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CA 2636645 A1 2007/09/07

(21) 2 636 645

(12) DEMANDE DE BREVET CANADIEN
CANADIAN PATENT APPLICATION

(13) A1

(86) Date de dépôt PCT/PCT Filing Date: 2007/01/09
(87) Date publication PCT/PCT Publication Date: 2007/09/07
(85) Entrée phase nationale/National Entry: 2008/07/09
(86) N° demande PCT/PCT Application No.: RU 2007/000003
(87) N° publication PCT/PCT Publication No.: 2007/100275
(30) Priorité/Priority: 2006/01/10 (RU2006100555)

(51) Cl.Int./Int.Cl. *B03B 9/06* (2006.01)

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(54) Titre : PROCEDE D'OBTENTION D'UN CONCENTRE COMPOSE DESTINE A L'EXTRACTION DE METAUX NOBLES

(54) Title: METHOD FOR PRODUCING A BULK CONCENTRATE FOR EXTRACTING PRECIOUS METALS

(57) Abrégé/Abstract:
The invention relates to methods for producing a bulk concentrate for extracting precious metals from clay-salt wastes of factories processing a potash-magnesium ore and rock salt. The inventive method is characterised in that it uses three hydrocyclones having a gradually reducing conicity (10°, 7°, 5°) for separating a solid material which is uniformly distributed in a liquid medium (saturated salt solutions) and embodied in the form of deposition coarse and fine fractions and a floated material in the form of a natural and synthetic organic substance. Sludges with a ratio S:L=1:3 are supplied for hydrocycling. The bulk concentrate produced from clay-salt wastes of the factories processing a potash-magnesium ore and rock salt is embodied in the form of a mixture of deposition and floated materials in the form of a water-insoluble sludge residues. The discharge of the second hydrocyclone in the form of a salt solution and the floated part of the water-insoluble sludge residues with the natural and synthetic organic substance are transported to a third hydrocycling stage. Said stage consists in separating the floted fraction with the natural and synthetic organic substance through a discharge nozzle and in combining it with concentrates of the first and second hydrocyclones. The salt solution in the form of a dressing process tailings is removed through a sand nozzle. Said invention makes it possible to obtain a concentrate containing a natural and synthetic organic substance comprising an important portion of precious metals and to reduce costs.

ABSTRACT

The invention pertains to methods for producing bulk concentrate for recovery of precious metals from clay-salt waste of plants processing potassium-magnesium ore and rock salt. It can also be used for extracting two or more components, in the form of solid particles that are in different "phase" states, for instance, sediment and floating particles, where the liquid phase can be represented by two and/or more components having different solubility or density.

The method is for producing bulk concentrate from clay-salt waste of plants processing potassium-magnesium ores and rock salt in order to recover precious metals and includes three-stage hydrocyclonage of slurries with concentrate extraction, wherein slurries arrive for hydrocyclonage with the S:L = 1:3 ratio, hydrocyclonage is conducted successively through 10°, 7° and 5° hydrocyclones, while bulk concentrate from clay-salt waste of plants processing potassium-magnesium ores and rock salt in order to recover precious metals is a mixture of sedimentary and floating materials that constitute water-insoluble residue of slurries, the overflow of the second hydrocyclone, in the form of salt solution and the floating part of water-insoluble residue of slurries with natural and industrial organic matter, is sent to the third hydrocycloning stage, where floated fraction with natural and industrial organic matter is extracted through a vortex finder and then combined with concentrates of the first and second hydrocyclones to form bulk concentrate, and the salt solution which constitutes a waste stream of the concentration method comes out through an apex, wherein slurries of chemical and flotation plants with high content of natural and industrial organic matter are processed.

The method of the invention makes it possible to produce a concentrate containing natural and industrial organic matter where a substantial portion of precious metals is concentrated, at lower cost.

