Recovery of Valuable Ni from Electroplate Nickel Slag by Bioleaching

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Electroplate is to plate a thin layer of special metal or alloy on surface of certain metals using electrolysis. Nickel plating is one of the most widely used electroplate processes, generating a great amount of electroplate nickel slag. Nickel is both toxic and expensive. Therefore, recovery of nickel from electroplate nickel slag not only benefits the environments but also obtains economic interests. In this works, recovery of valuable Ni from electroplate nickel slag by bioleaching at high pulp density of 10% was investigated. The best leaching performance of Ni was achieved when using elemental sulfur as energy substrates and using sulfur-oxidizing bacteria as leaching strain (S-SOB leaching system). The leaching efficiency and dissolved dose of Ni respectively reached 90% and 5400 mg/l after 9 days of contact; while only 42% of Ni release was obtained when using pyrite as energy substrates and using iron-oxidizing bacteria as leaching strain. The increase in sulfur dose, decrease in initial pH value and rise in temperature evidently enhanced Ni liberation. The acid dissolution by biogenic H_2SO_4 was the dominating mechanisms for Ni leaching; however, the sole chemical-origin H_2SO_4 dissolved only 42% of Ni, indicating that the biogenic acid possessed higher leaching capacity than the chemical H_2SO_4. In addition, the electroplate nickel slag wrapped by semi-permeable membrane achieved as low as 20% of Ni liberation, suggesting that the direct contact between bacteria and slag was necessary for the Ni leaching. The leaching mechanisms of Ni leaching were further revealed using XRD, EDS and SEM analysis.

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