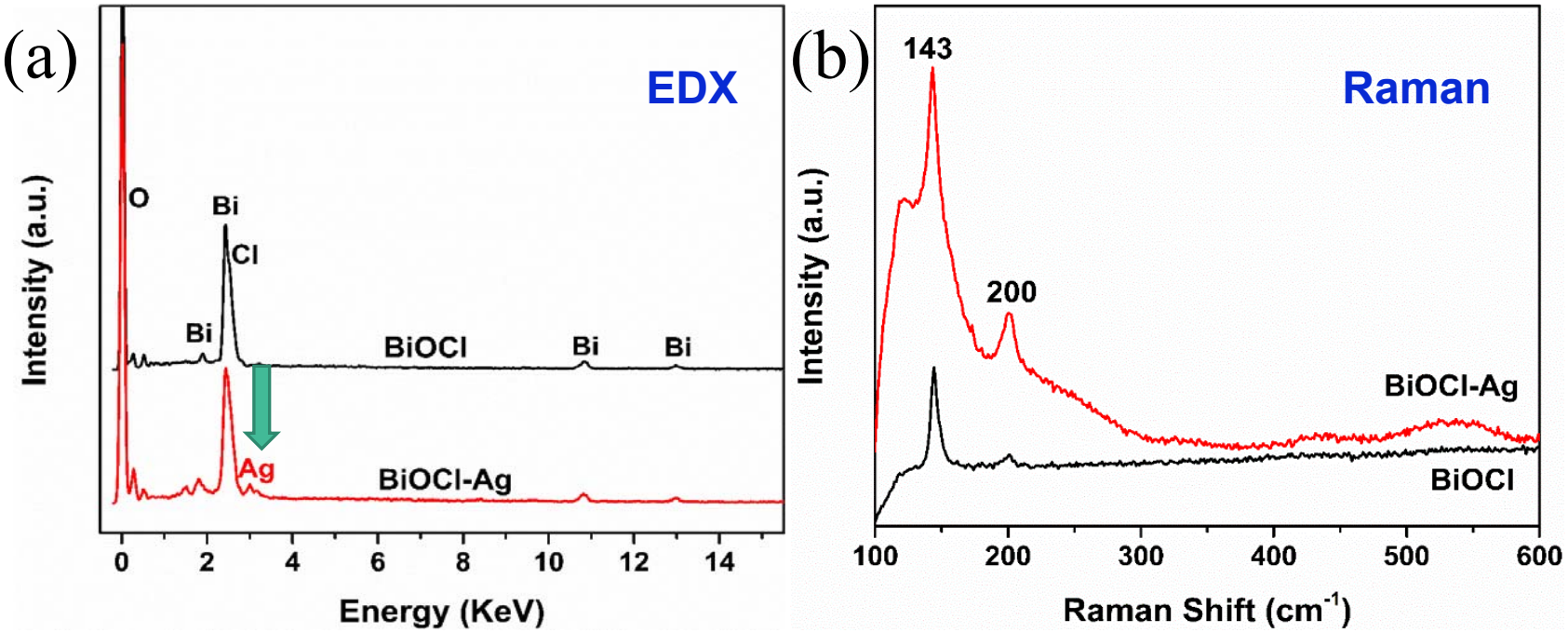
EDX, Raman Spectra



- **Appearance of Ag peaks**

- **Enhanced peak intensities**
- **SERS effect**
- **SPR effect of Ag NPs**

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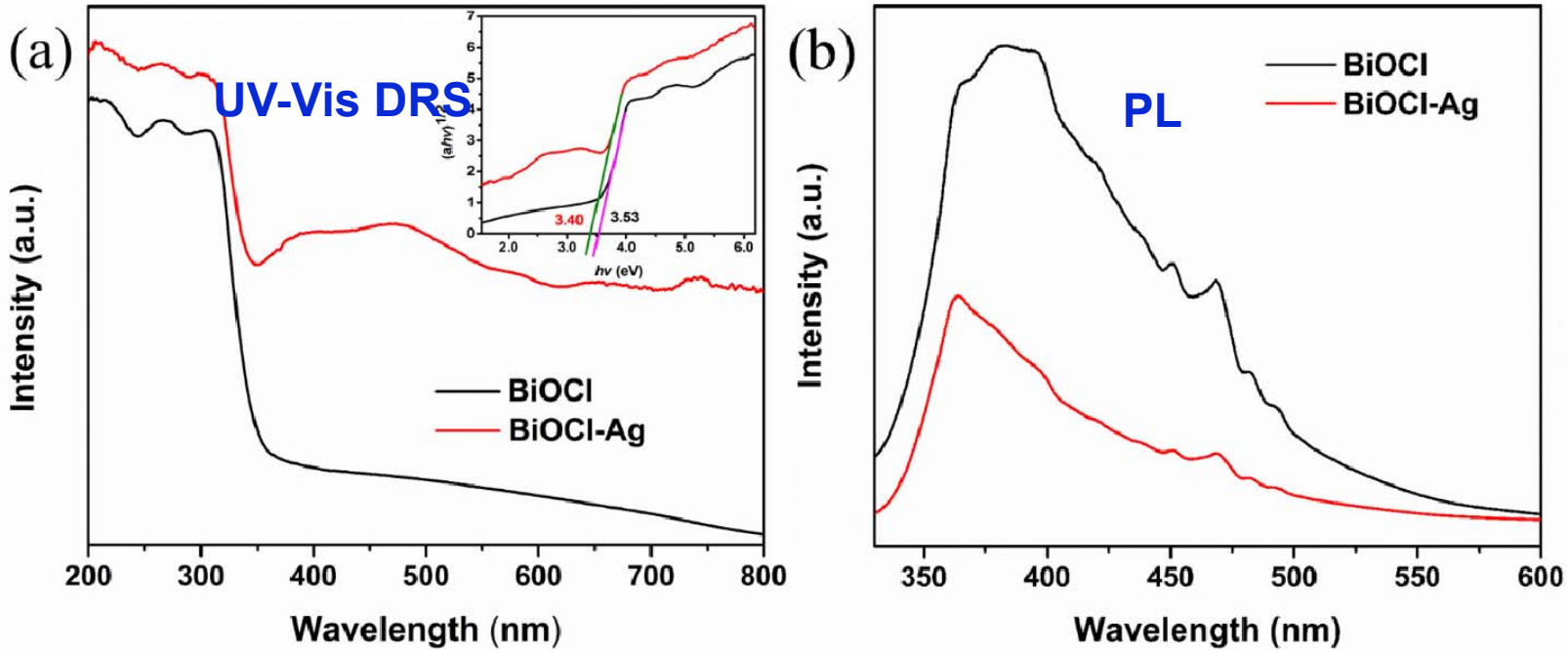
Optical absorption property



- Enhanced absorption in the visible light range
- SPR effect of Ag NPs