A METHOD FOR PRODUCING A BULK CONCENTRATE FOR RECOVERY OF PRECIOUS METALS

The invention pertains to methods for producing bulk concentrate for recovery of precious metals from clay-salt tailings or waste of plants processing potassium-magnesium ore and rock salt. It also can be used for extracting two or more components in the form of solid particles that are in different "phase" states, for instance, sediment and floating particles, where the liquid phase can be represented by two and/or more components having different solubility or density.

The present method for producing bulk concentrate from clay-salt tailings waste of plants processing potassium-magnesium ore and rock salt includes three stages conducted in hydrocyclones. The bulk concentrate of hydrocyclones is a solid phase consisting of sediment and of floating particles and comprising a water-insoluble residue (I.R.) slurry with a residual content of K and Na salts no greater than 15%. At the first hydrocyclone stage, a concentrate is extracted in a form of a high I.R fraction having a (solid:liquid ratio) S:L=1:3 ratio, and an overflow of the first hydrocyclone is produced in a form of low I.R. fraction and a salt solution. The overflow of the first hydrocyclone is diluted to a S:L=1:8 and sent for re-cleaning to the second hydrocyclonage stage, where a concentrate is extracted in a form or residual (small) fraction of I.R. slurry. The overflow of the second hydrocyclone in the form of salt solution and floating fraction of I.R. is sent to the third hydrocyclone stage, where a flotation concentrate is extracted through a vortex finder, and a bulk concentrate is formed by combining concentrates of the first and second hydrocyclones. The salt solution coming out through an apex of the third hydrocyclone constitutes a waste stream of the concentration method of the invention. The technical result is production of bulk concentrate (I.R.) of slurries with residual content of K and Na salts no greater than 15%, in order to extract Au, Pt and Pd through chlorinating roasting from clay-salt waste (slurries).

There are known methods that are similar to the present invention in technical terms ["Ore Concentration Handbook". Vol. 1. "Preparation Processes". M., "Nyedra" Publishing House, 1972, pp. 276-278; Povarov, A.I. "Hydrocyclones". M., "Gosgortekhizdat" Publishing House, 1961], for separating ground material in a

centrifugal field created as the result of rotation of pulp (hydrocyclones), where water represents the liquid phase.

This can be a particle separation by size, where large particles go into an apex and small particles go to overflow. When the taper angle decreases, small material that have higher density than the main bulk of small material can also go into an apex [Smetannikov, A.F., Kudryashov, A.I. "On the Possibility of Extracting Gold and Silver from Ores of the Verkhnekamsk Salt Deposit". "Ores and metals", 1995, No. 5, pp. 118-121.] These methods are designed for separating solid material, by size or density, in a liquid medium. However, these methods have not been used before for separating hard material evenly distributed in saturated salt solutions. For instance, waste of potassium plants (slurries) is represented by two phases. One phase is a saturated salt solution, and the other is water-insoluble residue (I.R.) particles.

Also known is a method for producing concentrate from clay-salt waste of plants processing potassium-magnesium ores and rock salt in order to recover precious metals (patent No. RU 2256504, published 2005.07.20) which includes at least a two-stage hydrocycloning of slurries with concentrate extraction, wherein hydrocycloning is conducted in two or three stages. Hydrocyclones concentrate is a solid phase–water-insoluble residue (I.R.) of slurries. Slurries arrive for hydrocyclonage with the S:L = 1:3 ratio. At the first hydrocyclonage stage, the concentrate is extracted in the form of large fraction of I.R., and the first hydrocyclone overflow is in the form of small fraction of I.R. and a salt solution. The overflow of the first hydrocyclone is diluted to S:L=1:8 and sent for re-cleaning to the second hydrocyclonage stage, where concentrate is extracted in the form or residual fraction of I.R. slurry, and the overflow of the second hydrocyclone is in the form of a salt solution. The concentrates extracted by hydrocyclonage are then combined, and if there is a large residual content of I.R. in the overflow of the second hydrocyclone, an additional third hydrocyclonage stage is run. This is how slurries of chemical and flotation plants are processed.

