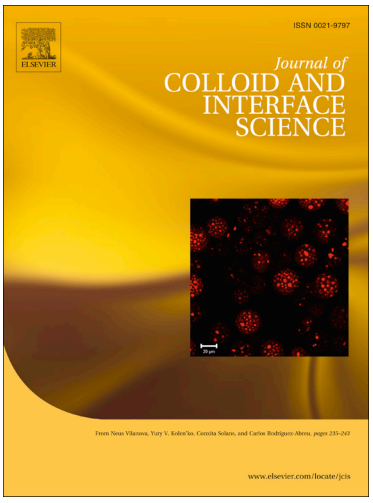

A novel visible-light responsive photocatalytic fuel cell with a heterostructured $BiVO_4/WO_3$ photoanode and a Pt/C air-breathing cathode

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A novel visible-light responsive photocatalytic fuel cell with a heterostructured $BiVO_4/WO_3$ photoanode and a Pt/C air-breathing cathode

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Abstract:

A series of heterostructured $BiVO_4/WO_3$ photoanodes were successfully prepared via a two-step method of hydrothermal deposition and impregnation. The optimized $BiVO_4/WO_3$ sample showed the highest photocurrent density of ~880 μA/cm^2 at 0.8 V (vs Ag/AgCl) in 0.1 M KH_2PO_4 aqueous solution (pH 7) under simulated AM1.5 illumination. The optimized $BiVO_4/WO_3$ photoanode was coupled with a Pt/C air-breathing cathode to build up a visible-light responsive PFC system. The as-prepared PFC system showed outstanding photoelectrocatalytic performances in converting organics into electricity, and when glucose was used as the 'fuel', the maximum power density (P_{max}) and the short-circuit current density (I_{sc}) were 8.58 μW/cm^2 and 91.8 μA/cm^2, respectively. Degradation experiments showed that the removal rate of tetracycline hydrochloride in PFC with $BiVO_4/WO_3$ photoanode and Pt/C air-breathing cathode was ~87.2% in 8 h, which was much higher than photolysis and photocatalysis process. The mechanism responsible for the enhanced photoelectrocatalytic performance of the as-prepared PFC system was also discussed.

Keywords:

$BiVO_4/WO_3$ photoanode; Pt/C air-breathing cathode; photocatalytic fuel cell; power production; photoelectrocatalytic degradation