Simultaneous removal of As(III) and As(V) from wastewater by co-precipitation using an experimental design approach

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ABSTRACT

Response surface methodology (RSM) with central composite design was used to determine the significant effects of pH, ferric ion, and initial arsenic concentrations on the removal efficiency of arsenic by a co-precipitation method. The regression function, with coefficients calculated by multiple linear regression, was calibrated and validated using external experimental runs. The correlation coefficients (R²) of the actual vs. predicted arsenic removal percentages were 0.9871 and 0.9478 for As(III) and As(V), respectively. All major factors were determined to be significant by analysis of variance, with p-values < 0.01 and had a district effort on the removal process. Multi-layer response surfaces were developed to determine the highest removal efficiency. The maximum removal efficiencies for arsenic species were approximately 100%, achieved by model prediction with a Fe/As mole fraction of 3.34 at pH 7. These optimized conditions were then applied to remove arsenic from two industrial wastewater samples, giving efficiencies of 93.98 and 91.48%. The results reveal that the chosen conditions from the RSM approach are applicable for arsenic removal from real water samples, without any pretreatment process.

Keywords: Simultaneous removal; Arsenic; Central composite design; Response surface methodology; Wastewater

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