The prior art method shortcoming is insufficient percentage of precious metals in the concentrate from plants' clay-salt waste.

The proposed invention solves the problem of complex extraction of precious metals from mineral stock represented by clay-salt tailings waste (slurries) of potassium production and by marker clays and containing chlorides of alkaline and alkaline-earth elements, at lower cost.

To achieve the stated technical result, in the method for producing bulk concentrate from clay-salt waste of plants processing potassium-magnesium ores and rock salt in order to recover precious metals, that includes three-stage hydrocycloning of slurries with concentrate extraction, wherein slurries arrive for hydrocycloning with the S:L = 1:3 ratio, hydrocyclonage is conducted in series successively through 10°, 7° and 5° cyclones, and bulk concentrate from clay-salt waste of plants processing potassium-magnesium ores and rock salt in order to recover precious metals is a mixture of sedimentary and floating materials that constitute water-insoluble residue of slurries, the overflow of the second hydrocyclone, in the form of a salt solution and floating part of water-insoluble residue of slurries with natural and industrial organic matter, is sent to the third hydrocyclonage stage, where a floating fraction with natural and industrial organic matter is extracted through a vortex finder and then combined with concentrates of the first and second hydrocyclones to form bulk concentrate, and a salt solution which constitutes a waste stream of the concentration method of the invention comes out through an apex, wherein slurries of chemical and flotation plants with high content of natural and industrial organic matter are processed.

The distinctions between the proposed method and the closest earlier known one are that hydrocyclonage is conducted successively through 10°, 7° and 5° cyclones, and bulk concentrate from clay-salt waste of plants processing potassium-magnesium ores and rock salt in order to recover precious metals is a mixture of sedimentary and floating materials that are water-insoluble residue of slurries, the overflow of the second hydrocyclone, in the form of salt solution and the floating part of water-insoluble residue of slurries with natural and industrial organic matter, is sent to the third hydrocyclonage stage, where the floated fraction with natural and industrial organic matter is extracted

through a vortex finder and then combined with concentrates of the first and second hydrocyclones to form bulk concentrate, the salt solution which constitutes tailings of the concentration process comes out through an apex, wherein slurries of chemical and flotation plants with high content of natural and industrial organic matter are processed.

Due to these features, a method has been developed that makes it possible to produce concentrate containing significant amount of natural and industrial organic matter where a substantial share of precious metals is concentrated.

The proposed method comprises the use of three hydrocycloneов with a successively smaller taper angle (10°, 7° and 5°) in order to separate solid material evenly distributed in liquid phase (saturated salt solutions) and represented by large and small fraction of sediment, from floating material represented by natural and industrial organic material.

The results achieved by this method consist in the fullest separation of two phases of solid material (sediment and floating part) from slurries, but with residual salt content no more than 15%. The insoluble residue is a concentrate containing Au, Pt and Pd compounds; the concentrate mineral base is formed by (in descending order) anhydrite, dolomite, quartz, feldspar, chlorite, hydrous micas, hydrous Fe oxides, sulfides, and natural and industrial organic matter.

To produce bulk concentrate, it is necessary:

1. To provide a process of extracting I.R. (concentrate) from clay-salt waste (slurries) using hydrocyclonage.

2. During the hydrocyclonage process, to produce concentrate with salt content no more than 15% for subsequent pyrometallurgical processing.

