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FLOTATION TREATMENT OF SYLVINITE ORES

Arthur J. Weinig, Golden, Colo., assignor to Potash Company of America, Denver, Colo., a corporation of Colorado

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This invention relates to a froth flotation treatment of sylvinite ores, and more particularly relates to a process in which sylvite constituents of a sylvinite ore are recovered in a substantially pure condition as a non-floated residue of the froth flotation operation.

This application is a continuation-in-part of my co-pending applications Serial No. 755,577, filed December 1, 1934, for Flotation process; Serial No. 11,059, filed March 14, 1935, for Flotation process, Case B; Serial No. 28,983, filed June 28, 1935, for Process of treating sylvinite ores and products obtained thereby; and Serial No. 81,729, filed May 25, 1936, for Process of treating ores.

The froth flotation treatment as described in said applications, Serial Nos. 755,577 and 11,059 has proven a highly efficient method of separating halite and sylvite constituents of sylvinite ores. In these operations, a relatively tough and stable froth is produced in which halite and gangue constituents are concentrated, leaving the sylvite particles as a non-floated residue.

While the reagent costs of these operations are relatively cheap, a considerable amount of reagent is required in the operation. For example, a given milling operation involves the use of approximately four pounds of palm kernel oil soap per ton of head ore.

It is a primary object of the present invention to provide a reagent combination which will effectively reduce the amount of reagent required for proper flotation and will reduce reagent costs proportionately.

Another object of the invention is the provision of a reagent combination which will increase tonnage of material treated in any given plant through a reduction in duration of the various treatments at different stages of the operation.

A further object of the invention is to increase selectivity of the flotation reagent in the froth flotation operation.

Still another object of the invention is to produce a froth that is more mobile and which breaks down more readily than any heretofore produced in the froth flotation of sylvinite ores.

Other objects reside in novel steps and treatments, all of which will appear more fully in the course of the following description.

In performing the process, the pulp is prepared in the usual way by grinding or otherwise reducing the sylvinite ore to a finely divided condition and entering the finely divided particles thereof into a saturated solution of the ore, that is, a solution saturated with respect to both sodium chloride and potassium chloride.

In this connection, it will be understood that any of the well-known methods of dry or wet grinding may be employed, and it has been found, in practice, that good results will be attained by wet grinding in a pebble mill in closed circuit with a classifier.

The reagents heretofore used for selective flotation of halite are fatty acids or fatty acid derivatives, soluble in the brine, such as salt water soaps, or the class of alkali resinates. An essentiality of the operation is that the saturated solution of the pulp contains lead and/or bismuth dissolved therein.

The present invention involves the use of the aforesaid reagents and solution in combination with a small quantity of cresylic acid or a cresol, from 0.5 to 0.1 pound being the preferred range for use in the process.

A substantial reduction in the quantity of reagent required results from the use of cresylic acid, while the efficiency of the process is improved. The selectivity of the reagent is increased with the result that less sylvite is carried into the froth than formerly, with consequent saving in time and expense in the operations required to complete the separation.

While various reagents in the classes aforementioned may be used, palm kernel soap, coconut oil soap, oleic acid, and sodium resinate have been found to be particularly efficacious in floating halite. The addition of the cresylic acid in the quantity aforementioned reduces the amount of soap or other reagent required in the approximate proportion of from 4 pounds to 1.6 pounds per ton of head ore.

To afford a better understanding of the application of the invention, reference is made to the following operation:

Flotation was effected in a pulp composed of a saturated sylvinite ore solution having a soluble lead content of 1.50 grams per litre. The reagent used, consisted of 0.12 pound cresylic acid and 1.6 pounds coconut oil soap (anhydrous) per ton of ore treated. The following results were obtained:

Product:	Per cent KCl
Halite froth removed	4.8
Middling	15.8
Non-floated residue	83.7

The reagent may be introduced into the pulp in any suitable manner, as, for example, directly into the flotation cell or in advance thereof, in conditioning apparatus, or at any other suitable place. The lead also may be introduced into the

saturated solution in any suitable manner, and good results are attained when the lead is introduced in the grinding circuit.

Many advantages result from the use of the present invention. In an actual mill operation it has been found to increase production in a plant of a given capacity from 10% to 12%, and at the same time has reduced the cost of the operation as much as 15%.

The increased capacity results from the fact that the flotation treatment is shortened by reason of the greater selectivity of the reagent, and the treatments subsequent to flotation are likewise shortened, due in part, to the character of the froth which breaks down readily, thereby facilitating handling of the concentrates and solution in launders, pumps and other mill equipment, and for the further reason that the treatments subsequent to flotation are shortened, due to the fact that less sylvite is present in the halite concentrate than under former conditions.

It will be understood that the present process will preferably employ the temperature control treatments disclosed in my co-pending application Serial No. 755,576, filed December 1, 1934, for Temperature control in a flotation process, as well as the treatments described in applications 28,983 and 81,729, previously identified. Particularly in the heating and cooling steps following flotation, an appreciable reduction in treatment time is experienced because of the decreased sylvite content in the halite froth.

From the foregoing it will be apparent that the present invention can be incorporated in the treatments described in my various co-pending applications identified hereinbefore, wherever flotation of halite and/or gangue is effected in a pulp containing lead and/or bismuth in solution.

Since lead and/or bismuth in solution is an essential constituent of the pulp in the performance of the process, the term "cation of the lead, bismuth class" will be used to designate any composition having the characteristics of dissolved lead in the halite-sylvite solution.

It is to be expressly understood that the term "fatty acid", as used in the description and claims, is intended to include all fatty acids and fatty acid derivatives which are capable of causing flotation of halite or halite and gangue particles in a saturated halite-sylvite solution containing dissolved lead therein.