- Narrowed Band gap: 3.53 vs 3.40

- Quenched peak intenisty
- Lower recombination of electron-hole pairs

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Result & discussion

Photodegradation of SAM

Antibacterial performance

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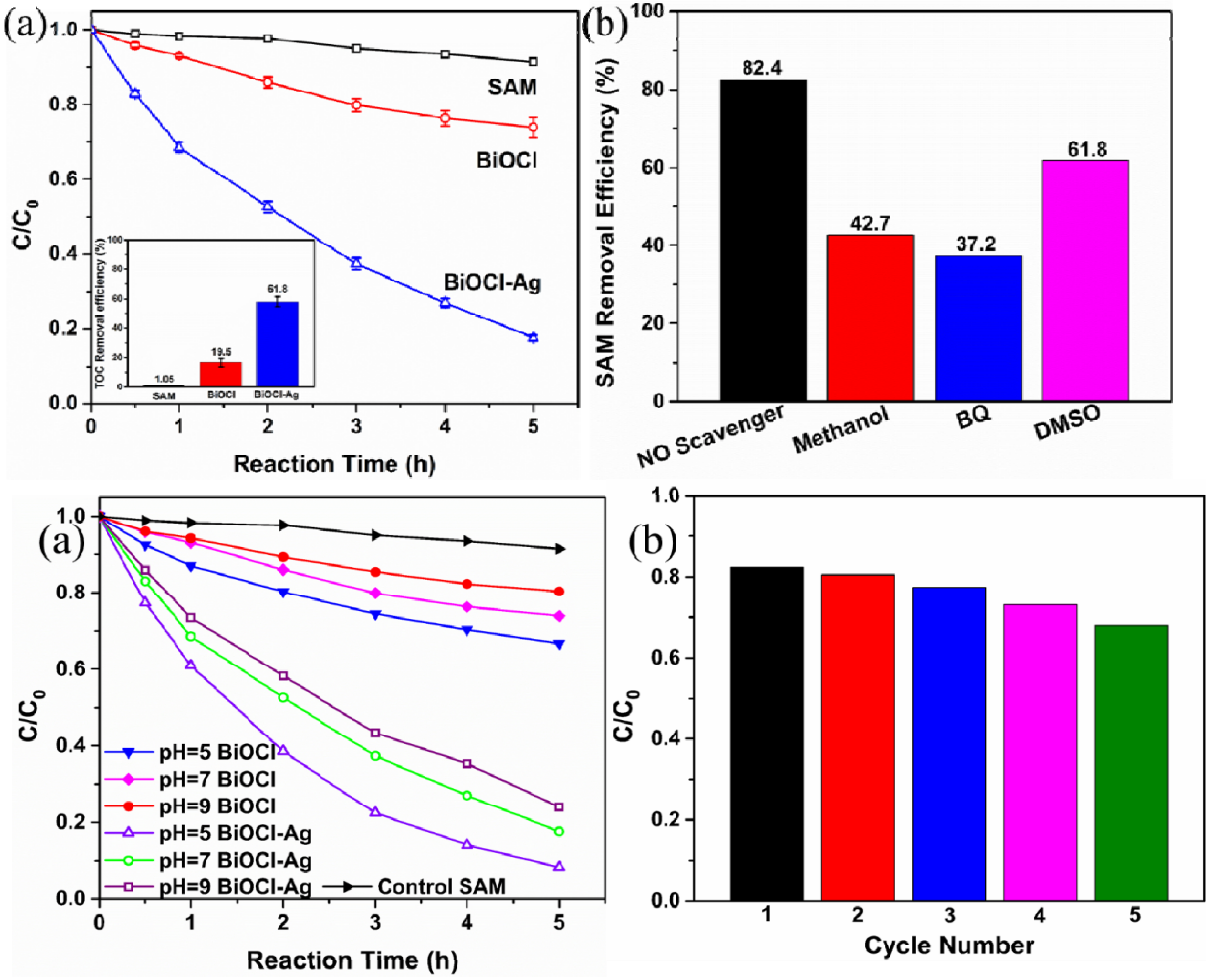
Photodegradation of SAM



