

THE COPPER, LEAD AND ZINC RECOVERY OF THE MINERALS PARTIAL OXIDATED WITH CHELATANT ACTION REAGENTS

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ABSTRACT. The flotation of copper minerals with salicylaldoxyme shows a good selectivity of the reagent. 8-hydroxyquinoline (oxyne) is less selective because part of calcite floates and decreases the copper content of the concentrate. In this case is demonstrated the utility of the flotation in two steps when the recovery percentage of the copper increases in the concentrate and decrease in the sterile.

The flotation of the lead and zinc minerals partial oxidated with oxyne shows an increase in the recovery of lead and zinc when the flotation in two stages is replaced by the flotation in three stages, better then the replacing of one stage with two stages flotation.

For copper, lead and zinc partial oxidated minerals the results obtained using oxyne are net superior to those obtained by preliminary sulphating of the surface. By using of the oxyne the recoveries increases as well as the metal content.

INTRODUCTION

The chelating action reagents are used to for ores separation by flotation [1-6], because if it was proved that it is specific for certain ions in solution, they would keep their selectivity even in the case of the adsorption to the surface of the minerals which contain these metallic ions [7-13].

Considering that the ores which follow to be studied contained the Cu (II), Pb(II), Zn(II) ions, we studied some chelating action reagents which form, in solution, stable chelatant compounds with these ions. We used a microflotation device [4-6]. Salicylaldoxyme and 8-hydroxyquinoline (oxyne), which gave the best results, were used for the ores containing oxidized minerals because, with common collectors, a satisfying recovery (couldn't be) is not attained and even when it is realized, a selective separation from the sterile is not achieved.

EXPERIMENTAL

For the experimental determinations we used a Wedag microflotation cell.

The two reagents with chelatant action salicylaldoxyme and oxyne, were tested in order to study their behaviour relating the natural minerals (the ones partially oxidised) containing copper, lead and zinc which contains quartz and calcite and have a grading in the range 45-250 μ .

When salicylaldoxyme is used, the experimental took place in the following way: 200 g ore are introduced in 1l cuve, 800 cm³ water are added, pH is fixed at 8, the reagent's solution is introduced, and after 5 minutes of conditioning it is floated 2-5 minutes (till the foams is exhausted), with a rotor speed of 1200 rotation /minute. 150 g/t foaming agent are introduced one minute before the end of the conditioning.

For the oxyne, a different procedure is adopted, because its solution in oil forms an emulsion with the water. The reagent's solution was 3 minutes emulsified with 200 cm³ water in the flotation cell, the pH was maintained at 7,5-8, the conditioning time was 10 minutes and during the flotation an air stream was introduced for 5 minutes.

The concentrate and the sterile obtained after the flotation are filtered, dried, weighted and analysed to determinate copper, zinc or lead.

The experimental followed the influence of the reagent's concentration (salicylaldoxyme or oxyne) on the copper, zinc or lead content and also the recovery percent of these metals in the partially oxidised ores studied.

RESULTS AND DISCUSSIONS

In a series of determinations salicylaldoxyme was used for the copper recovery from the ore composed by malachite and calcite containing 0,92% Cu.

It was worked at different salicylaldoxyme concentrations ranging 140 g/t - 1500 g/t. The copper content (% Cu) in the concentrates and steriles obtained were calculated.

In figures 1 and 2 can be noticed a good selectivity of the salicylaldoxyme, which at 750 g/t concentration leads to a concentrate containing 45,8% Cu.

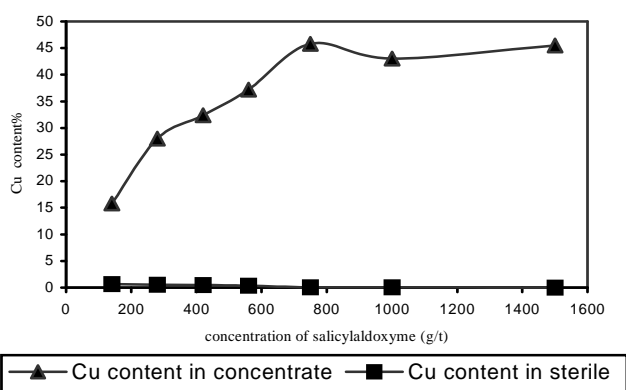


Figure 1 The variation of copper's content in concentrate and in sterile depending on the concentration of salicylaldoxyme for a copper ore

