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PROCESS OF PURIFYING GLASS SANDS

Francis X. Tartaron and James B. Duke, Mulberry, Fla., assignors to Phosphate Recovery Corporation, New York, N. Y., a corporation of Delaware

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1 Claim. (Cl. 209—166)

The present invention relates to an improved process of purifying glass sands by froth flotation.

In the glass-making art, silica sands occurring in natural granular form are employed, but such sands are rarely found free from iron impurities. These impurities may take the form of iron-bearing and iron-stained minerals, which are decidedly detrimental in glass making. They exist in the sands in very small quantity, but it is essential that they be reduced to very low and definite limits.

In producing glass sands of the highest quality they are usually given an acid wash, after having first been purified to as great an extent as possible by a mechanical separation, such as gravity tabling, the acid dissolving most of the remaining iron impurities.

By removing a larger proportion of the iron impurities prior to the acid wash, economies can be effected in the amount of acid consumed, the time taken to dissolve impurities and in the amount of water required for washing. The latter item may be of importance where the operations must be conducted where there is a limited water supply.

The present invention resides in the discovery that larger proportions of the iron impurities can be removed from glass sands by the froth flotation processes hereinafter described than by present known methods, for example gravity tabling. Froth flotation in itself is also more economical in water consumption.

The objects of the invention are to improve the removal of iron impurities from silica sands thereby producing glass sands of higher quality, and to effect economies in the purification process.

In accordance with the invention, the sands are agitated in aqueous pulp in the presence of a substantially insoluble and unsaponifiable oil, a higher fatty acid compound, and an alkali. Thereafter, the pulp is subjected to froth flotation, by which operation the iron impurities are largely floated away from the silica and sent to waste, the residual material consisting of the purified sands.

As the higher fatty acid compound, oleic acid and oleic acid soap have proved useful, but other higher fatty acids and fatty acid soaps can be used, as shown hereinafter in the specific examples. In general, the higher fatty acid compound used should be one containing a hydrocarbon radical of at least twelve carbon atoms. It is not required, of course, that the higher fatty acid compound used should be chemically pure. Moreover, it may often be advantageous from an economical standpoint to use crude fatty acid compound mixtures, such as those derived from fish oil and the product commercially known as "Varlacoid" which may contain a mixture of fatty acids and resin acids.

Examples of substantially insoluble and unsaponifiable oils are fuel oil, lubricating oil, Diesel oil, etc., while examples of alkalies are sodium hydroxide, calcium hydroxide, sodium carbonate, sodium silicate, etc.

If desired, a suitable frother such as pine oil may be used along with the other agents, but this is not essential.

The effectiveness of the process is revealed in the following examples, in each of which the glass sands used were obtained from the Central Silica Company.

Example 1

A sample of impure glass sands shown on analysis to contain 0.019% iron, was made up with water into a thick pulp of about 70% solids. To this pulp during agitation in an impeller-type mixer were added 0.2 lb. of caustic soda, 0.9 lb. of fuel oil, 1.1 lbs. of "Varlacoid," and 0.14 lb. of pine oil, all per ton of feed. This addition of reagents required about one minute, subsequent to which agitation in the mixer was continued for two more minutes. The pulp was then transferred to a subaeration flotation machine where it was diluted to about 20% solids and agitated to float off the iron impurities. The results were as follows:

Product	Weight	Fe	Total Fe
	Percent	*Percent*	*Percent*
Feed	100.0	0.019	100.0
Floated	2.7	0.314	44.7
Residue	97.3	0.011	55.3

Example 2

Another sample of impure glass sands, shown by analysis to contain 0.015% iron, was treated in the same way and with the same reagents as in Example 1 with the following results:

Product	Weight	Fe	Total Fe
	Percent	*Percent*	*Percent*
Feed	100.0	0.015	100.0
Floated	2.7	0.271	48.0
Residue	97.3	0.008	52.0

Example 3

A sample of impure glass sands, shown by analysis to contain 0.036% iron, was treated by the procedure of Example 1 using as reagents 0.2 lb. of caustic soda, 0.7 lb. of fuel oil and 2.4 lbs. of red oil, all per ton of feed. The results were as follows:

Product	Weight	Fe	Total Fe
	Percent	*Percent*	*Percent*
Feed	100.0	0.036	100.0
Floated	4.7	0.330	43.7
Residue	95.3	0.021	56.3

Example 4

A sample of impure glass sands, shown by analysis to contain 0.033% iron, was treated by the procedure of Example 1 using as reagents 0.4 lb. of caustic soda, 2.5 lbs. of fuel oil and 2.5 lbs. of Upjohn's fatty acid (of animal origin), all per ton of ore. The results were as follows:

Product	Weight	Fe	Total Fe
	Percent	*Percent*	*Percent*
Feed	100.0	0.033	100.0
Floated	5.6	0.240	40.4
Residue	94.4	0.021	59.6

Example 5

A sample of impure glass sands, shown by analysis to contain 0.034% iron, was treated by the procedure of Example 1 using as reagents 0.7 lb. of fuel oil and 0.7 lb. of potassium linolate, both per ton of ore. The results were as follows:

Product	Weight	Fe	Total Fe
	Percent	*Percent*	*Percent*
Feed	100.0	0.034	100.0
Floated	4.4	0.252	32.6
Residue	95.6	0.024	67.4

Example 6

A sample of impure glass sands, shown by analysis to contain 0.028% iron, was treated by the procedure of Example 1, using as reagents 3.7 lbs. fuel oil and 5.0 lbs. sodium oleate, both per ton of ore. The results were as follows:

Product	Weight	Fe	Total Fe
	Percent	*Percent*	*Percent*
Feed	100.0	0.028	100.0
Floated	4.9	0.190	32.9
Residue	95.1	0.020	67.1

Example 7

A sample of impure glass sands, shown by analysis to contain 0.038% iron, was treated by the procedure of Example 1 using as reagents 0.2 lb. of calcium hydroxide, 0.7 lb. of fuel oil and 2.4 lbs. of red oil, all per ton of ore. The results were as follows:

Product	Weight	Fe	Total Fe
	Percent	*Percent*	*Percent*
Feed	100.0	0.038	100.0
Floated	5.1	0.308	38.0
Residue	94.9	0.023	62.0

In the foregoing examples the flotation was effected in from three to seven minutes. The alkali to be used may be selected according to the particular conditions encountered.

As the foregoing examples show, the present invention effects the removal from the impure glass sands of from 32% to 48% of the contaminating iron.

It is to be understood that the invention as defined in the appended claim is not limited by any details of the foregoing illustrative embodiments.

What is claimed is:

The process of separating the iron impurities from the silica of glass sands which consists of conditioning a thick aqueous pulp of such sands with cooperating agents consisting of a substantially insoluble and unsaponifiable oil, a fatty acid having a hydrocarbon radical of at least twelve carbon atoms and an alkali, and then diluting said conditioned pulp and subjecting it to froth-flotation to float off the iron impurities from the silica, leaving the tailings as the purified glass sands.

FRANCIS X. TARTARON.
JAMES B. DUKE.