SAM: sulfanilamide

- ✓ **Increased degradation efficiency**
- ✓ **Lower pH leaded to higher efficiency**
- ✓ **Good stability and reusability**

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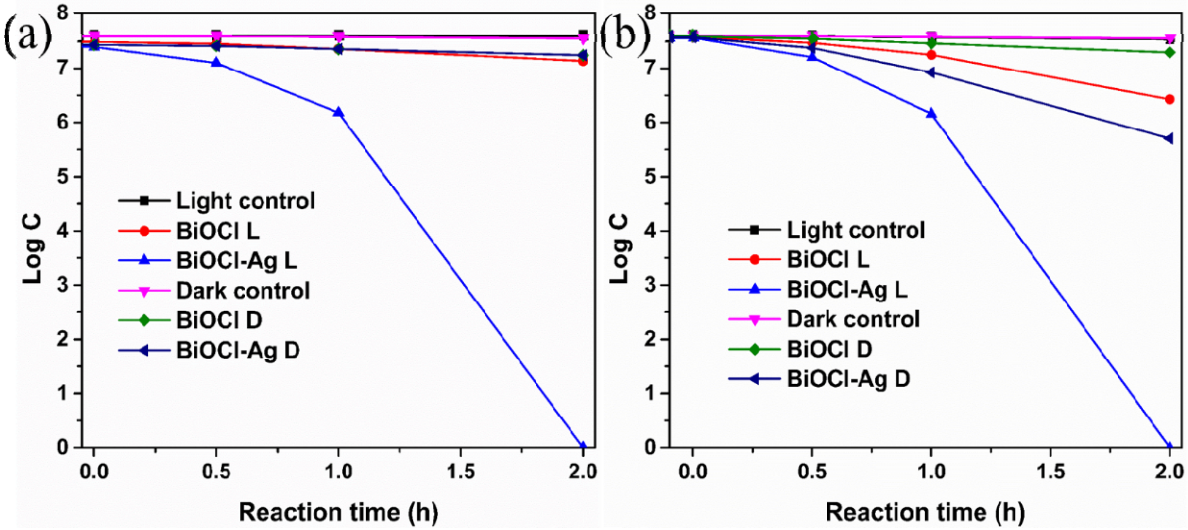
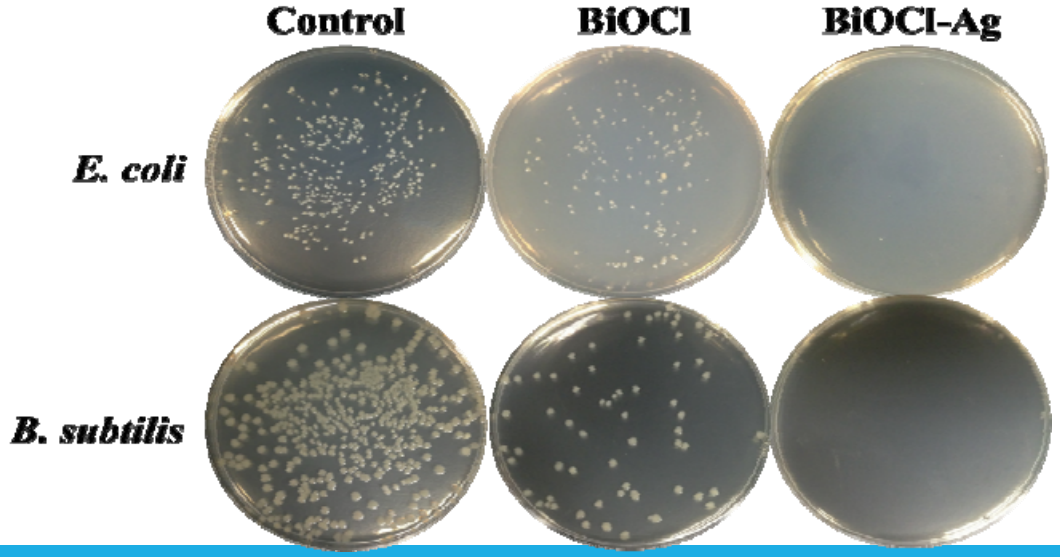
Antibacterial effect





