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SEPARATION OF MOLYBDENITE FROM COPPER SULPHIDES

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The present invention relates to a process of flotation concentration for the separation of molybdenite (molybdenum sulphide) from copper sulphides.

According to the invention, this separation is effected by treating a pulp of the material containing the molybdenite and copper sulphides in the presence of a substance acting to depress the molybdenite, other agents being also present in the pulp to effect flotation of the copper sulphides. By the use of the molybdenite depressant, flotation of the molybdenite is only temporarily inhibited. That is, the molybdenite remains in the pulp in such state that its subsequent flotation, if desired, may be readily carried out.

The basis of the invention is the discovery that materials of the class consisting of condensation products of aldehydic substances with aromatic sulphonic acids and the salts of these condensation products with salt-forming bases have the property of inhibiting the flotation of molybdenite while not preventing the flotation of copper sulphides.

The aldehydic substance, required for the reaction of condensation by which these molybdenite depressants are obtained, may be formaldehyde. Particularly satisfactory results have been obtained with this substance, although other aldehydes may be used. Both acetaldehyde and butyraldehyde, for example, have been found useful. Instead of the aldehyde itself, of course, a substance capable of yielding the aldehyde under the conditions obtaining in the reaction of condensation may also be used. The term "aldehydic substance" is thus used herein to include aldehydes and aldehyde-yielding substances.

The sulphonic acids which may be used for reaction with the aldehydic substance are of a large variety. These include the sulphonic acids of alkylated and non-alkylated aromatic hydrocarbons. Satisfactory results have thus been obtained with sulphonic acids derived from such hydrocarbons as benzene, para-xylene, naphthalene, alpha methyl naphthalene, and beta methyl naphthalene.

It is probable that the reaction of condensation employed in producing the molybdenite depressants of the invention is one according to which two aromatic sulphonic acid nuclei become connected to the aldehydic carbon atom of the aldehyde as a result of oxygen removal from the aldehyde and hydrogen removal from the sulphonic acid to form water. In the case of the reaction products obtained with formaldehyde, for example, it is believed that these are of the nature having the two aromatic sulphonic acid nuclei joined through the bivalent methylene radical CH_2.

Detailed procedures which have been used in producing the molybdenite depressants of the invention will hereinafter appear in the description of the examples of the process.

Although the condensation products themselves are useful in the process, it has usually been found convenient to employ their soluble salts. Their alkali metal and ammonium salts are especially preferred, although their alkaline earth metal salts are also useful.

In carrying out the invention, the molybdenite depressant may be added at any time previous to the flotation of the copper sulphides. Good results have been obtained by adding the molybdenite depressant during the preliminary operation of grinding the ore. In some cases, however, better results have been obtained by adding the molybdenite depressant during the conditioning operation immediately preceding the flotation of the copper sulphides.

The process of this invention may be carried out in either acid, neutral, or alkaline circuits, but it is advisable to determine which type of circuit insures the best results in each individual case. A few simple preliminary tests, of course, are all that is necessary for this purpose. The pH value of the pulp can be controlled by the usual methods found effective in the flotation art. The pulp may be made acid by the addition of sulphuric acid or some other acid, while such alkalies as soda ash and lime may be used to render the pulp alkaline.

The flotation of the copper sulphides may be effected by the use of any suitable reagents known in the art in association with the molybdenite depressant. Collectors that are useful for this purpose include alkali xanthates and "aerofloats," which may be used with such frothing agents as pine oil and cresol. Aerofloats are the flotation reagents described in the Whitworth Patent No. 1,593,232.

Subsequent flotation of the molybdenite may likewise be effected by any suitable method known in the art, as by the addition of small amounts of pine oil and kerosene. However, other reagents, such as xanthates and "aerofloats," may also be used to facilitate the flotation of the molybdenite.

Certain tests which were made in reducing the invention to practice will now be described, it being understood that the reagent quantities indicated in these examples are expressed in the usual manner in pounds per ton (2000 lbs.) of dry material treated.

