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PROCESS FOR IMPROVING THE BRIGHTNESS OF CLAY

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ABSTRACT OF THE DISCLOSURE

Process for removing discoloring impurities such as those that are organic or graphitic in nature from a clay slip. The process consists essentially of intimately contacting an aqueous slip of a fine milled clay with a water-insoluble, non-ionizable organic liquid, and thereupon recovering the clay from the separated clay water phase. The organic liquid is the sole chemical reagent necessary for the effective separation of the discoloring impurities from the fine milled clay in the slip.

The present invention relates to means for obtaining a kaolin clay of improved brightness characteristics. More specifically, the present invention deals with a process for improving the brightness of kaolin clays by a selective removal of discoloring impurities from the kaolin clay by an organic liquid extraction process.

In the United States, kaolin clays are produced in abundance from North Carolina, South Carolina, Georgia, Florida and Vermont. Kaolin clays denote a large variety of alumino silicate-bearing rocks of varying compositions and degrees of purity. Typically, kaolin clays comprise a substantial portion of kaolinite and may additionally have varying amounts of such minerals as dickite, nacrite, halloysite, montmorillonite (bentonite), attapulgite, fuller's earth and illite.

The end uses for which kaolin clays are produced usually demand that the clays be as bright as possible, the commercial value of kaolin clays being largely determined by their "brightness." The brightness of kaolin clays is conventionally and normally designated by "GE" values determined according to TAPPI (Technical Association of the Pulp and Paper Industry) Method T 645 *m*–54, as reported in the Testing Methods—Recommended Practices—Specifications of the Technical Association of the Pulp and Paper Industry.

Kaolin clays as mined are generally discolored by impurities. A pure kaolinite crystal has the elements hydrogen, oxygen, aluminum and silicon and the art has referred to the kaolinite crystal as $Al_2O_3.2SiO_2.2H_2O$. In addition to those elements, at least two dozen other elements have been detected by chemical analyses. These include carbon, iron, magnesium, calcium, potassium, sodium and titanium. Since pure kaolinite is colorless, the discoloration of kaolin clays is attributed to the other elements which exist either in inorganic or organic form in the kaolin clays.

The exact mineralogical composition of kaolin clays is not completely understood. It is known that at least some of the potassium found in kaolin clays is present as muscovite mica, that some of the silicon is present as quartz and that some of the titanium is present as rutile and anatase. 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 reduces 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 n the form of anatase

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and rutile, is recognized as a discoloring impurity in kaolin; presumably this is because iron 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.

Among the methods heretofore advanced for improving the brightness of kaolin clays was subjecting a particular kaolin clay to a froth flotation process to remove those fractions having the most discoloration. Alternatively, it has been suggested to subject a kaolin clay to chemical bleaching with a strong reducing agent such as sodium or zinc hydrosulfite. Size classification has also been used to obtain clay fractions of improved brightness.

The prior art methods have encountered substantial difficulties. For example, size classification has not proven effective where the discoloring impurities have a particle size in the same range as the desired clay product. Chemical bleaching in general has a small effect on many impurities.

An object of the present invention is to provide a process for improving brightness of kaolin clays as found in nature or as conventionally processed.

An additional object of the instant invention is to provide a proce for improving the brightness of kaolin clays, which clays may have the same particle size of discoloring impurities as the desired clay product.

Another object of the invention is to provide a process for improving the brightness of kaolin clays which avoids the necessity of a froth flotation step.

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

As disclosed in commonly assigned U.S. Patent 3,171,718, which issued on March 2, 1965, kaolin clays of improved brightness can be obtained by a process of delamination. In accordance with the instant invention, it has been found that the brightness of kaolin clays is unexpectedly increased if the delaminated clay, in an aqueous slurry, is intimately contacted with a substantially water-insoluble (solubility of less than one percent by weight of aqueous phase at the operating temperature of the process), non-ionizable (when in contact with water) organic material which is liquid under the conditions under which the delaminated kaolin clay is contacted with the organic material and which is further capable of wetting or partially wetting, in preference to water, all or part of the surface of the discoloring impurities in the delaminated clay such that two liquid phases are formed and maintained in the process. Any of a very wide variety of organic liquids or organic materials which are liquid under the temperature of treatment of 40° F. to 200° F., but may be solid otherwise, can be employed. The organic liquid should give an interfacial tension against water of from 20 to 55 dynes per centimeter at temperatures of the process. After treatment with the organic material the aqueous and organic phases are allowed or caused to separate and the delaminated clay water layer removed. The delaminated clay water slip may then be treated by conventional techniques, e.g. flocculation and filtration, and the solid clay dried.

In another but less preferred embodiment of the invention, the brightness of kaolin clay is unexpectedly increased by contacting an aqueous slurry of kaolin clay with an organic material, as outlined above with reference to the treatment of delaminated clay, the discolored kaolin clay slurry in this embodiment being subjected to a milling operation in order to make the discoloring impurities separable therefrom. The milling operation may be carried out prior to, simultaneous with, or subsequent to, treatment of the slurry with the organic material, the milling operation being accomplished by a colloid mill,