

## Electrochemical Characterization of Some Stages of the Acid Rock Drainages (ARD)

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Metal recovery is one of the main activities in the world; however, it generally ends with mining solid residues. This kind of residues is exposed to the open air, having the pyrite and arsenopyrite the as main components in some cases. Thus, the oxidation or dissolution of these sulfide minerals are the responsible of the generation of acid rock drainage (ARD) during weathering [1-3]; here the importance of electrochemistry and surface chemistry of arsenopyrite and pyrite minerals for understanding the mineral behavior and, with this information, the possibility of proposing technological alternatives in the treatment of this residues. On the other hand, the electrochemical characterization using cyclic voltammetry with carbon paste electrodes containing mineral particles (CPE-Mineral) has been an effective tool to demonstrate the overall reactivity (i.e. dissolution factibility) of the minerals, at the last decade. In this work, a comparative voltammetric study has been performed on a high purity pyrite mineral (98.8%) and arsenopyrite mineral (content of 86.95% arsenopyrite, 11.84% pyrite), in order to identify the stages where the ARD is generated due to the oxidation processes of the pyrite and arsenopyrite and the repercussion on their reactivity. Results of this work showed that the anodic behavior of the pyrite was according to literature [3]; however in arsenopyrite mineral the voltammetric studies showed the oxidation stages where the ARD is generated, also some of the products of the arsenopyrite oxidation were identified. In a first stage the oxidation was to  $\text{Fe}^{2+}$ , realgar ( $\text{As}_2\text{S}_2$ ),  $\text{H}_3\text{AsO}_3$ ,  $\text{S}^0$  and  $\text{H}_2\text{AsO}_4^-$  [4]. In a second stage the arsenopyrite and pyrite were oxidized to  $\text{FeOOH}_{(s)}$  and  $\text{S}^0$ , followed by oxidation of  $\text{S}^0$  to  $\text{SO}_4^{2-}$  and scorodite ( $\text{FeSO}_4 \cdot 2\text{H}_2\text{O}$ ) formation.

The analysis by SEM and EDS to surfaces of the electrodes with the mineral (CPE) modified by cronoamperometry, was carried out to support the reaction mechanisms. Meanwhile, to more negative potentials the recombination of  $\text{FeAsS}$  and the reduction to elemental arsenic [5] does not occur due to the formation of scorodite ( $\text{FeSO}_4 \cdot 2\text{H}_2\text{O}$ ) by a chemical reaction. On the other hand, the results indicate that the electrochemical reactivity of pyrite in the arsenopyrite mineral was delayed and displaced to more positive potentials with respect to the electrochemical response of high purity pyrite mineral, due to a galvanic effect, catalyzing the generation of the ARD.

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