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ORE CONCENTRATION

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This invention relates to the concentration of ores by flotation, and is herein illustrated as applied to the concentration of metalliferous ores with the aid of activated carbons, such as activated charcoal, in the presence of a xanthate.

The expression "activated carbon" as used in this specification is intended to refer to a vegetable wood charcoal whose adsorptive and absorptive property has been augmented by chemical and/or physical means.

This application is a continuation in part of my application Serial No. 624,965, filed July 27, 1932.

According to the present invention the xanthate may be added to the ore pulp in solution admixed with the activated carbon, or the activated carbon and xanthate may be added separately to the agitated pulp and so brought into contact.

When the pulp containing the added xanthate and the activated carbon is agitated in the usual manner, a froth concentrate may be separated in the usual way. The recovery of metalliferous mineral in a concentrate obtained in the presence of the activated carbon may not vary much from recovery of metalliferous mineral in the absence of the carbon, but it is found that the concentrate obtained in the presence of the activated carbon is considerably richer in metalliferous mineral than the concentrate obtained by the usual procedure with xanthate alone. In other words, the activated carbon causes the procedure to exclude from the concentrate a large proportion of the gangue, or so-called insoluble, of the ore which the concentrate would otherwise carry. Sometimes, however, the concentrate carries also an increased proportion of the metalliferous mineral in the ore.

Concentrates carrying the minimum of gangue were obtained when the xanthate added was in the neighborhood of a hundredth of a pound per tone of dry ore. In many cases the presence of activated carbon resulted in reducing the gangue content of the concentrate by about one-third.

Other features and advantages will hereinafter appear in connection with the following examples:

Example 1.—10 mesh Nevada Consolidated ore was wet ground for 7 minutes with 5 pounds of calcium oxide per ton of ore, diluted with added water and agitated for 2 minutes with 0.1 pound of pine oil, 1.0 pound activated charcoal and 0.01 pound of potassium ethyl xanthate, all per ton of ore. A froth concentrate was then separated for 5 minutes.

The concentrate was 4.2% of the weight of the heads. The heads contained 1.39% copper, the concentrates 30.88% copper and 9% insoluble or gangue, and the tailings contained 0.10% copper, representing a recovery of 93.1% of the copper. When no charcoal was used the concentrate contained only 27.04% of copper and 16% insoluble or gangue.

Example 2.—When 0.01 pound of potassium benzyl xanthate was substituted for the ethyl xanthate, using activated charcoal in an otherwise parallel test, with heads containing 1.36% copper, a concentrate weighing 4.23% of the heads was obtained. The concentrate contained 28.64% of copper and 13.6% insoluble or gangue, and the tailings contained 0.15% of copper, representing a recovery of 89.4% of the copper. In the absence of charcoal, other conditions being the same, the concentrate assayed only 24.8% of copper and 21.0% insoluble or gangue, with a slightly higher recovery.

Example 3.—When cyclohexanyl xanthate at the rate of 0.01 pound per ton of ore was substituted for ethyl xanthate in a parallel test, using activated charcoal with heads containing 1.36% of copper, the concentrates weighed 4.22% of the heads and contained 28.8% of copper and 14.4% insoluble or gangue. The tailings contained 0.15% of copper, representing a recovery of 89.4% of the copper.

In the absence of the activated charcoal, a slightly higher recovery was obtained with, however, a reduction of nearly 4% of copper in the concentrates, and an increase of 7.6% in insoluble or gangue.

Example 4.—When Nevada Consolidated copper ore was treated with activated charcoal and potassium amyl xanthate added separately to the pulp and brought into contact by the strong agitation thereof, the procedure and result were as follows:

The ore was wet ground in a ball mill with 5 pounds of lime per ton, for 7 minutes, water added, and agitated for 2 minutes in a flotation machine, with the addition of 1 pound activated charcoal, 0.01 pound potassium amyl xanthate, and 0.1 pound of pine oil, all per ton of ore. A froth concentrate was then separated for 5 minutes. The heads contained 1.36% of copper, the concentrates weighed 3.54% of the heads and contained 27.04% of copper with 14.8% insoluble or gangue, and the tailings contained 0.42% of copper, representing a recovery of 79.3% of the copper.

A parallel test made without the use of ac-

tivated charcoal resulted in a concentrate assaying 25.6% of copper, containing 20% insoluble or gangue.

Example 5.—When in a parallel test of the same Nevada Consolidated copper ore, potassium secondary butyl xanthate was substituted for amyl xanthate, the same amount of the same activated charcoal being used, the following results were obtained:

The heads contained 1.41% of copper, the concentrates weighed 3.73% of the heads and contained 26.56% of copper and 16.8% insoluble or gangue. The tailings contained 0.44% of copper, representing a recovery of 70.0% of the copper.

