Photocatalytic performance of carbon modified $BiVO_4$ for degradation of phenol under visible light

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Introduction

$BiVO_4$ is an excellent visible-light photocatalyst that is attributed to its narrow band gap, hemical stability and nontoxicity. However, the photocatalytic activity of the pure $BiVO_4$ still needs improvement due to the high recombination rate of photogenerated e^-–h^+ pairs. Recently, Wang et al. [1] synthesized carbon modified TiO_2 nanotube array photocatalysts by sucrose graphitization, and found that these photocatalysts showed the enhanced photoelectric catalytic activity due to the high migration efficiency of photoinduced electrons at the graphite-like carbon/TiO_2 interface. Therefore, It is worth researching how to reduce the recombination rate of photogenerated e^-–h^+ pairs at the carbon/$BiVO_4$ interface. Moreover, in order to study the effect of the carbon precursors on the photocatalytic activity better, sucrose and glucose were used in the preparation of catalyst. The photocatalytic activities were evaluated by phenol degradation under visible-light irradiation.

Materials and Methods

The catalysts was prepared by a hydrothermal method firstly and then calcination [2]. Sucrose and glucose were used as the carbon precursor. In the photocatalytic experiments, a 350 W Xe lamp was used as the light source and the UV part of the light was removed by a cut-off filter (λ>420nm). In all experiments, 200 mL 5M phenol solution and 0.2 g of catalyst was added into the reaction cell. Adsorption was conducted in the dark for 30 min before the lighting started. The temperature for all the photocatalytic reactions was kept at 25 ± 1 ℃. Illumination time was 3h and detection instrument was HPLC.

Results and Discussion

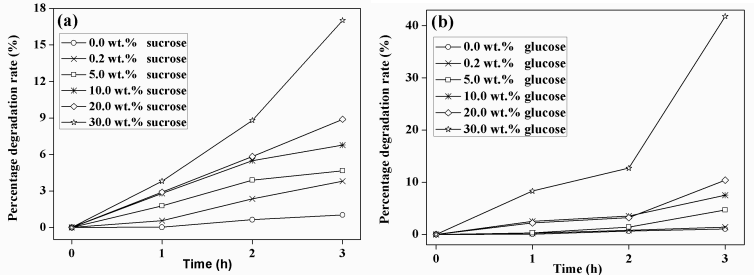

Fig. 1. The photocatalytic activities of carbon modified $BiVO_4$ for thedegradation of phenol, (a) sucrose and (b) glucose

The photocatalytic activities of carbon modified $BiVO_4$ for the degradation of phenol are shown in **Fig. 1**. It can be seen from **Fig. 1** that the phenol degradation rate increases with the increase of carbon precursors amount for both sucrose and glucose. The result indicates that the modification of carbon increase the photocatalysis of $BiVO_4$.

The effects of carbon precursors on the degradation of phenol are shown in **Fig. 2**. As can be seen, the catalysts with glucose and sucrose as the precursors have similar photocatalytic activity when precursor amount is less than 20 wt.%. However, the former has higher photocatalytic activity when precursor amount is greater than 20 wt.%. The result indicates that the choice of the carbon precursor had a great influence on the photocatalytic activity of $BiVO_4$.

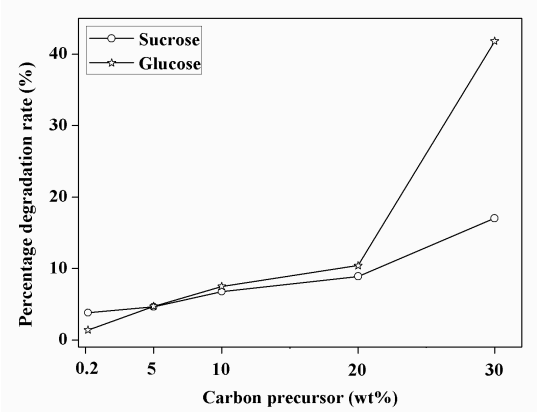

Fig. 2. The effects of carbon precursors on the degradation of phenol

Significance

Carbon modified $BiVO_4$ can enhance photocatalytic activity in degradation of phenol under visible light. The choice of the carbon precursors had a great influence on the photocatalytic activity of $BiVO_4$. The degradation rate increases with the increase of carbon precursors amount. Catalyst has much higher photocatalytic activity when the carbon precursors amount is greater than 20 wt.%.

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References

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