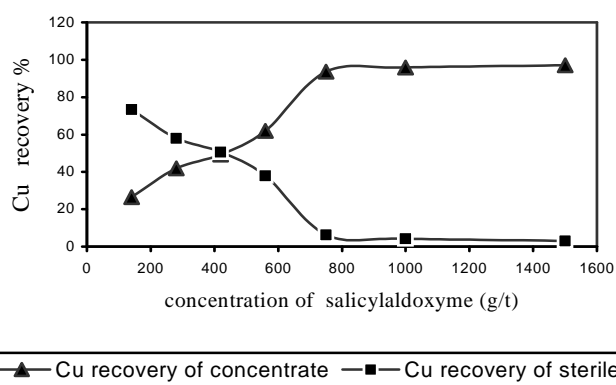


Figure 2 The variation of the copper's recovery in concentrate and in sterile depending on the salicylaldoxyme concentration for a copper ore

In these conditions a 93,6% recovery is attained and copper's content in the sterile is 0,06%. For 1500 g/t reagent, the recovery increases at 97%, the copper content in the concentrate decreases at 45.5% and in the sterile decreases significant till 0,028%.

Another series of determinations were realised using the 8-hydroxyquinoline (oxyne) for copper, lead and zinc recovery for three sorts of ores: copper, lead-zinc and copper-lead-zinc ore.

Malachite and calcite with 0,67% content of Cu constitute the sample of copper ore.

It was worked at different oxyne's concentrations ranging between 500 g/t and 2500 g/t.

In figures 3 and 4, the variation of Cu content and Cu recovery in the concentrate and in the sterile depending on the oxyne concentration can be followed.

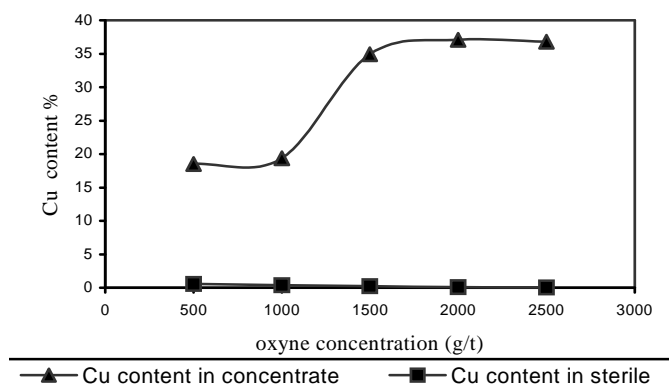


Figure 3 The variation of copper's content in concentrate and in sterile depending on the oxyne's concentration for a copper ore

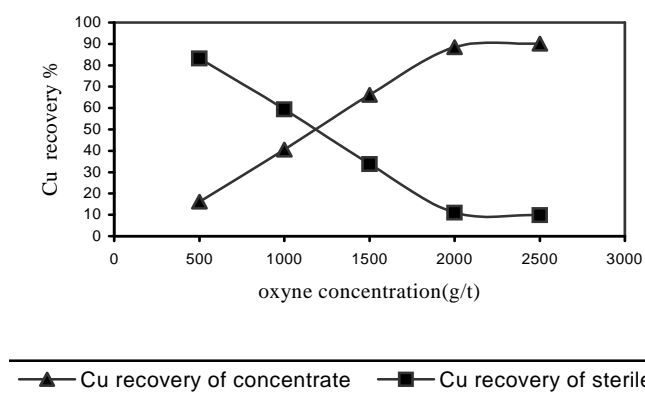


Figure 4 The variation of the copper's recovery in concentrate and in sterile depending on the oxyne concentration for a copper ore

It can be noticed that good copper recovery from the concentrate (88,5% respectively 90,14% is realised only at high oxyne's concentration, 2000g/t respectively 2500 g/t. In these conditions, the copper recovery from sterile decreases at 11,5% respectively 9,86% (greater values then in the case of the salicylaldoxyme). The copper content in the concentrate is 37,1% respectively 36,8%, smaller then in the case of salicylaldoxyme. This event demonstrates that a fraction of calcite floats and so the oxyne is less selective then salicylaldoxyme.

The influence of the reagent's addition in stages was followed using the same ore. For 2500 g/t reagent we realised a two stages flotation using 1500 g/t respectively 1000 g/t oxyne in every stage therefore two concentrates and a sterile were obtained. A cumulative concentrate is calculated from the two concentrates. It is noticed a recovery of 97,5% Cu of the concentrate and 2,5% Cu of the sterile and a 36,56% Cu content that demonstrates the utility of the two stages flotation for the increase of the util metal's recovery.

In the same time, by passing from one at two stages flotation the copper content in the sterile decreases from 0,067% to 0,017%.

The sample of lead-zinc ore was constituted by sulphuric lead and zinc and oxidised ores (galene, blende, lead and zinc sulphates, lead and zinc oxydes, cerusite and smithsonite) and also calcite. From the total zinc, which represents 2,98% almost 30% is oxidised and from the total lead which represents 1,25 % in proportion of 48% is oxidised. We made a flotation in one, two and three stages using the same total amount of reagent 3000 g/t, but splitted into steps of 2000 g/t and 1000 g/t respectively 1500 g/t, 1000 g/t and 500 g/t.