Example 1

To one hundred grams of concentrated sulphuric acid maintained at a temperature of 160° C. were added, over a period of about one hour, one hundred and eleven grams of beta methyl naphthalene. The reaction mixture was maintained for four hours thereafter at the temperature of 160° C. with constant stirring. It was

then allowed to cool to 100° C., at which point forty-four grams of water were added. To the diluted mixture maintained at a temperature of 80° C. were then added a total of forty-eight grams of 40% aqueous formaldehyde in successive amounts of twelve grams each at one-hour intervals, the reaction mass being constantly stirred throughout the total period of addition. The temperature was then raised to 100° C. during one hour and thereafter maintained at this temperature for twenty hours. Small quantities of water were added when necessary to keep the mass sufficiently fluid for efficient mixing. The material was then further diluted with water, cooled, neutralized with a solution of caustic soda, and filtered, after which the filtrate was evaporated to dryness at a temperature of 100° C. The resulting powder was the sodium salt of the condensation product of formaldehyde with the sulphonic acid of beta methyl naphthalene, which was tested as a molybdenite depressing agent as follows:

Arizona Molybdenum Corporation ore, containing molybdenite and copper sulphides, was ground wet in a ball mill for ten minutes with 1 lb. of the depressing agent per ton of ore, the particle size of the ore being reduced by this operation to minus 65-mesh. Subsequently, the material in the form of a freely flowing pulp was conditioned in a minerals separation subaeration flotation machine with 0.3 lb. of potassium ethyl xanthate and 0.15 lb. of steam distilled pine oil, both per ton of feed, after which a rough concentrate of copper was removed in the usual manner by flotation. The remaining pulp was then conditioned with 0.1 lb. of steam distilled pine oil and 0.4 lb. of kerosene, both per ton of feed, its subsequent frothing in the machine yielding a rough concentrate of molybdenum.

The results of the test are given in the following table:

	Percent weight	Assays		Distribution	
		Percent Cu	Percent MoS_2	Percent Cu	Percent MoS_2
Head	100.0	1.34	1.16	100.0	100.0
Cu conc	4.04	27.52	1.38	83.01	4.80
Mo conc	4.12	3.96	25.45	12.18	90.44
Tail	91.84	0.07	0.06	4.81	4.76

Example 2

A molybdenite depressing agent was prepared in the same manner as described in Example 1 with the only difference that alpha methyl naphthalene was used as a starting material for reaction with sulphuric acid. This agent was tested under identical conditions on the same ore as in Example 1. The results which were obtained in this instance were as follows:

	Percent weight	Assays		Distribution	
		Percent Cu	Percent MoS_2	Percent Cu	Percent MoS_2
Head	100.0	1.42	1.19	100.0	100.0
Cu conc	4.50	28.32	4.02	90.02	15.22
Mo conc	3.49	2.20	28.87	5.42	84.78
Tail	92.01	0.07	Trace	4.56	

Example 3

Here already prepared naphthalene beta sulphonic acid obtained from the Eastman Kodak Company was used for reaction with formaldehyde. The procedures of preparing the molybdenite depressing agent inclusive of the reaction of condensation were otherwise substantially the same as in Example 1. The molybdenite depressing agent finally obtained in the form of a dry powder was thus the sodium salt of the condensation product of formaldehyde with naphthalene beta sulphonic acid. Arizona Molybdenum Corporation ore was ground with this agent used at the rate of 1 lb. per ton of ore. A copper float was first produced by the use of 0.3 lb. of potassium ethyl xanthate and 0.15 lb. of steam distilled pine oil, both per ton of feed, after which a molybdenum float was separated from the residue by the use of 0.15 lb. of steam distilled pine oil and 0.4 lb. of kerosene, both per ton of feed. The results were as follows:

	Percent weight	Assays		Distribution	
		Percent Cu	Percent MoS_2	Percent Cu	Percent MoS_2
Head	100.0	1.32	1.15	100.0	100.0
Cu conc	4.37	25.56	0.85	84.32	3.24
Mo conc	7.65	2.14	12.20	12.35	81.41
Tail	87.98	0.05	0.20	3.33	15.35

Example 4

When the amount of the depressing agent of Example 3 was reduced to 0.5 lb. per ton of ore, the following results were obtained:

	Percent weight	Assays		Distribution	
		Percent Cu	Percent MoS_2	Percent Cu	Percent MoS_2
Head	100.0	1.38	1.11	100.0	100.0
Cu conc	4.03	30.16	5.08	87.97	18.37
Mo conc	2.58	3.18	35.25	5.94	81.63
Tail	93.39	0.09	Trace	6.09	