The method is realized as follows. Slurries are sent through a 10° hydrocyclone, where the largest part of I.R. sedimentary fraction goes into an apex, and the small part of I.R. sedimentary fraction, floating material (organic matter) and salt solution reports to the overflow. The overflow of the 10° hydrocyclone is sent to the feed of the second (7°) hydrocyclone, where the small part of I.R. sedimentary fraction goes into an apex,

and floating matter (organic matter) and salt solution go to overflow. The overflow of the second (7°) hydrocyclone is sent to the feed of the third (5°) hydrocyclone, where the salt solution goes into an apex, and floating material and the remaining salt go to overflow. Then, concentrates of the first and second hydrocyclones are combined with the floating part of I.R. received through the overflow of the third hydrocyclone, forming concentrate for pyrometallurgical processing. Salt, with its content limited by the 15% threshold, is being accumulated during all three stages of hydrocycloning. In the case of the excess of salt in the concentrate, re-cleaning is organized at each hydrocycloning stage; it consists of installing a pair of hydrocyclones at each stage, 10°, 7° and 5° ones, respectively. In this case, a concentrate received through an apex of the first 10° hydrocyclone is directed to the feed of the second 10° hydrocyclone, where concentrate with re-cleaned. A large fraction of I.R. goes into an apex and then is directed into the receiving tank for concentrate, while overflows of both 10° hydrocyclones are combined and directed to the feed of the first 7° hydrocyclone. The concentrate from an apex of the first 7° hydrocyclone goes to the feed of the second 7° hydrocyclone, where re-cleaned concentrate of small residual fraction of I.R. goes into an apex, and then is directed into the receiving tank for concentrate, while overflows of both 7° hydrocyclones go to the feed of the first 5° hydrocyclone. The material coming out into an apex of the first 5° hydrocyclone is directed to the feed of the second 5° hydrocyclone, where the salt solution cleaned from the floating part of I.R. goes into an apex, while the remaining floating material of I.R. goes to overflow, and is combined with overflow of the first 5° hydrocyclone and directed to the receiving tank for final formation of bulk concentrate. The Figure shows the flowchart of the process of producing bulk concentrate with re-cleaning.

The need to create such a complex flowchart is because slurries of flotation processing of potassium-magnesium ores, unlike slurries of chemical processing of potassium-magnesium ores, contain significant amount of natural and industrial organic matter, where a substantial share of precious metals is concentrated.

Bulk concentrate from clay-salt waste of plants processing potassium-magnesium ores and rock salt, that is used in this work, represents slurries of chemical and flotation plants with pulp density of 13 g/cm^3 and S:L=1:3 ratio. The difference is a high content of organic matter represented by natural and industrial organic matter (amines and polyacrylamides). And while organic matter content (total) for chemical plants did not exceed 1.5%, total organic matter content in our example was as high as 3%, which is due to including cyclone dust, waste of flotation production, into chemical processing of waste, where organic matter content is traditionally high (up to 5%). This determined the use of a hydrocyclone with a 5° taper angle at the third stage of hydrocycloning, for complete separation of floating fraction of natural and industrial organic matter I.R. Including the 5° taper angle, in the chain has made it possible to fully recover into concentrate the floating portion of I.R. represented by organic matter, with losses of no more than 5%, and ensured total losses of no more than 7% of I.R., with the total coefficient of 0,9.

CLAIMS:

1. A method for producing a bulk concentrate for recovery of precious metals that includes a three stage hydrocycloning of a tailing slurry for isolating the bulk concentrate, wherein the slurry has a solid to liquid ratio S:L = 1:3, the method characterized in that the three stage hydrocycloning is performed in a series through 10°, 7°, and 5° cyclones wherein the bulk concentrate for recovery of precious metals is a mixture of sedimentary and flotation materials that constitute a water insoluble residue of the slurry that derives from a clay-salt waste generated in a potassium-magnesium ore and rock salt processing plant,

sending a salt solution overflow from the second stage hydrocycloning to the third stage hydrocycloning, the salt solution having a floating fraction of water-insoluble tailings with natural and industrial organic matter,

extracting the floating fraction of water-insoluble tailing with natural and industrial organic matter through a vortex finder,

combining the floating fraction with concentrates from the second and third stage hydrocycloning to form the bulk concentrate, and

eliminating the salt solution that constitutes a waste stream of the method through an apex.

2. A method according to claim 1, characterized in that the slurry of chemical and flotation plants comprising a high content of natural and industrial organic matter is processed.