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Development of Anodic Cementation Reactor from Recycled Aluminum Cans to Selectively Recover Gold from Refractory Gold Ores using Copper Ammoniacal Thiosulfate solution as Lixiviant

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Abstract: The depletion of high-grade gold ores and the environmental impacts of traditional cyanidation have prompted the exploration of alternative gold recovery methods. Inspired by the previous study of Zoleta et al. (2023), which demonstrated the use of aluminum powder as a cementation agent for selective gold recovery, this research investigates the use of cast aluminum derived from recycled cans as a cost-effective and safer alternative to zero-valent aluminum powder for recovering gold from refractory gold ores using copper ammoniacal thiosulfate solution. Two anodic cementation reactor prototypes were designed using SOLIDWORKS and fabricated through sand casting. The experiments examined the effects of reactor design, agitation speed, cementation time, and iron oxide addition on gold recovery selectivity. Gold and copper recoveries were determined using Inductively Coupled Plasma Atomic Emission Spectroscopy (ICP-AES), while the surface morphology and elemental composition of the iron oxide before and after cementation were analyzed using Scanning Electron Microscopy with Energy-Dispersive X-ray Spectroscopy (SEM-EDS). Results showed that Au recovery remained consistently high, ranging from 97.19% to 98.17%. Notably, the A1B2R2 configuration—combining low agitation, extended contact time, and Reactor 2—achieved the lowest Cu recovery at 26.44%, indicating strong selectivity toward gold. These findings demonstrate the practical potential of using cast aluminum reactors made from recycled cans for safer, selective, and cost-effective gold recovery from refractory ores.

Key Words: Selective Cementation; Refractory Gold Ores; Cast Aluminum Reactor; Ammoniacal Thiosulfate; Gold Recovery

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