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The comparison between novel reagent H-142, H-143, H-145 and xanthate for flotation behaviour of molybdenum-containing ores

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ABSTRACT: In this study, a novel flotation collector reagents were tested for molybdenum containing ore. H-142 (E)-4-[(2-hydroxyethyl)amino]-3-penten-2-one, H-143 (Z)-4-[(2-[(E)-1-methyl-3-oxo-1-byteny]) aminoethyl) amino]-3-penten-2-one and H-145 (E)-4-[(6-[(E)-1-methyl-3-oxo-1-butenyl] aminohexyl) amino]-3-penten-2-one collector reagents were used in flotation process for molybdenum containing ore. Maximum metal recoveries of molybdenum were 63.61%, 67.80% and 68.13%, respectively. Molybdenum recovery of traditional collector butyl xanthate was 15.8%.

Keywords: Synthetic reagent, Flotation, Molybdenum, Collector

INTRODUCTION

Molybdenum does not naturally occur as a free metal on the Earth, but rather in various states in minerals, which is most frequently used as an alloying addition in alloy and stainless steels [1]. Its alloying versatility is unmatched because its addition enhances strength, hardenability, weldability, toughness, elevated temperature strength and corrosion resistance.

Approximately, 50% all molybdenum production comes from Cu-Mo ore as a by-product [2]. Mongolia is a major producer and exporter of copper and molybdenum concentrate, accounting for 1.2% of the world's molybdenum production [3]. Molybdenum recovery of Erdenet mining what is only one Cu-Mo mining industry in Mongolia is only 45%. It needs to find a way to increase molybdenum recovery. One of main minerals of molybdenum is molybdenite (MoS_2) that begins from primary process of geochemistry.

Flotation means to concentrate the minerals according to their physical and chemical diversity of surface, and specific character to be soaked with water. A several chemicals of different capacity are used in the flotation process. Flotation chemicals are divided as collector, coordinator and foaming according to their purpose.

Here, we present the possibility use of novel collector reagents such as (E)-4-[(2-hydroxyethyl)amino]-3-penten-2-one (H-142), (Z)-4-[(2-[(E)-1-methyl-3-oxo-1-byteny]) aminoethyl) amino]-3-penten-2-one (H-143) and (E)-4-[(6-[(E)-1-methyl-3-oxo-1-butenyl] aminohexyl) amino]-3-penten-2-one) (H-145) that recover the molybdenum from the Cu-Mo ore and compare the result with the traditional collector BX.

EXPERIMENTAL

Main analysis and experiments were carried out in the laboratory of precious and rare metals, Institute of Chemistry and Chemical Technology, Mongolian Academy of Sciences and Central Laboratory of Geology. Samples were prepared from copper and molybdenum ore of Erdenet mining in 2007. Novel reagents H-142, H-143 and H-145 as collectors that synthesized in the Irkutsk Institute of Organic

Chemistry, Russian Federation. The chemical structures are shown in Figure 1.

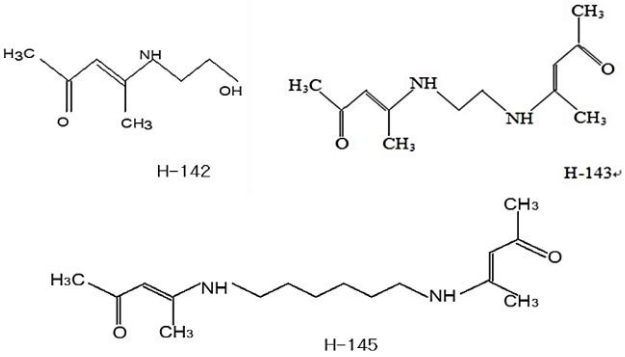

Figure 1. The chemical structure of the collectors

The reagents H-142, H-143 and H-145 were used and compared with the traditional BX with same 20-80 g/t consumption rates. The contents of metals in both ore and concentrates were investigated by chemical and photometrical analysis. The flotation process was carried out using flotation cell FL-237-A.

RESULTS AND DISCUSSION

Chemical analyses were shown that the copper–molybdenum ore contains 0.5 % of copper, 0.0275 % of molybdenum and 1.81 % of iron. The X–ray diffraction pattern showed (not shown here) a different silicate minerals reflection in copper–molybdenum ore.

We have investigated dependence of molybdenum recovery rate on collector's consumption. Molybdenum recovery changed with collectors consumption which varied between 20 -80 g/ton with 20 g/ton step.

The molybdenum metal recovery was the higher with H-142 reagent in comparison to BX collector at each consumption range of 20 to 80 g/t, as shown in Figure 2. The highest metal recovery in case of H-142 reagent was 63.61% use of collector consumption at 20g/t.