A parallel test made without the use of activated charcoal resulted in a concentrate assaying 21.76% of copper and containing 24.8% insoluble or gangue.

The above tests were run with so-called "Nuchar", an activated charcoal.

Ten mesh Mountain Copper Company ore was reground 20 minutes with 3 pounds of lime per ton, diluted with water and agitated for 3 minutes with 5 lbs. "Nuchar", 0.1 pound potassium ethyl xanthate, and 0.2 pound of pine oil, all per ton of ore. The froth was removed for a period of 5 minutes. The concentrates were 9.65% by weight of the heads. They assayed 26.24% of copper and 6.2% insoluble or gangue. The heads contained 2.98% copper by calculation, and the tails assayed 0.5% copper. The copper recovery amounted to 93.4% of the total.

In a parallel test made with another activated carbon, so-called "Norite", which is an activated carbon understood to be made from distillation residue from paper mill waste liquors electrically carbonized and activated by steam, the concentrates weighed 13.4% of the weight of the heads, the calculated assay of which was 2.93% copper. The concentrates assayed 18% copper and 3.8% insoluble or gangue, representing a recovery of 82.3% of the total copper in the ore.

A parallel test made on the same ore, but without activated charcoal, resulted in a concentrate weighing 24.4% of the heads. The calculated copper of the heads was 3.1%. The concentrates contained 11.52% copper and 28.4% insoluble, representing a recovery of 90.7% of the copper in the ore.

Ten mesh Desloge Lead Company ore was reground 15 minutes diluted with water and agitated 2 minutes with 4 pounds "Nuchar", an activated carbon supposed to be made from gas activated birchwood charcoal, 0.05 amyl xanthate, and 0.15 pound pine oil, all per ton of ore. The froth concentrate removed for 5 minutes represented 5% by weight of the heads, the calculated lead content of which was 3.96%. The concentrates contained 77% lead and 2.1% insoluble or gangue, representing a lead recovery of 97.1%. The tails assayed 0.12% lead.

A similar test made with "Norite" resulted in a concentrate weighing 6.3% of the heads, the calculated lead content of which was 4.35%. The concentrates contained 68% lead and 3.4% insoluble or gangue, representing a lead recovery of 98.4%. The tails assayed 0.075% lead.

A parallel test made without activated charcoal produced concentrates assaying 64.8% lead and 3.3% insoluble or gangue. These represented 6.3% by weight of the heads, the calculated lead content of which was 4.19%. The lead recovery in the concentrates amounted to 95.7%. The tails assayed 0.2% lead.

Ten mesh zinc ore, free from lead, and from the Joplin district, was reground 10 minutes, diluted with water and agitated 2 minutes with 1.0 pound $CuSO_4$, 10 lbs. "Nuchar", 0.3 pound potassium ethyl xanthate, and 0.7 pound pine oil, all per ton of ore. The concentrates removed for 5 minutes represented 17.9% of the weight of the heads. The calculated zinc content of the heads was 13.88%. The concentrates contained 66.2% zinc and 1.8% insoluble or gangue, representing a recovery of 85.2% of the total zinc in the ore. The tails assayed 2.5% zinc.

A parallel test made with "Norite" produced a concentrate containing 64.7% zinc and 2.6% insoluble or gangue. It weighed 18.6% of the heads, the calculated zinc content of which was 14.09% zinc, representing zinc recovery of 85.5%. The tails assayed 2.5% zinc.

A parallel test without activated charcoal produced a concentrate weighing 21.1% of the heads. The calculated zinc content of the heads was 13.9% zinc. The concentrates contained 62.8% zinc and 5.4% insoluble or gangue, representing a recovery of 95.5% of the total zinc in the ore. The tails assayed 0.8 zinc.

Having thus described certain embodiments of the invention, what I claim is:

1. The process of concentrating an ore, which consists in dispersing together in an ore pulp an alkaline xanthate and an activated carbon material, agitating such pulp with another agent so as to produce a floating concentrate, and separating the concentrate.

2. The process of concentrating an ore, which consists in dispersing together in an alkaline ore pulp an alkline xanthate and activated charcoal, agitating such pulp with another agent so as to produce a floating concentrate, and separating the concentrate.

3. The process of concentrating an ore, which consists in dispersing in an ore pulp separately mixed xanthate solution and activated charcoal, agitating the pulp with another agent so as to produce a floating concentrate, and separating the concentrate.

4. The process of concentrating an ore, which consists in dispersing in an alkaline ore pulp separately mixed xanthate solution and activated charcoal, agitating the pulp with another agent so as to produce a floating concentrate, and separating the concentrate.

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