

Removal of As(V) from waters by reaction with cerussite PbCO_3

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Arsenic is one of the most toxic elements and occurs at concentrations above drinking water standards (0.01 mg/dm^3) in many parts of the world [1]. A novel method for removal of AsO_4^{3-} ions from aqueous solutions is proposed herein. The principle of the method is based on reaction with cerussite PbCO_3 in the presence of Cl^- ions, resulting in precipitation of mimetite $\text{Pb}_3(\text{AsO}_4)_3\text{Cl}$.

To determine the effectiveness of the method, solutions containing 50 mg As(V)/dm^3 were reacted with synthetic crystalline cerussite powder (grain size $2 - 10 \mu\text{m}$) at pH from 2 to 8 in the presence of Cl. The solutions were tested for AsO_4^{3-} and Pb (using colorimetry and AAS, respectively) while solids were analysed by XRD and SEM-EDS.

In all experiments, As(V) is removed and mimetite forms as fine-crystalline incrustations on the surface of cerussite. Most of the As is eliminated from solution within one day of the reaction. After 5 days, the [As] stabilizes to values between $0.82 \text{ mg As(V)/dm}^3$ for pH=2 and $6.07 \text{ mg As(V)/dm}^3$ for pH=8. Repeating the procedure three times with the same solution but a new portion of cerussite results in a further reduction in [As] to values below $0.04 \text{ mg As(V)/dm}^3$ and $4.57 \text{ mg As(V)/dm}^3$ for pH=2 and pH=8, respectively. The same cerussite can be used several times: a 4-time repeated use with a new solution still results in a decrease in [As].

Very low solubility of mimetite, with which the solution is in equilibrium, ensures that As(V) and Pb concentrations are very low. The best results are obtained at a pH between 4 and 6: [As] is reduced by more than 96% and cerussite can be used several times since mimetite incrustations do not block the surface of the reacting cerussite. Optimization of this method can lead to the development of new technology for As(V) removal from aqueous solutions.

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[1] Murcott S. (2012). Arsenic Contamination in the World. IWA Publishing, London.