

Title : Development of Lead-free Halide Perovskite Photocatalysts on Porous Support Materials for Oxidation of Toluene under Visible Light

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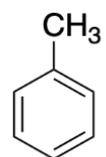
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ABSTRACT

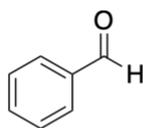
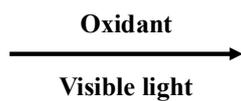
Lead-free halide perovskite photocatalysts on porous support materials were developed herein for the oxidation of toluene under visible light. In this study, silica gel beads (SiO_2 , SG) were employed as photocatalyst supports and their surfaces were modified with MCM-41 (MSG) by the hydrothermal method to enhance catalyst distribution and immobilization on porous surface of silica. Two lead-free halide perovskites, cesium bismuth bromide ($\text{Cs}_3\text{Bi}_2\text{Br}_9$, CBB) and cesium antimony bromide ($\text{Cs}_3\text{Sb}_2\text{Br}_9$, CSB), were synthesized on porous supports (SG and MSG) by impregnation and anti-solvent precipitation methods. The growth of CBB and CSB particles on porous silica, including their surface morphology, crystal structure, light absorption, and charge separation were investigated by SEM-EDS, XRD, UV-Vis spectrophotometry and PL techniques, respectively. The results showed that CSB/MSG has light absorption at 489 nm (visible range), while MSG absorbed light at 282 nm (UV range). Steady-state photoluminescence study indicated that the CSB has lower recombination rate than CBB, which is advantageous for enhancing photocatalytic activity. The CSB/MSG demonstrated superior photocatalytic activity, achieving a toluene oxidation rate of $221.34 \mu\text{mol g}^{-1} \text{h}^{-1}$ with 82.88% benzaldehyde selectivity.

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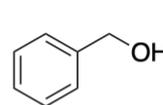


Toluene



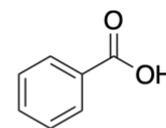
Benzaldehyde (BAD)

+



Benzyl alcohol (BA)

+



Benzoic acid (BZA)

**Lead-free halide perovskite photocatalysts
on porous support materials**

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