The experimental results are presented in Figures 5 and 6. At the three stages flotation (comparing with two stages flotation) we noticed a better growing of the util metal recovery from 89,8% to 98,34 % for zinc and from 83,4 % to 92,5 % for lead related to the passing from one stage to two stages (Figure 6).

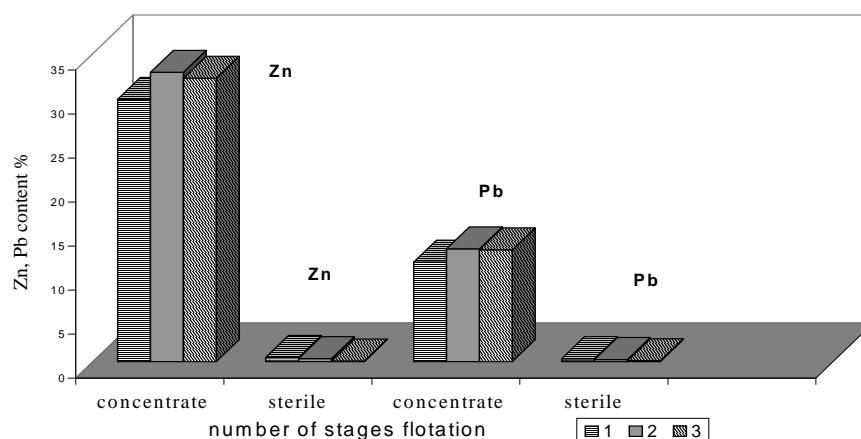


Figure 5 Zn or Pb content in concentrate and in sterile for one, two and three stages flotation

The lead and zinc content of the concentrate grows more when is passed from one to two stages flotation: from 29,8% to 32,87 % for zinc and from 11,80% to 12,80 % for lead and is mentained then almost constant for three stages flotation. The lead and zinc content in the flotation sterile is low in all the cases for example for zinc is 0,33% in two stages and 0,054 % in three stages flotation.

The sample of copper-lead-zinc ore contained: lead as carbonate, sulphate, pyromorfite and vanadite in proportion of 35 %, the difference being galene; copper as sulphate, carbonate (29%) and the remainder percent was as sulphide and calcopyrite; zinc as sulphate, carbonate (20%) and the difference being blende, quartz and calcite.

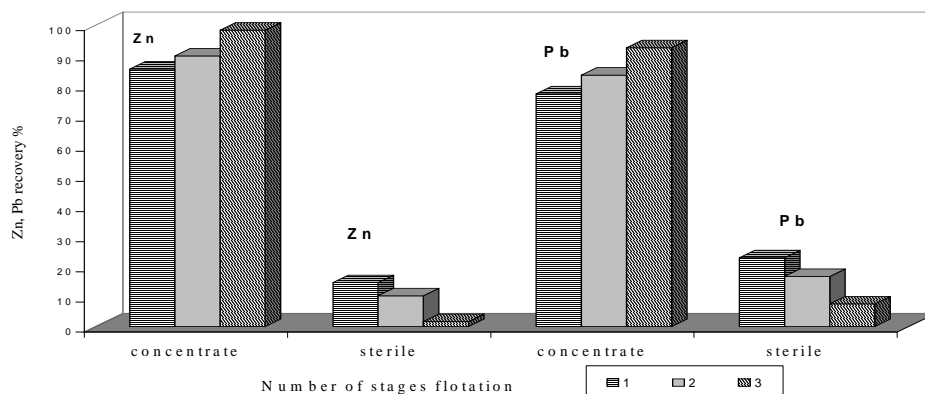


Figure 6 Zn or Pb recovery in concentrate and in sterile for one, two and three stages flotation

We performed a three-stages flotation, when we measured 1500 g/t, 1000 g/t and 500 g/t in every stage. We also performed a two stages flotation with 2000 g/t and 1000 g/t reagent in every stage.

The experimental results are included and are shown in Figures 7 and 8. An increasing of the recovery can be noticed at the passing from two to three stages flotation: for copper from 84,65% to 92,8%, for lead from 83,2 to 91,5% and for zinc from 90,74 % to 98,9%.

When the reagent 8-hydroxyquinoline is used, the results obtained are superior related at the flotation with amyl xanthate after a preliminary sulphating of the ore's surface. Therefore can be noticed an important increasing of the recovery especially for lead from 78,65% to 91,5% and for copper from 83,34% to 92,8%. For zinc the increasing realised was from 94,06% to 98,9%. The metal content in the concentrate enlarged from 1,01% to 2,18% for copper, from 5,28% to 12% for lead and from 10,41% to 21,2% for zinc. It is very important the fact that the metal content in the sterile decreased from 0,12% to 0,02% for zinc, from 0,27% to 0,097% for lead and from 0,037% to 0,015% for copper.

