

Concentration of Iranian low grade zinc ore

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ABSTRACT

Concentration of low grade zinc ore with average grade of 12% Zn has been studied. Due to increasing of reagents costs and environmental problems, hydrometallurgical methods on low grade ore are not economic. Rather, the hydrometallurgical process on zinc concentrate, produced by gravity and flotation methods, can make economical utilization of this resource. The Mineralogical studies indicated that the calcite and quartz are the main gangue minerals and the smithsonite as the main valuable zinc mineral of the ore. The liberation degree of smithsonite was determined 90 microns. By jigging tests on (-15+1) mm fraction, a concentrate grading of 29.5% Zn and a recovery of 73.5% is obtained. A concentrate of the smithsonite containing 28.5% Zn with a recovery of 68% can be obtained by the shaking table on -1 mm fraction. By flotation on a compound preconcentrate from gravity separation methods, a concentrate grading of 37.3% Zn with a recovery of 93.6% is obtained. A flowsheet combining jigging, shaking table and flotation is suitable for obtaining a final concentrate grading of 37.3% Zn and a total recovery up to 64%.

Keywords: Smithsonite, Gravity separation, Flotation, Mining Tails, Zinc Ore.

INTRODUCTION

The oxidized deposits beside sulphides one is the most important resources for production of lead and zinc. The main valuable minerals in this type of deposits are cerussite and smithsonite. Flotation is the commonly used method for beneficiation Smithsonite and other oxidized lead and zinc minerals from ores (Ciccu, et al., 1979, Pereira, et al., 2005). Separation of these minerals from gangues by flotation is extremely complex due to their similarities in physico-chemical and surface chemistry properties of constituent minerals. In addition flotation of zinc minerals is more difficult than the flotation of corresponding sulphide minerals (Rey, 1953). A lot of researches have been performed on flotation of oxidized lead and zinc ores by using different reagents and conditions (Ciccu, et al., 1979, Pereira, et al., 2005, Rey, 1953, Keqing, et al., 2005, Marabini, et al., 1994, Marabini, et al., 2007, Omasundaran 1987, Onal, et al. 2005, Peres, et al. 1994, Hosseini and Forssberg, 2006, Hosseini Forssberg, 2007, Navidi Kashani and Rashchi, 2008). The researches have been indicated that, in spite of difficulties in flotation of these minerals sulphidization-flotation technique is still a competent and applicable option for the recovery of oxidized lead and zinc minerals.

Angouran is the largest oxidized lead and zinc mine in Iran located in Zanjan province. The exploited ore containing 25 % Zn and 10% Pb is upgraded in Dandi processing plant. By flotation of lead minerals a lead concentrate grading 60% Pb is produced. The tailing of flotation is zinc concentrate containing 30% Zn which is fed in hydrometallurgical process. By selection mining in the past years, a large amount of low grade ore has been stored near the mine as waste (Irannajad, 2007). Recovery of zinc from this resource is the goal of this paper.

The low content of valuable minerals in the ore increases chemical reagents using and environmental problems in flotation and hydrometallurgical processes. So, preconcentration of the ore by gravity methods could be reduce reagents cost and environmental problems. In this research, the upgrading capability of studied resource by combination of gravity and flotation methods are investigated by performing different flotation, jigging and tabling tests.

MATERIALS AND METHODS

About 1 ton representative sample was collected from said low grade stockpile. The crushing of the sample was done by