Example 5

Using previously prepared benzene sulphonic acid purchased on the market as a starting material, the sodium salt of the condensation product of formaldehyde with this sulphonic acid was obtained in substantially the same manner as before, the following test being carried out on this agent:

Arizona Molybdenum Corporation ore was ground to minus 65-mesh in the absence of the molybdenite depressing agent. A freely flowing pulp of the ground ore was first thoroughly mixed with 4 lbs. of the depressing agent and 36.8 lbs. of sulphuric acid, both per ton of ore, after which it was mixed with 0.1 lb. of potassium ethyl xanthate and 0.15 lb. of steam distilled pine oil, both per ton of ore. Subsequent frothing of the pulp yielded a rough concentrate of copper. The remaining pulp was then mixed with 0.1 lb. of steam distilled pine oil and 0.2 lb. of kerosene, both per ton of ore, its subsequent frothing yielding a rough concentrate of molybdenum.

The results of the test were the following:

	Percent weight	Assays		Distribution	
		Percent Cu	Percent MoS_2	Percent Cu	Percent MoS_2
Head	100.0	0.61	1.29	100.0	100.0
Cu conc	4.32	11.12	5.3	78.79	17.68
Mo conc	2.96	2.80	36.0	13.60	32.32
Tail	92.72	0.05	None	7.61	

The pH value of the tailing was 5.9.

Example 6

In a parallel test carried out under the same conditions as in Example 5, the sodium salt of the condensation product of formaldehyde with the sulphonic acid of paraxylene yielded the results indicated in the following table:

	Percent weight	Assays		Distribution	
		Percent Cu	Percent MoS_2	Percent Cu	Percent MoS_2
Head	100.0	0.59	1.33	100.0	100.0
Cu conc	4.16	10.88	1.70	76.83	5.30
Mo conc	3.97	2.28	31.80	15.37	94.70
Tail	91.87	0.05	None	7.80	

Example 7

Formaldehyde was condensed with naphthalene sulphonic acid, the resulting product being used as such in the following test:

Arizona Molybdenum Corporation ore was ground wet in a ball mill for ten minutes in the presence of 1 lb. of the condensation product per ton of ore. The material was then transferred to a flotation machine where it was treated with 0.3 lb. of potassium ethyl xanthate and 0.15 lb. of steam distilled pine oil, both per ton of ore, to give a copper concentrate. Thereafter, the residue was treated with 0.1 lb. of steam distilled pine oil and 0.4 lb. of kerosene, both per ton of ore, to give a molybdenum concentrate.

The results of the test were as follows:

	Percent weight	Assays		Distribution	
		Percent Cu	Percent MoS_2	Percent Cu	Percent MoS_2
Head	100.0	0.57	1.38	100.0	100.0
Cu conc	4.28	10.32	9.15	76.94	28.48
Mo conc	2.23	2.58	44.10	10.03	71.52
Tail	93.49	0.08	Trace	13.03	

Example 8

The condensation product of Example 7 was neutralized with caustic soda and subsequently filtered, after which the filtrate was evaporated to dryness. The dry powder thus obtained was used in a test identical in every respect to the test of Example 7. The results in this instance were slightly better, as shown by the following table:

	Percent weight	Assays		Distribution	
		Percent Cu	Percent MoS_2	Percent Cu	Percent MoS_2
Head	100.0	0.546	1.43	100.0	100.0
Cu conc	4.61	9.28	8.30	78.33	26.7
Mo conc	1.92	3.24	54.70	11.39	73.3
Tail	93.47	0.06	None	10.28	

Example 9

When ammonium hydroxide was used to neutralize the condensation product of Example 7, the following results were obtained:

	Percent weight	Assays		Distribution	
		Percent Cu	Percent MoS_2	Percent Cu	Percent MoS_2
Head	100.0	0.538	1.51	100.0	100.0
Cu conc	4.16	9.52	7.70	75.02	21.21
Mo conc	1.83	4.12	65.00	14.29	78.79
Tail	94.01	0.06	None	10.69	

Example 10

The depressing agent of Examples 3 and 4 (the sodium salt of the condensation product of formaldehyde with naphthalene beta sulphonic acid) was here used in the following manner:

A pulp of Arizona Molybdenum Corporation ore was treated with 0.2 lb. of potassium ethyl xanthate and 0.2 lb. of steam distilled pine oil, both per ton of ore, to give a rougher bulk flotation concentrate of copper and molybdenum, a final tailing being obtained. The rougher bulk concentrate was conditioned for five minutes with 0.25 lb. of the depressing agent per ton of ore, after which it was treated with 0.05 lb. of steam distilled pine oil, 0.05 lb. of potassium ethyl xanthate, and 0.05 lb. of potassium amyl xanthate, all per ton of ore, to give a flotation concentrate of copper. The unfloated residue from this operation constituted the molybdenum concentrate.

