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Selective precipitation of Cu^{2+}, Zn^{2+} and Ni^{2+} ions using $H_2S_{(g)}$ produced by hydrolysis of thioacetamide as the precipitating agent

Paula M.O. Silva[a,b], Giselle S.C. Raulino[c], Carla B. Vidal[b], Ronaldo F. do Nascimento[b,*]

[a]*Analytical Chemistry Department, Universidade Federal Fluminense (UFF), Outeiro de São João Batista, S/N, Bairro Centro, 24020-141, Niterói, RJ, Brazil, email: paulamarcelleufc@hotmail.com (P.M.O. Silva)*
[b]*Department of Analytical Chemistry and Physical Chemistry, Federal University of Ceará, Rua do Contorno, S/N Campus do Pici, Bl. 940 CEP: 60451-970, Fortaleza, CE, Brazil, Tel. +55 85 3366 9042; emails: ronaldo@ufc.br (R.F. do Nascimento), carlab.vidal@gmail.com (C.B. Vidal)*
[c]*Northeast College – Fanor Devry, Campus Dunas, Santos Dumont Avenue, 7800, 60191-156, Fortaleza, CE, Brazil, email: gisellescr@yahoo.com.br*

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ABSTRACT

Precipitation using sulfide is an alternative method for the recovery and reuse of metal ions present in industrial effluents. This work explored the selective precipitation of Cu(II), Zn(II) and Ni(II) using $H_2S_{(g)}$ generated by the hydrolysis of thioacetamide. The studies were conducted on a laboratory scale in two stages. In the first stage, precipitation studies were performed for each individual ion (100 mg L^{-1}) at varying pH levels (0.5–6.0) and contact times (30–150 min). In the second stage, tests were performed in multielement solutions. Individual precipitation studies showed that Cu(II) precipitates in the first 30 min, and at all tested pH values, 99.9% of the copper ions were removed. The precipitation of Zn(II) required 60 min of contact time with the gas and a pH above 4.0 to reach greater than 95% removal of the ions. Ni(II) began to precipitate at pH 6.0 after 120 min and reached greater than 90% removal. In the second stage, the fractional precipitation studies of Cu^{2+}–Zn^{2+} and Cu^{2+}–Ni^{2+} systems, it was possible to separate and precipitate both metal ions above 90%. For the Zn^{2+}–Ni^{2+} system, rigid control of pH was required to separate the metal sulfides because of their very close pK_{ps} values, but a removal of 90% was achieved for both ions. The results of the fractional separation involving three metal ions, Cu(II), Zn(II) and Ni(II), were satisfactory and did not require the use of complexing agents.

Keywords: Selective precipitation; pH; Toxic metals; $H_2S_{(g)}$

* Corresponding author.