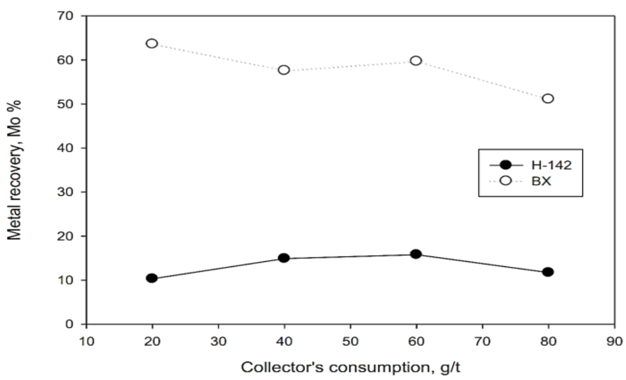

Figure 2. Dependence of H-142 collector's consumption on Molybdenum metal recovery (%)

The result shows that collecting activity of H-143 and H-145 reagents are much higher than traditional reagent BX for the molybdenum metal recovery.

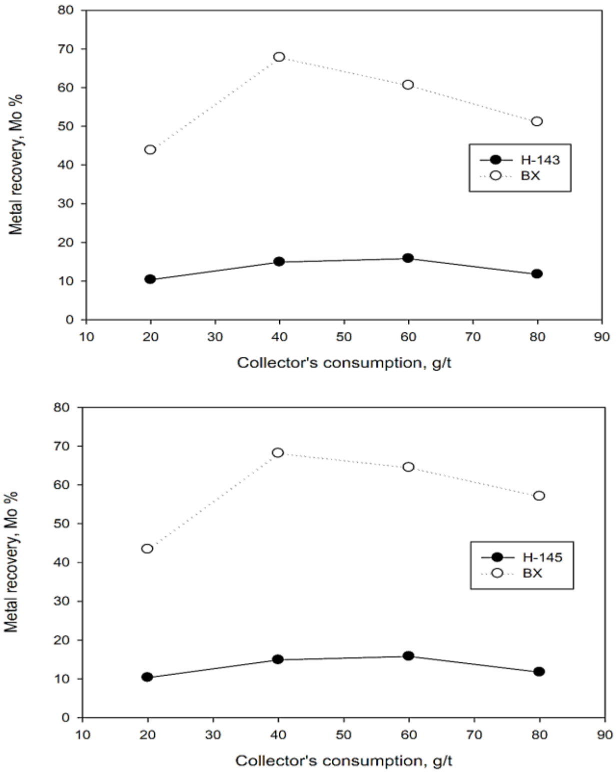

Figure 3. Dependence of H-143 and H-145 consumption on molybdenum metal recovery (%)

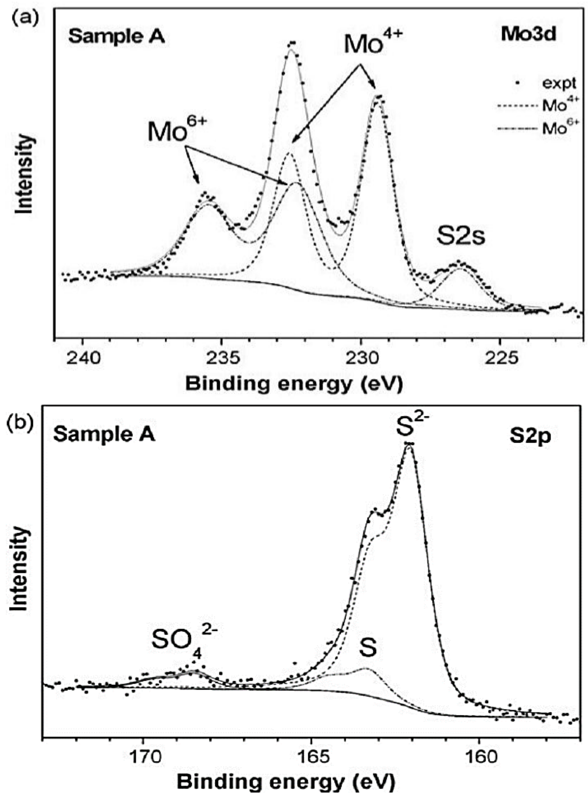

Figure 4. XPS results of molybdenite [13].

The fig. 4 is shown that MoO_3 (Mo 3d 3/2 peak at 235.7 eV) and SO_4^{2-} (168.3 eV) species are the major oxidation products at the molybdenite surface [13]. All of the novel collectors contain amine and carboxyl groups. Novel collectors can play both roles of anionic and cationic collector. Amine groups of the novel reagents were acting chelating agents banding with molybdenite. Therefore, the novel collectors were captured more molybdenite than that of BX.

CONCLUSIONS

Novel collectors H-142, H-143 and H-145 have been defined that reactants were actively recovered molybdenum from Cu-Mo ore using flotation process. According to the characterization of molybdenite, amine groups of novel collectors were played one of roles of banding SO_4^{2-} of molybdenite. Moreover, BX has only anionic groups that were captured molybdenite. The max molybdenum recovery of H-142, H-143, H-145, and BX were 63.61%, 67.80%, 68.13%, and 15.8%. The novel collectors were more suitable than BX for molybdenum flotation.

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