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FLOTATION OF CEMENT MINERALS

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The present invention relates to the froth flotation of cement minerals and more specifically relates to a method of improving the promoting power of the promoters ordinarily employed in concentrating cement ore values by froth flotation.

It is well known in the art that the values of cement ores can be concentrated or recovered by froth flotation processes in which fatty acid substances are employed as promoters. Among the more important promoters used heretofore are the free fatty acids themselves such as oleic acid, fish oil fatty acids, talloel, fatty acid soaps, and the like. In carrying out the actual froth flotation operation these various promoters may be mixed with an alkali such as caustic soda along with a water-immiscible oil such as fuel oil and may or not also contain a frother such as pine oil or kerosene.

In accordance with the present invention it has been discovered that the promoting power of the fatty acid type promoters employed in concentrating cement materials by froth flotation can very greatly be increased by adding a low percentage of an aliphatic alcohol or aliphatic ether alcohol to the promoter prior to the froth flotation operation. Some of the prior processes have used alcoholic solutions of flotation reagents, e. g., where the alcohol used is equal to or greater than the amount of flotation reagent. In such processes the alcohol was used as a solvent for the flotation reagents and was merely a method of obtaining the flotation reagents in highly concentrated form. In the present invention, however, the fatty acid type flotation reagent is diluted with about 20% or less of an alcohol to increase the promoting power. The quantity of alcohol employed in carrying out the present invention is very much less than the quantities employed as solvents in the prior solution methods. The exact reason why the promoting power of the cement flotation promoters is increased by the diluting with a small amount of an alcohol has not been definitely determined and we do not desire therefore to limit the present invention to any theory or explanation as to why the promoting power is increased.

In carrying out the present invention the fatty acid promoter is diluted with about 20% or less of an aliphatic alcohol or aliphatic ether alcohol.

This mixture is then employed in the usual manner for conducting the froth flotation. We may, however, mix the fatty acid alcohol mixture with an equal quantity of fuel oil and then add this 50/50 mixture to the flotation feed or pulp containing the correct quantity of caustic and then condition for a short time prior to the froth flotation.

It is an advantage of the present invention that the promoting power of the fatty acid type promoters is increased by diluting with 20% or less of any of the well known aliphatic alcohols or ether alcohols and is not limited to any particular alcohol or ether alcohol. Among the aliphatic alcohols that have been found to be useful are those such as methyl, ethyl, propyl, isopropyl, butyl, iso-butyl, octyl; the polyhydroxy alcohols such as glycol, diethylene glycol, or polyethylene glycols, and the various ether alcohols such as mono-methyl ether of diethylene glycol, mono-ethyl ether of diethylene glycol, mono-butyl ether of diethylene glycol and the like. The term "aliphatic alcohol" as used in the appended claims is intended to include the unsubstituted mono- and poly-hydric aliphatic alcohols and the aliphatic ether alcohols such as those listed above.

The invention will be further illustrated in connection with the following specific examples.

Example 1

The ore sample used in these tests was a sample of full size range cement rock slurry (not deslimed) from the Valley Forge Cement Company. The sample in the form of a pulp was thoroughly mixed by agitation with a mechanical agitator.

The procedure following in conducting these flotation tests is described as follows:

Charges of the slurry containing 600 grams of dry solids were transferred to a laboratory-size Fagergren flotation machine and diluted to 22% solids with laboratory water.

Reagents were then added and conditioned with the pulp for one minute. The air valve was opened and the resulting concentrate froth was skimmed off for three minutes. The flotation test products were filtered, dried, weighed and titrated for CaCO_3 contents.

The metallurgical data pertaining to these tests are given in the table.

subjecting an aqueous pulp of cement rock to froth flotation in the presence of talloel diluted