Changes and modifications may be availed of within the spirit and scope of the invention as defined in the hereunto appended claims.

What I claim and desire to secure by Letters Patent is:

1. A process for the recovery of potassium chloride from sylvinite ores by selective flotation, which comprises entering sylvinite ore into a saturated solution of such ore, containing a cation of the lead, bismuth class, to form a pulp, and subjecting the pulp to a froth flotation treatment in the presence of a cresol and a fatty acid having a selective affinity for sodium chloride in the pulp.

2. A process for the recovery of potassium chloride from sylvinite ores by selective flotation, which comprises entering sylvinite ore into a saturated solution of such ore, containing a cation of the lead, bismuth class, to form a pulp, and subjecting the pulp to a froth flotation treatment in the presence of a cresol and a fatty acid derivative having a selective affinity for sodium chloride in the pulp.

3. A process for the recovery of potassium chloride from sylvinite ores by selective flotation, which comprises entering sylvinite ore into a saturated solution of such ore, containing a cation of the lead, bismuth class, to form a pulp, and subjecting the pulp to a froth flotation treatment in the presence of a cresol and a salt water soap having a selective affinity for sodium chloride in the pulp.

4. A process for the recovery of potassium chloride from sylvinite ores by selective flotation, which comprises entering sylvinite ore into a saturated solution of such ore, containing a cation of the lead, bismuth class, to form a pulp, and subjecting the pulp to a froth flotation treatment in the presence of a cresol and an alkali resinate having a selective affinity for sodium chloride in the pulp.

5. A process for the recovery of potassium chloride from sylvinite ores by selective flotation, which comprises entering sylvinite ore into a saturated solution of such ore, containing a cation of the lead, bismuth class, to form a pulp, and subjecting the pulp to a froth flotation treatment in the presence of a cresol and a coconut oil soap having a selective affinity for sodium chloride in the pulp.

6. A process for the recovery of potassium chloride from sylvinite ores by selective flotation, which comprises entering sylvinite ore into a saturated solution of such ore, containing a cation of the lead, bismuth class, to form a pulp, and subjecting the pulp to a froth flotation treatment in the presence of a cresol and oleic acid having a selective affinity for sodium chloride in the pulp.

7. A process for the recovery of potassium chloride from sylvinite ores by selective flotation, which comprises entering sylvinite ore into a saturated solution of such ore, containing a cation of the lead, bismuth class, to form a pulp, and subjecting the pulp to a froth flotation treatment in the presence of a cresol and sodium resinate having a selective affinity for sodium chloride in the pulp.

8. A process according to claim 1 in which the cresol is present in an amount of from 0.5 to 0.1 pound per ton of ore treated.

9. A process according to claim 1 in which the fatty acid is present in an amount approximating 1.6 pounds per ton of ore treated.

10. A process according to claim 1 in which the cresol is present in an amount approximating .12 pound and the fatty acid is present in an amount approximating 1.6 pounds per ton of ore treated.

11. In a froth flotation treatment of sylvinite ore, in which halite constituents are floated by the action of a fatty acid reagent, the step of reducing the quantity of fatty acid required for the flotation reaction by mixing the fatty acid with a relatively small quantity of a cresol.

12. In a froth flotation treatment of sylvinite ore, in which halite constituents are floated by the action of an alkali resinate reagent, the step of reducing the quantity of alkali resinate required for the flotation reaction by mixing the alkali resinate with a relatively small quantity of a cresol.

13. In a froth flotation treatment of sylvinite ore, in which halite constituents are floated by the action of a fatty acid reagent, the step of accelerating the flotation action by subjecting halite constituents to the action of a fatty acid mixed with cresylic acid.

14. In a froth flotation treatment of sylvinite

ore, in which halite constituents are floated by the action of an alkali resinate reagent, the step of accelerating the flotation action by subjecting halite constituents to the action of an alkali resinate mixed with cresylic acid.

15. In a froth flotation treatment of sylvinite ore, in which halite constituents are floated by the action of an alkali resinate reagent, the step of reducing the quantity of alkali resinate required for the flotation reaction by substituting approximately three parts cresylic acid for approximately forty parts fatty acid in the reagent composition.

16. In a froth flotation treatment of sylvinite ore, in which halite constituents are floated by the action of a fatty acid reagent, the step of reducing the quantity of fatty acid required for the flotation reaction by substituting approximately three parts cresylic acid for approximately forty parts fatty acid in the reagent composition.

17. In a process for treating sylvinite ores, the step of subjecting sylvinite ore in finely divided condition in a saturated solution of the ore containing dissolved lead to a froth flotation treatment in the presence of cresylic acid and a flotation reagent having a selective affinity for halite constituents of the ore.

18. In a process for treating sylvinite ores, the step of subjecting sylvinite ore in finely divided condition in a saturated solution of the ore containing dissolved bismuth to a froth flotation treatment in the presence of cresylic acid and a flotation reagent having a selective affinity for halite constituents of the ore.

19. In a process for treating sylvinite ores, the step of subjecting a pulp of sylvinite ore, in finely divided condition in a saturated solution of the ore containing a cation of the lead, bismuth class dissolved therein, to a froth flotation treatment in the presence of a cresol and a flotation reagent having a selective affinity for halite constituents of the pulp.

20. A process for the recovery of potassium chloride from sylvinite ores by selective flotation, which comprises entering sylvinite ore into a saturated solution of such ore, containing a cation of the lead, bismuth class, to form a pulp, and subjecting the pulp to a froth flotation treatment in the presence of a cresol and one of that group of reagents consisting of alkali resinates and fatty acids, having a selective affinity for sodium chloride in the pulp.

ARTHUR J. WEINIG.