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Highly efficient and selective recovery of Au(III) from a complex system by molybdenum disulfide nanoflakes

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Abstract

The design and synthesis of efficient adsorbing materials for recovery of precious metal are of paramount importance for fulfilling high-tech industry's need. Herein, a one-step hydrothermal synthesis method was employed to construct the sulfur-rich MoS₂ nanoflakes under a mild condition. The first experiment evidence proved that MoS₂ nanoflakes were capable of capturing gold, with an extremely high uptake capacity (1133 mg g⁻¹) and excellent selectivity. More importantly, MoS₂ nanoflakes showed preferential Au³⁺ uptake behaviour compared with other precious metal ions such as Pd²⁺ (47.6 mg g⁻¹) and Pt⁴⁺ (38.5 mg g⁻¹). Different factors affecting the sorption process such as pH, adsorbent amount, contact time, ion strength, and reusability were systematically studied. The adsorption mechanism may be attributed to their intrinsically sulfur-rich characteristic for the strong soft-soft interactions between S atoms and Au atoms. These findings open up the possibility to expand the applications of sulfur-rich nanomaterials in the recovery of precious metal.

Keyword: MoS₂ nanoflakes; Recovery; Precious metal; Gold; Palladium; Platinum

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