Sulfide precipitation coupled with polyelectrolytes for Cu and Ni removal from printed circuit board complex rising wastewater

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Abstract

Heavy metals pollutants from various types of industrial effluents such as metal plating, tanneries, batteries, mining and electronic parts facilities, etc., become seriously environmental problems nowadays. Chemical precipitation, particularly, using hydroxide precipitation technique is the most widely implementation for soluble heavy metals removal from industrial wastewater due to its relatively inexpensive and simple application. Sulfide precipitation is also concerned one of the most effective method to treat heavy metal ions regarding to its non-amphoteric sludge characteristics. In addition, metal sulfide sludge has shown better thickening and dewatering properties in comparison with metal hydroxide sludge.

In this study, real complex rising wastewater from printed circuit board manufacturing industry with initial pH of 8.1, 350 mg/L suspended solids (SS), 221 NTU turbidity, heavy metals in term of total and dissolved Cu and Ni of 86.6, 41.3 and 12.4, 4.3 mg/L, respectively, have been tested with 0 – 5 folds Na_2S of stoichiometry (considering to Cu removal) to evaluate Cu and Ni removal efficiencies. Thereafter, sulfide precipitated wastewater was further treated by cationic and anionic polyelectrolytes under dosing rates of 0.25 – 5.0 mg/L in order to evaluate sludge settling ability.

The results showed that optimum dosage of Na_2S was 1.5 times of stoichiometry for copper removal with 5 minutes of reaction time. In this stage, it found that Cu and Ni concentrations and turbidity have been reduced for 98.1 and 98.6 and 99.9 %, respectively. Optimum dosages of cationic and anionic polyelectrolytes were found to be the same value at 4 mg/L, corresponding to total Cu removal of 99.1 and 99.2 %, Ni removal of 91.1 and 89.5 % for cationic and anionic polyelectrolytes application, respectively. Removing SS values in supernatant after cationic and anionic polyelectrolytes adding were 28 and 16 mg/L, referring to SV30 of 60 and 65 mL/L, which sludge setting velocities have been improved to 11 and 13-folds, respectively. Precipitated sludge characteristics obtained from XRD presented amorphous form with recovered Cu and Ni in dried sludge of 11.6 – 12.3 % and 0.006 – 0.007 % (w/w) for cationic and anionic polyelectrolytes applying, respectively.

Recent Publications

1. Sriprasert P., Banks C.J. and Heaven S., 2016, Applications of gas-sparged two-phase flow and three-phase moving bed for fouling control in AnMBR systems, Presented to Workshop on Anaerobic Membrane Bioreactors: in situ membrane cleaning, University of Southampton, Southampton, The UK, 20th June.
2. Sriprasert N. and Sriprasert P., 2018, Hydrazine reduction process for copper recovery from spent copper etching solution from printed circuit board manufacturing, E-poster presented to the 9th World Convention on Recycling and Waste Management, Osaka, Japan, the 22nd-23rd October
3. Sriprasert N. and Sriprasert P., 2018, Recovery of copper from spent copper etching solution using wasted aluminum drill entry sheets from PCBs industry, E-poster presented to

the 5th Global Summit and Expo On Pollution Control, Prague, Czech Republic, the 25th – 27th October.
4. Sriprasert N. and Sriprasert P., 2018, Using of iron filings for copper recovery from spent copper etching solution by cementation process, E-poster presented to the 9th International Conference on Recycling: Reduce , Reuse and Recycle, Vancouver, British Columbia, Canada, the 5th – 6th December.
5. Sriprasert P. and Sriprasert N., 2018, Electrowinning process for copper removal from spent etching solution in printed circuit boards manufacturing, E-poster presented to the 9th International Conference on Recycling: Reduce , Reuse and Recycle, Vancouver, British Columbia, Canada, the 5th – 6th December.

Biography

Pakpong Sriprasert is lecturer of Environmental Technology, Faculty of Environment and Resource Studies at Mahasarakham University, Maha Sarakham, Thailand. Her research currently focus on pollution control and environmental sustainability, especially, the process of water pollution and treatment of both domestic and industrial wastewater. She specializes in wastewater treatment technologies including chemical and biological processes. She has built valuable results after years of experience in these researches. Sriprasert completed BEng in Environmental Engineering from King Mongkut's University of Technology Thonburi, Thailand. She has also completed her MEng in the same field at Chulalongkorn University, Thailand. Currently, she is doing PhD at the University of Southampton, UK, she works on application of two- and three- phase flow for anaerobic membrane cleaning.

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