

(Bio)Leaching of copper from Kupferschiefer with citric acid

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The Central European Kupferschiefer deposit bearing copper up to five percent is the most important natural copper resource in Europe, and thus raised again interest of both industry and science. Due to the complex composition of the shale including copper and sulfide rich ores, carbonates and organic compounds there is no efficient biotechnological approach applied yet. Although promising approaches using acidophilic microorganisms were presented [1] issues such as acid pretreatment and resulting gypsum waste remain. Thus leaching at neutral and alkalic pH ranges has been investigated using both foreign and indigenous species including yeasts [2-4]. Especially usage of microbially produced organic acids [5] has shown good results regarding copper recovery. In previous studies [4] the impact of glutamic (see figure) and citric acid on copper minerals in Kupferschiefer ore has been examined using bulk chemicals. The presentation compares those results to copper leaching with citric acid as biotechnologically produced product in fermentation broth produced by the yeast *Yarrowia lipolytica*.

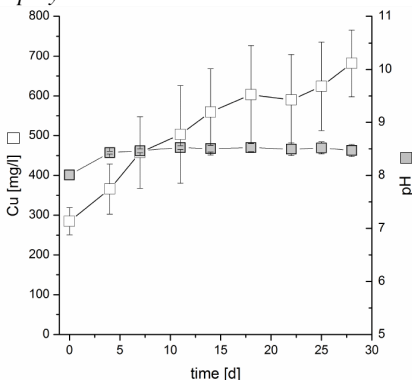


Figure: Copper concentrations and pH in the leaching batch within 28 days of leaching, containing Kupferschiefer ore (particle size 0.1-2 mm, 5 % pulp density) and 1 % GA.

[1] Sethurajan *et al.* (2012) *Environ. Eng. Manag. J.* **11** (10), 1839-1848. [2] Matlakowska *et al.* (2010) *Environ. Sci. Technol.* **44** (7), 2433-2440. [3] Rajpert *et al.* (2013) *Chemosphere* **91**, 1257-1265. [4] Kostudis *et al.* (2015) *Min. Eng.* <http://dx.doi.org/10.1016/j.mineng.2014.12.035>. [5] Anjum *et al.* (2010) *Appl. Clay. Sci.* **47**, 356-361.