Metallurgical data

Test No.	Feed, percent CaCO ₃	Concentrate			Tailing			Mixture tested		Promoter lbs./ton of feed
		Percent weight	Percent CaCO ₃	Dist. percent CaCO ₃	Percent weight	Percent CaCO ₃	Dist. percent CaCO ₃	Promoter	Diluent	
1	75.47	49.71	83.79	55.19	50.29	67.24	44.81	F. O. F. A.	None	0.65
2	75.78	75.03	85.07	84.22	24.97	47.88	15.78	F. O. F. A., 90%	Ethyl alcohol, 10%	0.64
3	75.49	80.89	84.30	90.33	19.11	38.20	9.67	F. O. F. A., 50%	Ethyl alcohol, 50%	0.65
4	75.42	75.56	84.30	84.34	24.44	48.39	15.66	F. O. F. A., 90%	Isopropyl alcohol, 10%	0.66
5	75.67	77.77	83.54	85.86	22.23	48.13	14.14	F. O. F. A., 90%	Sec. butyl alcohol, 10%	0.67
6	75.99	80.20	84.57	89.26	19.80	41.23	10.74	F. O. F. A., 90%	Tert. butyl alcohol, 10%	0.66
7	75.46	78.08	84.56	88.51	21.02	41.26	11.49	F. O. F. A., 90%	Sec. amyl alcohol, 10%	0.67
8	76.37	80.79	84.32	89.20	19.21	42.92	10.80	F. O. F. A., 90%	Tert. amyl alcohol, 10%	0.66
9	75.50	81.82	82.77	89.70	18.18	42.79	10.30	F. O. F. A., 90%	Capryl alcohol, 10%	0.67
10	76.02	76.27	84.57	84.85	23.73	48.55	15.15	F. O. F. A., 90%	Ethyl ether of diethylene glycol, 10%	0.64
11	75.70	80.45	84.56	89.87	19.55	39.22	10.13	F. O. F. A., 90%	Butyl ether of diethylene glycol, 10%	0.65
12	75.72	21.36	86.34	24.35	78.64	72.84	75.65	F. O. F. A.	None	0.27
13	75.82	50.37	84.56	56.18	49.63	66.94	43.82	F. O. F. A., 90%	Ethyl alcohol, 10%	0.29
14	75.00	53.30	86.09	61.18	46.70	62.34	38.82	F. O. F. A., 80%	Ethyl alcohol, 20%	0.23
15	75.49	66.39	83.80	73.69	53.61	59.09	26.31	F. O. F. A., 90%	Isopropyl alcohol, 10%	0.28
16	75.66	68.31	84.05	75.89	51.69	57.56	24.11	F. O. F. A., 90%	Sec. butyl alcohol, 10%	0.29
17	76.20	66.88	84.32	74.01	53.12	59.79	25.99	F. O. F. A., 90%	Tert. butyl alcohol, 10%	0.28
18	75.68	70.77	83.80	78.36	29.23	56.03	21.64	F. O. F. A., 90%	Sec. amyl alcohol, 10%	0.29
19	76.13	67.96	84.32	75.27	32.04	58.77	24.73	F. O. F. A., 90%	Tert. amyl alcohol, 10%	0.28
20	75.66	73.10	83.54	80.71	26.90	54.25	19.29	F. O. F. A., 90%	Capryl alcohol, 10%	0.29
21	76.14	62.95	84.57	69.92	37.05	61.83	30.08	F. O. F. A., 90%	Ethyl ether of diethylene glycol, 10%	0.29
22	75.74	68.06	83.80	75.30	31.94	58.58	24.70	F. O. F. A., 90%	Butyl ether of diethylene glycol, 10%	0.30
23	75.97	76.68	85.34	86.13	23.32	45.17	13.87	Oleic acid	None	0.66
24	76.04	78.32	85.08	87.63	21.68	43.38	12.37	Oleic acid, 90%	Ethyl alcohol, 10%	0.64
25	75.81	80.19	85.34	90.61	19.81	36.22	9.49	Oleic acid, 80%	Ethyl alcohol, 20%	0.67
26	74.83	67.21	86.27	78.03	32.79	50.14	21.97	Oleic acid	None	0.28
27	75.57	72.40	85.34	81.76	27.60	49.93	18.24	Oleic acid, 90%	Ethyl alcohol, 10%	0.29
28	75.42	72.85	85.34	82.43	27.15	48.81	17.57	Oleic acid, 80%	Ethyl alcohol, 20%	0.29
29	76.29	75.04	86.79	85.37	24.96	44.72	14.63	Talloel H.	None	0.68
30	76.65	77.04	86.16	86.60	22.96	44.72	13.40	Talloel H., 90%	Ethyl alcohol, 10%	0.66
31	76.00	76.96	85.78	86.86	23.04	43.33	13.14	Talloel H., 80%	Ethyl alcohol, 20%	0.67
32	76.54	59.97	86.54	67.80	40.03	61.57	32.20	Talloel H.	None	0.26
33	76.25	68.60	85.40	76.84	31.40	56.25	23.16	Talloel H., 90%	Ethyl alcohol, 10%	0.27
34	76.18	65.39	84.51	72.54	34.61	60.43	27.46	Talloel H., 80%	Ethyl alcohol, 20%	0.25

In above tests F. O. F. A. designates fish oil fatty acid.

What we claim is:

1. In the recovery of values from cement rock by froth flotation the process which comprises subjecting an aqueous pulp of cement rock to froth flotation in the presence of a fish oil fatty acid diluted with about 10% of ethyl alcohol as the flotation promoter.

2. In the recovery of values from cement rock by froth flotation the process which comprises subjecting an aqueous pulp of cement rock to froth flotation in the presence of a fish oil fatty acid diluted with about 10% of an aliphatic alcohol.

3. The improvement in the recovery of cement rock values by froth flotation processes which comprises subjecting an aqueous pulp of cement rock to froth flotation in the presence of a cement rock ore promoter of the group consisting of higher fatty acids, mixtures of higher fatty acids, and soaps of such acids, said promoters being diluted with at least one aliphatic alcohol, the alcoholic content of said promoter being from about 9% to not more than about 20%.

4. In the recovery of values from cement rock by froth flotation, the process which comprises subjecting an aqueous pulp of cement rock to froth flotation in the presence of a fish oil fatty acid diluted with from about 9% to not more than about 20% of an aliphatic alcohol.

5. In the recovery of values from cement rock by froth flotation, the process which comprises

with from about 9% to not more than about 20% of an aliphatic alcohol.

6. In the recovery of values from cement rock by froth flotation, the process which comprises subjecting an aqueous pulp of cement rock to froth flotation in the presence of talloel diluted with about 10% of an aliphatic alcohol.

7. In the recovery of values from cement rock by froth flotation, the process which comprises subjecting an aqueous pulp of cement rock to froth flotation in the presence of talloel diluted with about 10% of ethyl alcohol.

8. In the recovery of values from cement rock by froth flotation, the process which comprises subjecting an aqueous pulp of cement rock to froth flotation in the presence of oleic acid diluted with from about 9% to not more than about 20% of an aliphatic alcohol.

9. In the recovery of values from cement rock by froth flotation, the process which comprises subjecting an aqueous pulp of cement rock to froth flotation in the presence of oleic acid diluted with about 10% of an aliphatic alcohol.

10. In the recovery of values from cement rock by froth flotation, the process which comprises subjecting an aqueous pulp of cement rock to froth flotation in the presence of oleic acid diluted with about 10% of ethyl alcohol.

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