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FLOTATION PROCESS

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This invention relates to flotation processes for the separation of valuable ore constituents in which the flotation process is assisted by certain organic compounds comprising substituted naphthalene sulfonic acids.

Alkyl substituted naphthalene sulfonic acids or their water soluble salts in which the alkyl substituent has at least 3 carbon atoms, impart to their water solutions very desirable wetting properties; such solutions, for instance, will form a continuous film on oily or greasy, water-repellent metallic surfaces.

I have now found that these alkyl substituted naphthalene sulfonic acids, when added in small amounts to flotation operations, will assist in the selective separation of the ore constituents and also that they are in themselves frothing agents, which, when used in connection with the usual collecting agents, will permit of a good commercial separation and recovery of the valuable ore constituents.

Propyl-, butyl-, benzyl-naphthalene monosulfonic acids are typical representatives of the class of alkyl-naphthalene sulfonic acids which I have tried and found useful in flotation processes. They are particularly applicable in connection with the flotation of sulfidic ores.

My novel process comprises substantially submitting ore in the form of a pulp to a flotation operation in the presence of an alkylated naphthalene sulfonic acid with or without the addition of either a collecting agent or a frothing agent.

The following examples will show specific application of my invention to flotation processes of various ores:

1. A pyrites ore containing small amounts of chalcopyrite was used. It assayed 0.26% Au, 0.45% Ag, 1.52% Cu, 1.1% Zn, 43.5% Fe, and 12.5% insoluble. This ore was ground to pass 82% through a 300 mesh screen and was floated in standard pneumatic rougher and cleaner cells at 3 1/2 to 1 pulp density. It was first conditioned by pre-agitation with 5 parts sodium hydroxide, 1/20 part sodium cyanide, and floated with 1/2 part propyl-naphthalene sodium sulfonate and 1/10 part distilled pine oil, the parts given representing pounds per ton of ore. The following table gives the results obtained in this flotation process:

	Per cent of total weight	Containing per cent Cu	Per cent Cu of total Cu
Concentrate	19.90	6.50	80.95
Tailings	80.10	0.38	19.05

With the same ore and a similar operation, but using 1/2 part butyl-naphthalene sulfonic acid instead of the propyl-derivative, the following results were obtained:

	Per cent of total weight	Containing per cent Cu	Per cent Cu of total Cu
Concentrate	19.13	7.17	84.13
Tailings	80.87	0 32	15.87

2. A lead ore was used in this test, consisting of a clean Utah galena containing only pyrites as the other mineral sulphide of importance. This ore was ground to pass 70% through a 200-mesh screen and was floated in a standard flotation cell, using the following reagents, the parts given being equivalent to pounds per ton of ore:

2 parts soda ash, 1/4 part thiocarbanilide, 1/10 part sodium cyanide, and 1/8 part propyl-naphthalene sodium sulfonate as the frothing agent; the following results were obtained:

	Per cent of total weight	Containing per cent Pb	Per cent Pb of total Pb
Concentrate	19.32	63.0	89.28
Tailings	80.78	1.8	10.72

Using the same ore and the following re-

agents: 2 parts soda ash, 1/4 part thiocarbanilide, 1/10 part sodium cyanide, and 1/4 part butyl-naphthalene sodium sulfonate, the following results were obtained:

	Per cent of total weight	Containing per cent Pb	Per cent Pb of total Pb
Concentrate	20.0	60.4	88.82
Tailings	80.0	1.9	11.18

These tests are remarkable for the high lead content in the flotation concentrate.

The froth produced by the alkyl naphthalene sulfonate in the above tests was not very persistent, but was sufficient to produce good separation as indicated by the results. Additions of small amounts of pine oil did not help the froth to stand up, and seemed rather to decrease the lead content of the concentrates. The use of caustic alkali, on the other hand, decreased materially the effect of the naphthalene sulfonic acids.

Other collecting and frothing agents can be used in connection with the particular naphthalene sulfonic acids, as well as other additions, such as alkali metal sulfites or soluble copper salts, and the conditions under which these agents are used or details of the process can be varied, as well known to those skilled in this art, without departing from the spirit of this invention.

The alkylated naphthalene sulfonic acids are commercially available in the form of their sodium salts; as such they are well adapted for flotation work; other water soluble salts or the free acids could also be used, the actual compound present in the flotation operation depending upon the acid or alkaline condition of the operation.

For purposes of this invention I wish it to be understood that the benzyl radical or similar alphyl-aryl groups are included in the term "alkyl" as used herein.

I claim:

1. In a process of concentrating ores or minerals by a froth flotation operation, the step which comprises performing the froth flotation operation in the presence of an alkyl-naphthalene sulfonic acid compound.

2. In a process of concentrating ores or minerals by a froth flotation operation, the step which comprises performing the froth flotation operation in the presence of a water soluble alkyl-naphthalene sulfonic acid compound in which the alkyl group contains at least 3 carbon atoms.

3. In a process of concentrating ores or minerals, the step which comprises adding an alkyl-naphthalene sodium sulfonate to the ore pulp and subjecting said pulp to a froth flotation operation.

4. The use of an alkyl-naphthalene sulfonic acid compound in which the alkyl group contains more than 2 carbon atoms as a frothing agent in a flotation process for the concentration of ores or minerals.

In testimony whereof, I affix my signature.

GEORGE LUTZ.