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Destabilization potential of Fe³⁺ and Al³⁺ chloride salts and af-PFCl of Mg(OH)₂ during the treatment of AMD

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The treated acid mine drainage (AMD) was collected from the western decant in Krugersdorp, South Africa and was investigated in a series of small-scale laboratory tests using 200 mL of AMD dosed with FeCl₃, AlCl₃ and a synthetic acid free (af) flocculent prepared by a mixture of FeCl₃ and Mg(OH)₂ (af-PFCl_{Mg}) respectively, the latter being to reduce the negative effect of the reagents (FeCl₃ and Mg(OH)₂) when dosed in pure form. Three treatment methods were employed such as a jar test, no mixing and a shaker. The speed of the equipment used for mixing and shaking was at 250 rpm for 2 mins and allowed to settle for 1 hour after which the pH, conductivity and turbidity were measured. The experimental results show that turbidity removal in the samples with AlCl₃ and a synthetic af-PFCl_{Mg} is similarly identical but slightly higher than that of the samples with FeCl₃. The results showed that conductivity has an impact on the rate of hydrolysis. Comparative turbidity removal of the AMD sample between AlCl₃, FeCl₃ and af-PFCl indicates that the latter is an ideal replacement of a corrosive FeCl₃ and Alzheimer-associated AlCl₃. On the other hand, the optimal turbidity removal of the samples without mixing shows that destabilization-hydrolysis depends on the valence and electronegativity of the metal ions, which also indicates the insignificant effect of the pH adjustment. The SEM images show that the sludge in the samples with af-PFClMg dosage consists of a large cake-like structure, which is typical of optimal adsorption. The formation of the precipitates was found to be influenced by the ionic strength of the metal ion rather than by the pH of the solution.

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