- ✓ **Higher efficiency under light irradiation**
- ✓ **Ag NPs can enhance the antibacterial efficiency**

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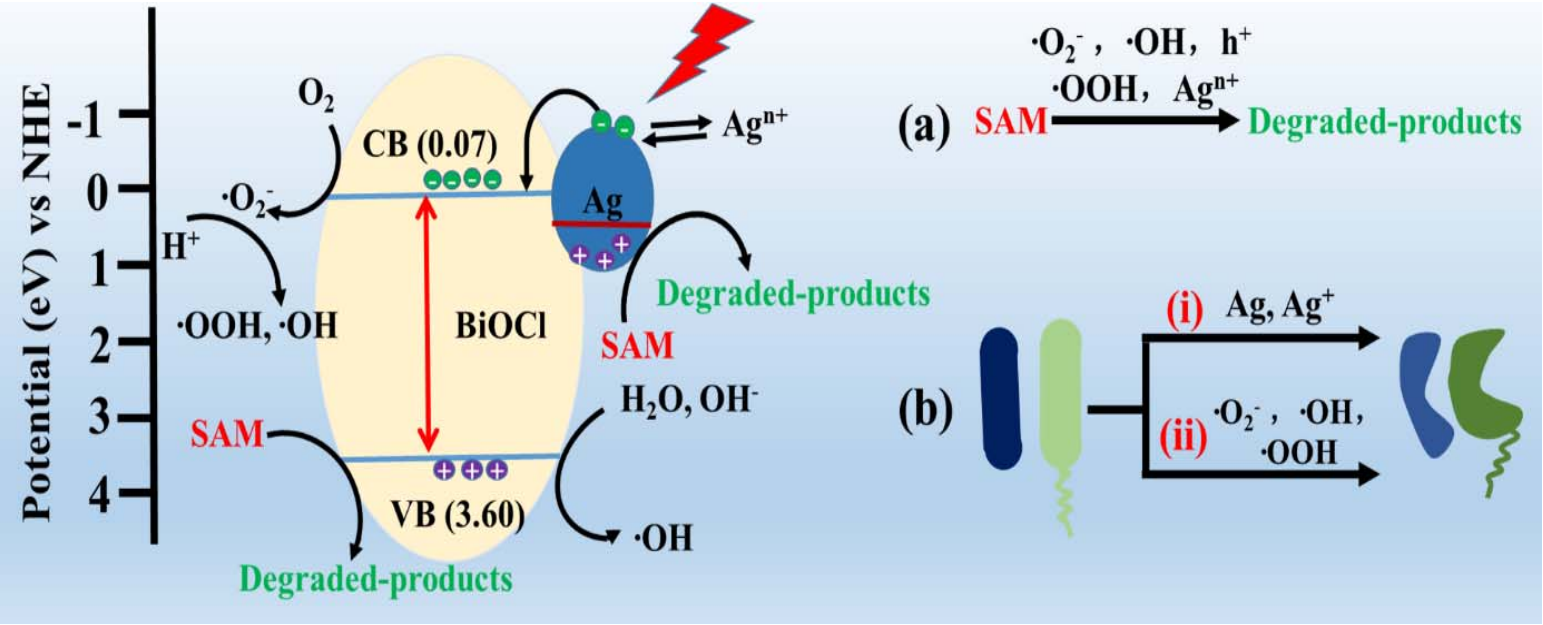
Possible mechanisms



