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Hydrazine reduction process for copper recovery from spent copper etching solution from printed circuit board manufacturing

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This research aimed to study the technology of copper recovery from spent copper etching solution by hydrazine reduction process from PCB manufacturing. The initial pH of waste was 0.2 and total copper concentration was 18,540 mg/L which 96% of soluble form. The optimal reduction conditions were determined including initial pH, amount of hydrazine and reaction time. Initial pH were tested at 0.2, 3, 5, 7, 9 and 11 with hydrazine amount of 0.5, 1, 2 and 3-folds of stoichiometry under reaction time of 0-60 minutes. After copper reduction process, solid sludge were seeded and aged at 55° for 2 hours in comparison with, without seeding and ageing process. Settling capability was tested, aimed to be a guideline for settling tank design. In addition, characteristics of solid sludge morphologies and phase identification of a crystalline material, as well as copper content were assessed. Results indicated that hydrazine reduction approach for copper recovery requires at least 20 minutes for reaction time to be completed. The most effective condition was found when initial pH was adjusted to be 11 with 0.5-folds of stoichiometry for hydrazine applying. Dissolved copper concentration could be reduced significantly which soluble copper concentration remained 113 mg/L, corresponding to 99.4% of copper removal efficiency. When initial pH were set to be 0.2, 3, 5, 7 and 9 with 3-folds of stoichiometry for hydrazine applying, however, soluble copper concentrations were found in range of 5746-2477 mg/L corresponding to copper removal efficiencies of only 67-86%. For the settling ability aspect, after 2 hours at 55 oC of seeding and ageing processes, dense solid sludge could instantly be formed. Large metal flocs, which are easily separated from the supernatant in comparison to without seeding and ageing case, were observed. Obtained solid particles morphologies presented in smooth spherical shape with average particles size of approximately 5-10 m. For the pH 11 case, at optimal condition for hydrazine reduction, results exhibited similar copper fraction in dried solid sludge of 79 and 74% (w/w) for with and without seeding and ageing process, respectively. Oxide forms of copper in solid sludge composition including tenorite (CuO), cuprite (Cu_2O) and brochantite ($Cu_4SO_4(OH)_6$) were detected.

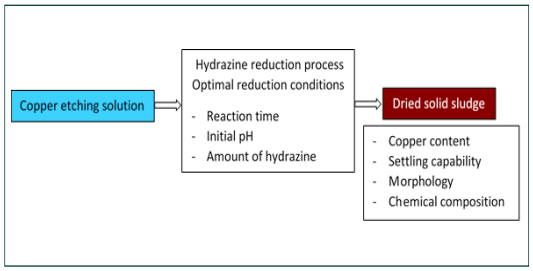

Figure-1: Schematic of hydrazine reduction process for copper recovery from spent copper etching solution from printed circuit board manufacturing.

Biography

Nanthanat Sriprasert is a Lecturer of Environmental Technology in Faculty of Environment and Resource Studies at Mahasarakham University, Thailand. She enjoys both research and the educational role of supporting students on professional and personal development. Her research has currently been focused on pollution control and environmental sustainability, especially, the process of utilizing industrial and agricultural waste/wastewater into useful products by recycling. She has her expertise in waste recycling and waste management, particularly, technologies of base and precious metals recovery from e-waste and PCBs manufacturing wastewater. She has completed her BEng and MEng in Environmental Engineering from Suranaree University of Technology, Thailand. She was awarded her PhD by University of Southampton, UK, for the work on requirement and distribution of trace elements in mesophilic anaerobic digestion.

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