

Mechanisms of Gold Recovery From Aqueous Solutions Using Gallic acid-modified Magnetite Particles Synthesized Via Reverse Co-precipitation Method

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Abstract: Gallic acid-modified magnetite particles (Mag-GA) were synthesized via reverse co-precipitation method. The obtained Mag-GA were characterized by Fourier Transform Infrared spectroscopy and X-Ray diffraction. FTIR characterization for Mag-GA after modification indicated the presence of specific absorption bands for functional groups of humic acid and Fe-O bonds, though with lower intensity than before modification. The XRD patterns showed that the crystallinity of magnetite before modification were higher than after modification with gallic acid. The mechanism of synthesis was assumed to occur through electrostatic bonding between the surface of magnetite and gallic acid. The Mag-GA particles were applied for AuCl_4^- adsorption and results showed that the optimum adsorption of $[\text{AuCl}_4]^-$ onto Mag-GA was found at pH 3. The mechanism of gold recovery using Mag-GA particles takes place through the formation of hydrogen bonding followed by reduction of trivalent gold ions to metallic gold, which is accompanied by simultaneous oxidization of the hydroxyl groups of gallic acid. This assumption was supported by FTIR spectra, XRD chromatogram and photo-optical microscope that showed the presence of metallic gold on Mag-GA after adsorption.

Keywords : Gallic acid-modified magnetite particles, the reverse co-precipitation, the synthesis mechanism, the mechanism of gold adsorption onto Mag-GA particles.