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2,732,940

FROTH FLOTATION PROCESS

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This invention relates to a method for effecting the concentration of minerals by flotation. By the term "minerals" is meant metallic and non-metallic ores and coal.

Froth flotation processes for the concentration and purification of many minerals are well known. In such processes water containing frothing agents is added to the materials and separation is effected by selective flotation.

The object of the invention is to provide a process which is carried out with the aid of new frothing agents, whereby greater efficiency is obtained.

The present invention is for a method of effecting the concentration of minerals, as hereinbefore defined by flotation which comprises the step of adding to the mineral pulp, in the capacity of frothing agent an ortho-phthalic acid diester of a lower alkanol of 2 to 3 carbon atoms or of the lower alkoxy derivative of such an alkanol.

The compounds employed as frothing agents accordingly include the ortho-phthalic acid diesters of ethanol, isopropanol and propanol and the methoxy-, ethoxy-, isopropoxy-, or -propoxy-derivatives of these alcohols such as di-(3-methoxypropyl) ortho phthalate, di-(2-ethoxyethyl) ortho-phthalate and bis-(2,3-dimethoxypropyl) ortho-phthalate.

The compounds employed according to the present invention as frothing agents may be used either in pure form, or in impure form as, for example, admixed with the by-products coproduced with them, or alternatively admixed with compounds having frothing properties, for example the tetra-alkoxy derivatives of paraffins such as 1:1:2:2 - tetraethoxyethane, 1:1:2:2 - tetranormal-propoxyethane, 1:1:2:2-tetrabutoxymethane, 1:1:3:3-tetranormal-propoxypropane, 1:1:4:4 - tetramethoxybutane and 1:1:5:5-tetraethoxypentane.

One noteworthy advantage of the froth flotation agents according to the present invention is that satisfactory frothing is obtained with the aid of a very much smaller proportion thereof than as compared with the more usual previously used froth flotation agents, such as steam distilled pine oil.

The froth flotation agents according to the present invention are capable of producing a froth that is not noticeably brittle or weeping and which obviates the need for the addition of froth-stiffening substances.

The present invention for the treatment of minerals by froth-flotation is of particular application in the treatment of sulphide ores such as copper-containing sulphidic ores, but is also applicable to the treatment of other ores such as lead, zinc, iron, molybdenum, nickel and gold sulphide and non-sulphide ores and also to mineral ores such as coal ores.

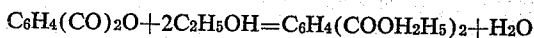
The froth flotation process may be carried out as used or described in the art, the frothing agents herein disclosed being suitable for use with or without collecting agents, modifying agents, activating agents and other

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froth flotation reagents, and otherwise applicable to the processes generally employed. The conditions most suitable for operation, that is the amount of the frothing agent, the particle size of the ore, the temperature, the pH of the mixture, the proportion of ore in the pulp, the addition of other agents and adjuncts for the process, are readily determinable by one skilled in the art. We have found the use of amounts of the froth flotation agents of our invention in the range 0.0001% to 0.05% and preferably about 0.001% by weight based on the weight of the mineral satisfactory.

In the flotation of sulphidic and oxidized metallic ores, compounds such as the xanthates, such as ethyl xanthate, dithiophosphates, phosphocresylic acids and diphenyl thiourea, are frequently used as collecting agents, while in the flotation of non-metallic ores, fatty acids and fatty acid soaps are normally used as collecting agents.

The ortho-phthalic acid diesters may be prepared from phthalic anhydride in known manner according to the typical esterification reaction:



or, where appropriate, by an alcoholysis reaction, for instance the production of diisopropyl ortho-phthalate from dimethyl ortho-phthalate and isopropanol.

The following example is given to illustrate the process of the present invention. The parts and percentages are by weight

Example

500 parts of a siliceous copper ore containing chalcocite, chalcopyrite and bornite is ground with 200 parts of water in a rod mill to minus 80 mesh particle size. The pulp is transferred to a Fagergren flotation machine and 0.005 part of potassium ethyl xanthate is added thereto. The pulp is diluted with 3000 parts of water, 0.0033 part of di-(3-methoxypropyl) ortho-phthalate is added as frothing agent, and the mixture is then conditioned without aeration for 2 minutes. The pH of the pulp is about 7.2. Aeration is then applied and the froth is removed for 8 minutes. The froth obtained is not brittle or weeping and no stiffener is added.

For purposes of comparison the above process is repeated exactly as described above with the exception that the 0.0033 part of di-(3-methoxypropyl) ortho-phthalate is replaced by 0.0087 part of pine oil. The results obtained in both cases are shown in the table below:

Frother	Percent Frother on ore	Copper in ore (percent)	Copper in concentrate (percent)	Copper in tailings (percent)	Recovery of copper in concentrate (percent)
Di-(3-methoxypropyl) ortho-phthalate.....	0.0007	4.06	61.9	1.15	73
Pine oil.....	0.0017	4.07	60.3	1.04	75

The process of this example is repeated exactly as described above using in place of the di-(3-methoxypropyl) ortho-phthalate 0.0012 part of diethyl ortho-phthalate with similar results.

We claim:

1. A method of effecting the concentration of minerals by flotation which comprises the step of adding to the mineral pulp, in the capacity of a frothing agent, a phthalic acid diester of a lower alkoxy alkanol of two to three carbon atoms.

2. A method according to claim 1, in which lower alkoxy stands for one of the groups methoxy, ethoxy, propoxy and isopropoxy.

3. A method of effecting the concentration of minerals by flotation which comprises the step of adding

to the mineral pulp, in the capacity of a frothing agent,
di-(3-methoxypropyl) phthalate.

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