The results of the test were as follows:

	Percent weight	Assays		Distribution	
		Percent Cu	Percent MoS_2	Percent Cu	Percent MoS_2
Head	100.0	0.56	1.35	100.0	100.0
Cu conc	3.63	12.60	0.78	77.84	2.10
Mo conc	2.73	1.80	48.30	8.77	97.90
Tail	93.64	0.08	Trace	13.39	

Example 11

The depressing agent of Example 1 (the sodium salt of the condensation product of formaldehyde with the sulphonic acid of beta methyl naphthalene) was here used as follows:

Arizona Molybdenum Corporation ore was first reduced to a particle size of minus 65-mesh and thereafter transferred to a flotation machine where, in the form of a freely flowing pulp made acid with 36.8 lbs. of sulphuric acid per ton of ore, it was conditioned for two minutes with 1 lb. of the inhibiting agent per ton of ore. A rough concentrate of copper was first produced by the use of 0.2 lb. of potassium ethyl xanthate and 0.15 lb. of cresylic acid, both per ton of ore, after which a molybdenum concentrate was separated from the residue by the use of 2 lbs. of sodium carbonate, 0.7 lb. of kerosene, and 0.2 lb. of steam distilled pine oil, all per ton of ore.

The following results were obtained:

	Percent weight	Assays		Distribution	
		Percent Cu	Percent MoS_2	Percent Cu	Percent MoS_2
Head	100.0	0.573	1.47	100.0	100.0
Cu conc	6.27	7.56	5.60	82.76	24.34
Mo conc	5.24	1.04	21.20	9.52	75.66
Tail	88.49	0.05	None	7.72	

Example 12

Acetaldehyde was condensed with naphthalene sulphonic acid, the resulting product being used in its natural acid state as follows:

Arizona Molybdenum Corporation ore was ground in a ball mill for ten minutes with 4 lbs. of the molybdenite depressing agent per ton of ore. In the form of a freely flowing pulp it was then treated in a flotation machine with 0.3 lb. of potassium ethyl xanthate and 0.15 lb. of steam distilled pine oil, both per ton of ore, to give a concentrate of copper. Thereafter, the residue was treated with 0.15 lb. of steam distilled pine

oil and 0.4 lb. of kerosene, both per ton of ore, to give a concentrate of molybdenum.

The results of the test were as follows:

	Percent weight	Assays		Distribution	
		Percent Cu	Percent MoS_2	Percent Cu	Percent MoS_2
Head	100.0	0.55	1.32	100.0	100.0
Cu conc	4.76	9.56	9.60	82.53	34.68
Mo conc	2.13	1.90	40.40	7.35	65.32
Tail	93.11	0.06	None	10.12	

Example 13

Butyraldehyde was condensed with naphthalene sulphonic acid, the resulting product being used in its natural acid state as follows:

Arizona Molybdenum Corporation ore was ground in a ball mill for ten minutes with 30 lbs. of the molybdenite depressing agent per ton of ore. In the form of a freely flowing pulp it was then treated in a flotation machine with .3 lb. of potassium ethyl xanthate and 0.15 lb. of steam distilled pine oil, both per ton of ore, to give a concentrate of copper. Thereafter, the residue was treated with 0.3 lb. of steam distilled pine oil, 0.75 lb. of kerosene, and 0.1 lb. of cresylic acid, all per ton of ore, to give a concentrate of molybdenum.

The results of the test were as follows:

	Percent weight	Assays		Distribution	
		Percent Cu	Percent MoS_2	Percent Cu	Percent MoS_2
Head	100.0	0.608	1.43	100.0	100.0
Cu conc	7.56	6.24	2.2	77.63	11.62
Mo conc	11.07	0.86	9.0	15.67	69.61
Tail	81.37	0.05	0.33	6.70	18.77

The effectiveness of the molybdenite depressants of the invention is clearly shown by the foregoing examples, it being understood that the copper and molybdenum concentrates obtained in these examples were rougher concentrates which, in practice, would be raised to commercial grade in accordance with the customary procedures of retreatment.

