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PROCESS FOR TREATING CLAY

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ABSTRACT OF THE DISCLOSURE

Process for varying the titanium content of finely divided titanium-containing ores by adding to an aqueous dispersion of the ore a calcium, barium, strontium or magnesium hydroxide or salt at a specific alkaline pH. In the process, a flocculated ore rich in titanium settles, leaving dispersed an ore of less concentration of titanium than the original finely divided titanium-containing ore.

The present invention is concerned with a process for varying the titanium content of finely divided titanium-containing ores and for improving the brightness characteristics of a kaolin clay. More particularly, it relates to a selective flocculation procedure whereby a portion of kaolin clay, rich in discoloring impurities, is caused to flocculate, i.e. to aggregate and settle out, from an aqueous kaolin clay suspension, leaving suspended a purer kaolin clay fraction of improved brightness, as compared with the original kaolin clay.

Typically, kaolin clays comprise a substantial amount of kaolinite and may additionally have varying amounts of such minerals as montmorillonite, halloysite, attapulgite, Fuller's earth, dickite and illite. Pure kaolinite is essentially a white mineral while kaolin clay, as found in nature, and as commercially produced, is discolored. It has long been recognized that this discoloration which reduced the brightness of a kaolin clay can be due to, among other things, the various iron and titanium-containing impurities present in the clay. Titanium dioxide (TiO_2), usually in the form of anatase and rutile, is recognized as a discoloring impurity in kaolin; presumably this is because iron in its oxide or other form is incorporated into the crystalline lattice of the anatase and rutile, since pure anatase or rutile is ordinarily a very white substance. As little as 1% of an iron containing material, or less, can suffice to render titanium dioxide highly colored. As used in the application, the term "titanium dioxide" refers to the impure form of anatase and rutile.

Today there is a large commercial interest in improving the brightness of a kaolin clay. In many applications, e.g. paper coating, the value of a kaolin clay depends on its brightness. The brightness of a kaolin clay is conventionally expressed in "GE" values, determined according to TAPPI (Technical Association of the Pulp and Paper Industry) Method T 646 m–54, as reported in the Testing Methods—Recommended Practices—Specifications of the Technical Association of the Pulp and Paper Industry, and is an indication of the amount of iron and titanium-containing impurities present in the clay. For example, chemical analysis of two samples of kaolin clay having GE values of 91.2 and 83.5, respectively, showed the sample with GE value of 91.2 to have approximately 1/20 the titanium dioxide content of the other sample.

An object of the present invention is to provide a simple and economic process for improving the brightness of a kaolin clay, whether it be a kaolin clay as found in nature, a conventionally processed kaolin clay or a kaolin clay product produced as described, for example, in U.S. Patent 3,171,718 issued Mar. 2, 1965. This patent is assigned to the same assignee as the instant application and its disclosure is incorporated herein.

A further object of the present invention is to improve the brightness of kaolin clay by a simple selective flocculation procedure.

Yet an additional object of the present invention is to vary the titanium content of finely divided titanium-containing ores.

Other objects of the invention will become obvious from the following description and the appended claims.

Most kaolin clays, as found in nature, are flocculated. If a kaolin clay, however, is suspended in water and sufficient dispersant (e.g. tetrasodium pyrophosphate) is added, the kaolin clay and presumably any impurity becomes dispersed. It is common practice in the clay industry to cause total flocculation of a dispersed kaolin clay by the addition of hydrogen ion as supplied, for example, by a mineral acid.

Surprisingly, it has now been found that the titanium content of finely divided titanium-containing ores can be varied by adding to an aqueous dispersion of a finely divided titanium-containing ore, a particular flocculating material at a specific pH range. In the process, a flocculated ore rich in titanium settles, leaving dispersed an ore of less concentration of titanium than the original titanium-containing ore.

The process of the present invention is especially applicable for removing discolored impurities from kaolin clay and, as a result, has found preference in the clay field. It is in direct contrast to a total flocculation procedure whereby a complete separation of the clay takes place. In treating clays a portion of kaolin clay, rich in discoloring impurities, is flocculated from an aqueous kaolin clay suspension containing about 5 to about 70 weight percent of clay solids, preferably from about 10 to 40 weight percent of clay solids. A purer and brighter portion of kaolin clay remains dispersed in the suspension while the flocculated, discolored portion settles out of the aqueous suspension at a fast rate, thus allowing the flocculated discolored portion to be readily separated from the purer dispersed portion.

In a preferred embodiment of the present invention, the discolored kaolin clay starting material is first subjected to a milling operation which can be done in association with fine non-abrasive, resilient grinding media as described, for example, in U.S. Patent 3,171,718, and the delaminated kaolin clay then selectively flocculated according to the present invention.

It is advantageous in the process of the present invention to disperse a kaolin clay or finely divided titanium-containing ore in water with a conventional clay dispersant as sodium silicate, tetrasodium pyrophosphate, sodium hexametaphosphate, sodium tripolyphosphate and the like.

The process of the present invention requires maintaining the pH of the slip (the aqueous slurry) within a specific pH range. There is then added to the slip, salts