- Absorption of visibe light of Ag due to SPR effect
- Improved photo-excited electron-hole pairs separation efficiency
- Generation of various active species
- Degradation of SAM due to active species
- Antibacterial effect due to active species and Ag

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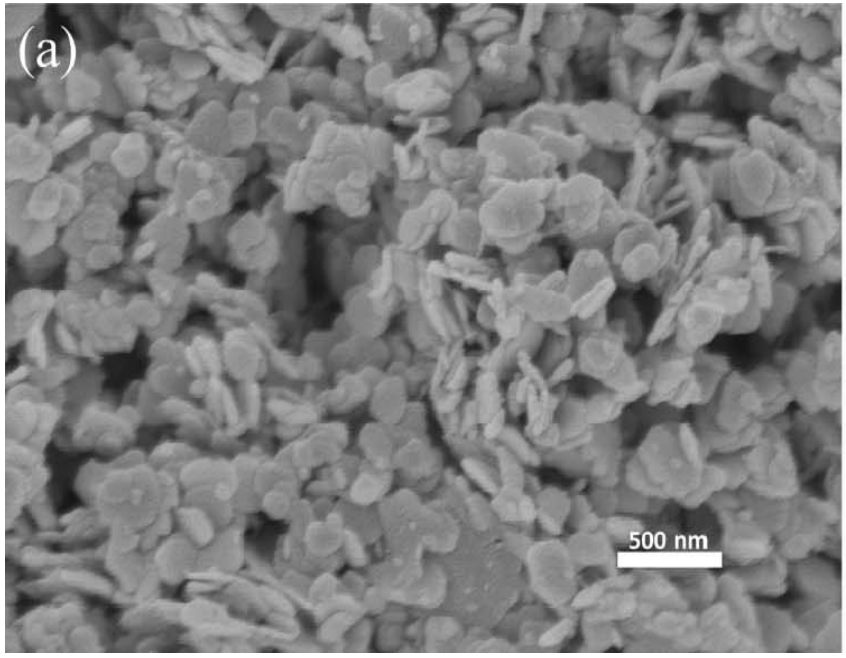
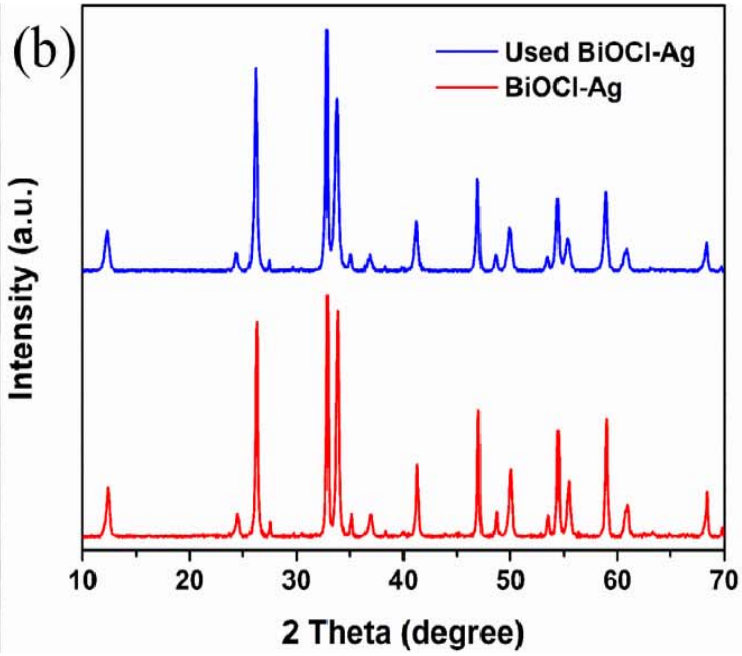
Photostability of BiOCl-Ag





SEM image after 5 cycles

XRD pattern after 5 cycles

- **No clear change of morphology**
- **No clear change of crystallinity**
- **Good photostability!**

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Conclusions

- Introduction of Ag NPs affected the properties of BiOCl
- BiOCl-Ag composites presented significant improved photocatalytic properties
- SPR effect of Ag NPs plays an important role
- BiOCl-Ag composites are promising candidate as photocatalysts

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Thank you

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