In the following claims, the term "copper sulphide" should be construed as covering one or more copper sulphides.

What is claimed is

1. A process of flotation concentration for the separation of copper and molybdenum sulphides, which comprises subjecting the material containing said sulphides to a flotation operation in the presence of a molybdenum sulphide depressing agent selected from the class consisting of the condensation products of aldehydic substances with aromatic sulphonic acids and the salts of these condensation products with salt-forming bases so as to produce a concentrate of copper sulphide with a rejection of molybdenum sulphide.

2. A process of flotation concentration for the separation of copper and molybdenum sulphides, which comprises subjecting the material containing said sulphides to a flotation operation in the presence of a molybdenum sulphide depressing agent selected from the class consisting of the condensation products of aldehydic substances with aromatic sulphonic acids and the ammonium, alkali-metal and alkaline-earth-metal salts of these condensation products so as to produce a concentrate of copper sulphide with a rejection of molybdenum sulphide.

3. A process of flotation concentration for the separation of copper and molybdenum sulphides, which comprises subjecting the material containing said sulphides to a flotation operation in the presence of a molybdenum sulphide depressing agent selected from the class consisting of the condensation products of aldehydic substances with aromatic sulphonic acids and the ammonium, alkali-metal and alkaline-earth-metal salts of these condensation products so as to produce a concentrate of copper sulphide with a rejection of molybdenum sulphide, and subsequently subjecting the residue to a flotation operation yielding a molybdenum sulphide concentrate.

4. A process of flotation concentration for the separation of copper and molybdenum sulphides, which comprises subjecting the material containing said sulphides to a flotation operation in the presence of a molybdenum sulphide depressing agent selected from the class consisting of the condensation products of aldehydic substances with sulphonic acids of aromatic hydrocarbons and the salts of these condensation products with salt-forming bases so as to produce a concentrate of copper sulphide with a rejection of molybdenum sulphide.

5. A process of flotation concentration for the separation of copper and molybdenum sulphides, which comprises subjecting the material containing said sulphides to a flotation operation in the presence of a molybdenum sulphide depressing agent selected from the class consisting of the condensation products of formaldehyde with aromatic sulphonic acids and the salts of these condensation products with salt-forming bases so as to produce a concentrate of copper sulphide with a rejection of molybdenum sulphide.

6. A process of flotation concentration for the separation of copper and molybdenum sulphides, which comprises subjecting the material containing said sulphides to a flotation operation in the presence of a molybdenum sulphide depressing agent selected from the class consisting of the condensation products of formaldehyde with aromatic sulphonic acids and the ammonium, alkali-metal and alkaline-earth-metal salts of these condensation products so as to produce a concentrate of copper sulphide with a rejection of molybdenum sulphide, and subsequently subjecting the residue to a flotation operation yielding a molybdenum sulphide concentrate.

7. A process of flotation concentration for the separation of copper and molybdenum sulphides, which comprises subjecting the material containing said sulphides to a flotation operation in the presence of a molybdenum sulphide depressing agent selected from the class consisting of the condensation products of formaldehyde with sulphonic acids of aromatic hydrocarbons and the salts of these condensation products with salt-forming bases so as to produce a concentrate of copper sulphide with a rejection of molybdenum sulphide.

8. A process of flotation concentration for the separation of copper and molybdenum sulphides, which comprises subjecting the material containing said sulphides to a flotation operation in the presence of a molybdenum sulphide depressing agent selected from the class consisting of the condensation products of formaldehyde with sulphonic acids of alkylated aromatic hydrocarbons

and the salts of these condensation products with salt-forming bases so as to produce a concentrate of copper sulphide with a rejection of molybdenum sulphide.

9. A process of flotation concentration for the separation of copper and molybdenum sulphides, which comprises subjecting the material containing said sulphides to a flotation operation in the presence of a molybdenum sulphide depressing agent selected from the class consisting of the condensation products of formaldehyde with sulphonic acids of polynuclear aromatic hydrocarbons and the salts of these condensation products with salt-forming bases so as to produce a concentrate of copper sulphide with a rejection of molybdenum sulphide.

