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DRYING ALUM

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This invention relates to the dehydration of inorganic salts containing water of crystallization and more particularly to the preparation of dehydrated potash alum.

Normal potash alum is a combination of potassium and aluminum sulfates having the chemical formula $K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$. It melts in its own water of hydration at approximately 92° C. and the water of hydration may be driven off at temperatures below 400° C., leaving the anhydrous salt. However, as the water is expelled from the material, its boiling point rises progressively and the material at the same time becomes more and more pasty. When around 35% of the original moisture has been driven off, the mass becomes so pasty that it begins to be filled with air pockets and puffs or swells up so that by the time it is fully dehydrated, the product is a loose, puffy material that is very friable and has an apparent density as low as 0.2.

This friable fluffy material is very difficult to handle in subsequent operations requiring the use of dehydrated alum and, consequently, many attempts have been made to provide a dehydrated product having more desirable physical properties. The drying of hydrated alum at temperatures below its melting point by means of a current of warm air or under a partial vacuum has been proposed. If extreme care is used, the material may be dried in this manner without fusion but this treatment requires a long heating, expensive apparatus, the use of large volumes of hot air, etc. Attempts have also been made to melt the hydrated alum and spray dry it by spraying the molten alum into a column of rising warm air. Here again, however, complicated apparatus is required, the process is expensive to operate and a difficult problem is posed in the handling of the material at its different stages.

An object of this invention is to provide a simple economical process for dehydrating inorganic salts such as potash alum that contain substantial quantities of water of crystallization.

Another object is to dry potash alum in a simple practical manner to obtain a product that is physically strong, slightly porous but of relatively high apparent density.

A further object is to provide an economical method of drying potash alum, either alone or containing added ingredients, by seeding the alum during the drying process with dehydrated alum.

Other objects will be apparent or will be explained in connection with the following description of the invention.

Partially dehydrated potash alum may exist as

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a stable or as a meta-stable form, or a mixture of both forms. The dehydration of the molten alum produces first the meta-stable form which in turn is gradually converted to the stable form, although considerable dehydration may take place without any conversion to the stable form.

The meta-stable form is characterized by relatively high viscosity and low vapor pressure at any given temperature compared with the stable form. For this reason, the stable form is more readily dehydrated than the meta-stable in the liquid state.

We have found that dehydration of potash alum proceeds satisfactorily when its rate does not exceed the rate of transformation of the meta-stable to the stable form, and that this transformation rate varies with the amount of stable form which is present in the mixture. Thus, by forming sufficient stable form alum in a mixture, or by adding the stable form to the mixture, it is possible to dehydrate potash alum rapidly without producing an undesirably light product.

For example, we have found that dehydrated potash alum in a form suitable for handling in large scale apparatus can be produced by adding crushed dehydrated alum to the alum that is being dehydrated. The recycling or reuse of dehydrated alum not only assists the drying process by lowering the average moisture content, but makes it possible by reason of the "inoculation" with the stable form to keep the melt quite fluid throughout the first part of the drying process and overcomes the objectionable spewing or swelling of the charge that occurs when no recycling is employed.

A charge may be heated rapidly by this process and still remain fluid until the point of actual solidification. Continued heating of the solidified cake dries out the mass without further fusing, and leaves a product that has good mechanical strength but sufficient porosity to give it an apparent density of about 1.0.

The dehydrated alum that is re-cycled may be added to an original mass of hydrous crystals or it may be added to a molten bath or hydrated alum while dehydration is progressing, provided the dehydrated product is added before the alum being dried increases substantially in volume by reason of swelling. In other words, the dehydrated alum should be added before the hydrated material has lost more than about 35% of its original water content. For most purposes, it is convenient to melt the hydrous alum crystals and immediately add dehydrated alum to the melt.