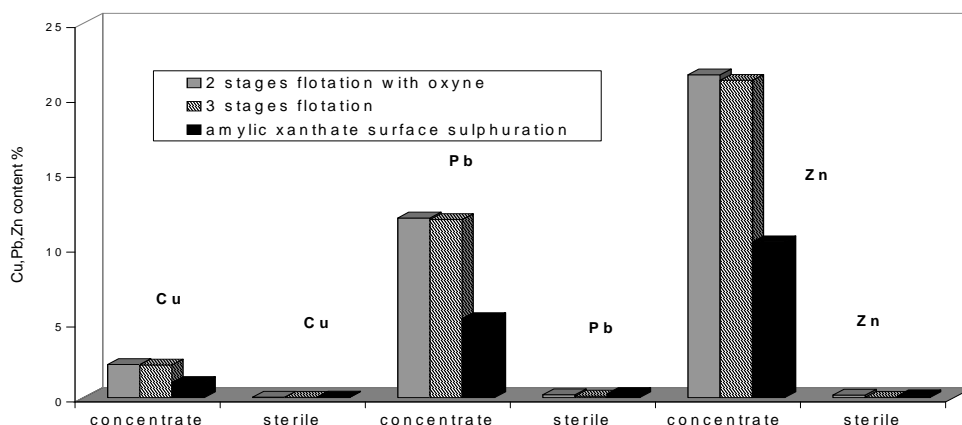


Figure 7 Cu, Zn and Pb content in concentrate and in sterile for two and three stages flotation and for amyl xanthate sulphuration of the surface

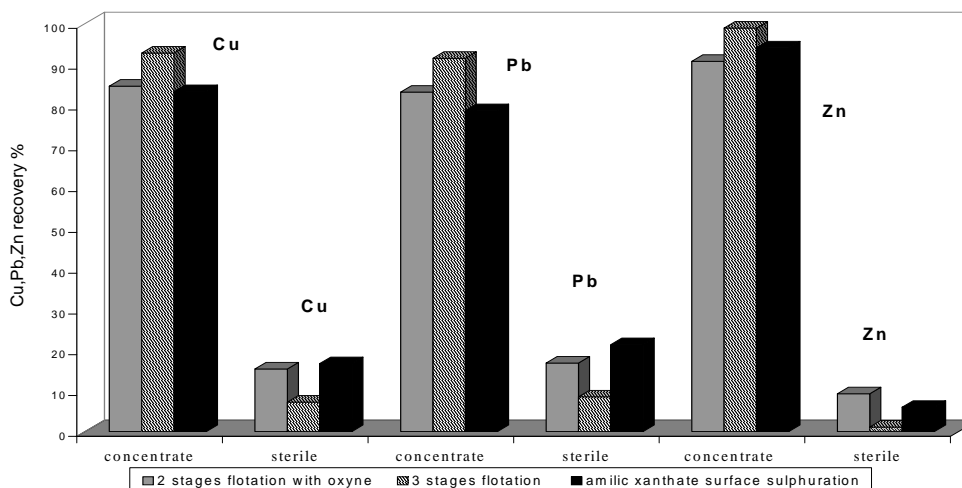


Figure 8 Cu, Zn and Pb recovery in concentrate and in sterile for two and three stages flotation and for amyl xanthate sulphuration of the surface

CONCLUSIONS

1. For the copper ore flotation with salicylaldoxyme can be noticed a good reagent selectivity that leads, for a concentration of 750 g/t reagent, to a concentrate containing 45,8% Cu.
2. A maximum recovery of the copper (97%) with 1500 g/t reagent when is realised the copper in the sterile is the least (0,028%).
3. With the oxyne (8-hydroxyquinoline), also used for copper's ores are realised goods copper recoveries (90,14%) at a concentration of 2500 g/t. This reagent is less selective then the salicylaldoxyme as it was demonstrated by the copper

content in the concentrate which has been maxim 37,1%. We demonstrated in this case that the two-stages flotation is very advantageous because the copper recovery increases at 97,5% and the copper content in the sterile decreases at 0,017% this being very important.

4. In the case of the partially oxidised lead-zinc ores the recovery are greater for the three stages flotation respectively 98,34% for zinc and 92,5 for lead when the oxyne is used.
5. For the partially oxidised copper-lead-zinc ores the obtained results using the oxyne are clearly better then those obtained by the amyl xanthate flotation after a preliminary sulphating of the ore's surface. So the recoveries increase for lead from 78,65% to 91,5%, for copper from 83,34 % to 92,8% and for zinc from 94,06 to 98,9%. The metal's content increases in the concentrate and decreases in the sterile.
6. Using the reagent with chelatant action, salicylaldoxyme and oxyne, is eliminated the difference between the oxidised and sulphured ores concerning the recovery of the util metal.

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