10. A process of flotation concentration for the separation of copper and molybdenum sulphides, which comprises subjecting the material containing said sulphides to a flotation operation in the presence of a molybdenum sulphide depressing agent selected from the class consisting of the condensation products of formaldehyde with sulphonic acids of alkylated polynuclear aromatic hydrocarbons and the salts of these condensation products with salt-forming bases so as to produce a concentrate of copper sulphide with a rejection of molybdenum sulphide.

11. A process of flotation concentration for the separation of copper and molybdenum sulphides, which comprises subjecting the material containing said sulphides to a flotation operation in the presence of a molybdenum sulphide depressing agent selected from the class consisting of the condensation products of formaldehyde with sulphonic acids of benzene and the salts of these condensation products with salt-forming bases so as to produce a concentrate of copper sulphide with a rejection of molybdenum sulphide.

12. A process of flotation concentration for the separation of copper and molybdenum sulphides, which comprises subjecting the material containing said sulphides to a flotation operation in the presence of a molybdenum sulphide depressing agent selected from the class consisting of the condensation products of formaldehyde with sulphonic acids of aromatic hydrocarbons of the benzene series and the salts of these condensation products with salt-forming bases so as to produce a concentrate of copper sulphide with a rejection of molybdenum sulphide.

13. A process of flotation concentration for the separation of copper and molybdenum sulphides, which comprises subjecting the material containing said sulphides to a flotation operation in the presence of a molybdenum sulphide depressing agent selected from the class consisting of the condensation products of formaldehyde with sulphonic acids of naphthalene and the salts of these condensation products with salt-forming bases so as to produce a concentrate of copper sulphide with a rejection of molybdenum sulphide.

14. A process of flotation concentration for the separation of copper and molybdenum sulphides, which comprises subjecting the material containing said sulphides to a flotation operation in the presence of a molybdenum sulphide depressing agent selected from the class consisting of the condensation products of formaldehyde with sulphonic acids of aromatic hydrocarbons of the naphthalene series and the salts of these condensation products with salt-forming bases so as to produce a concentrate of copper sulphide with a rejection of molybdenum sulphide.

15. A process of flotation concentration for the separation of copper and molybdenum sulphides, which comprises subjecting the material containing said sulphides to a flotation operation in the presence of a molybdenum sulphide depressing agent selected from the class consisting of the alkali metal and ammonium salts of the condensation products of formaldehyde with sulphonic acids of aromatic hydrocarbons so as to produce a concentrate of copper sulphide with a rejection of molybdenum sulphide.

16. A process of flotation concentration for the separation of copper and molybdenum sulphides, which comprises subjecting the material containing said sulphides to a flotation operation in the presence of a molybdenum sulphide depressing agent selected from the class consisting of compounds having at least one methylene group connected to two aromatic sulphonic acid nuclei and the salts of these compounds with salt-forming bases so as to produce a concentrate of copper sulphide with a rejection of molybdenum sulphide.

17. A process of flotation concentration for the separation of copper and molybdenum sulphides, which comprises subjecting the material containing said sulphides to a flotation operation in the presence of a molybdenum sulphide depressing agent selected from the class consisting of compounds having at least one methylene group connected to two naphthalene sulphonic acid nuclei and the salts of these compounds with salt-forming bases so as to produce a concentrate of copper sulphide with a rejection of molybdenum sulphide.

18. A process of flotation concentration for the separation of copper and molybdenum sulphides, which comprises subjecting the material containing said sulphides to a flotation operation in the presence of a molybdenum sulphide depressing agent selected from the class consisting of the condensation products of acetaldehyde with sulphonic acids of aromatic hydrocarbon and the ammonium, alkali-metal and alkaline-earth-metal salts of these condensation products so as to produce a concentrate of copper sulphide with a rejection of molybdenum sulphide.

19. A process of flotation concentration for the separation of copper and molybdenum sulphides, which comprises subjecting the material containing said sulphides to a preliminary flotation operation yielding a bulk concentrate of said sulphides, and subjecting said bulk concentrate to a flotation operation in the presence of a molybdenum sulphide depressing agent selected from the class consisting of the condensation products of aldehydic substances with aromatic sulphonic acids and the ammonium, alkali-metal and alkaline-earth-metal salts of these condensation products so as to produce a concentrate of copper sulphide with a rejection of molybdenum sulphide.

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