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NONCAKING METAPHOSPHATE

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The present invention relates to non-caking metaphosphate, and more particularly to alkali-metal metaphosphate, such as sodium metaphosphate, prepared in powdered form for domestic use and in a non-caking condition.

As set forth in the patent to Ralph E. Hall No. 1,956,515, granted April 24, 1934, sodium hexametaphosphate has remarkable properties as a water softener and detergent. It has the property of sequestering calcium and magnesium in but slightly ionized metaphosphate complexes.

The sodium hexametaphosphate or "Graham's salt" as produced commercially is in the form of glass. In making the sodium metaphosphate the melted sodium metaphosphate is run onto cold metal surfaces where it is quickly chilled in thin layers, resulting in a solidified product which resembles glass in that it is a hard transparent and glassy-like material. The chilling is usually accomplished by running the molten sodium hexametaphosphate onto an iron chilled wheel from which it falls and breaks up into plates of about ¼ to ⅛ inch thick and of 1 or 2 inches in area. This material is usually shipped in barrels or waterproof packages and is dissolved by the user, preferably to make a solution which is used from time to time as required.

The sodium hexametaphosphate is very deliquescent. If the sodium metaphosphate glass is ground to a fine powder and put into the ordinary pasteboard carton, it will cake when exposed to ordinary atmosphere and may become quite sticky if exposed to very damp atmospheres. While the sodium hexametaphosphate broken glass is readily usable by commercial establishments, such as laundries, it it not in convenient form to supply to the ordinary housewife who buys her water softeners in small pasteboard packages from grocery stores. The housewife demands a water softener in condition such that it can be added in powdered form to the water to be softened and will immediately dissolve therein. The powdered material must be such for domestic trade that it can be packaged in ordinary pasteboard cartons and will not cake on the shelves of the retailer or cake after the packages have been opened by the housewife who usually uses the material by pouring it out of the package as required, leaving the material in the package exposed through the open top.

I have found that the sodium metaphosphate can be prepared in convenient form for domestic use by powdering the metaphosphate and mixing it with a minor portion of intumesced borax, which serves to prevent the caking of the metaphosphate powder, and also prevents it from caking and gumming which would occur if the powder alone were packaged.

In preparing the material for domestic use, I preferably employ the sodium hexametaphosphate as commercially produced, consisting of a mixture of the sodium metaphosphate with a small amount of sodium pyrophosphate, usually about 90% of the sodium hexametaphosphate and about 10% of sodium pyrophosphate. This material, which is produced in glass-like form, is ground and screened to produce a powder which will pass through a 50-mesh screen, and of which not more than about 15% will pass through a 200-mesh screen.

While I prefer to use the powder so sized and screened, the sodium metaphosphate powder may be of different particle size, so long as it is ground sufficiently fine so as to be readily dissolved when added to water by the user. For this purpose, the largest particle size should preferably not be over that which will pass through a 40 or 50-mesh screen. It is advisable to screen out the greater part of very fine material which would pass through a 200-mesh screen, as the very fine material seems to have greater tendency to cake than material which will be held on a 200-mesh screen.

After the sodium metaphosphate has been reduced to the proper powder, it is thoroughly mixed with a small amount of intumesced borax and then the mixture put up in small packages suitable for retail domestic trade.

The intumesced borax should also be powdered so as to be readily soluble, and also so as to furnish a light fine powder which will serve to separate the particles of the sodium metaphosphate and prevent them from caking.

Borax when it is strongly heated gives off its water of crystallization and becomes intumesced. Upon strongly heating, the borax becomes pasty and afterward puffs up or intumesces so that it has a low volume density. Any suitable process may be employed for intumescing the borax. However, I have found that the most satisfactory way for preparing the borax for my use is to first take ordinary commercial borax and heat it on a metal pan to a temperature between 100 to 150° C. This drives off about half of the water of crystallization and produces a puffed-up cake. This puffed-up rather crusty cake is then finely ground and the material is further heated in a pan to a temperature preferably above 200° C. and less than the melting

point of the intumesced borax. Upon further heating, the borax becomes further intumesced and forms a light fluffy powder consisting of the ground particles which have become further puffed up or intumesced during the second heating. This material is then screened to remove the larger particles. It is preferably screened to pass through about a 40-mesh screen, the larger particles being ground and re-used. The borax powder should be a rather fine powder, the largest particles of which are small enough to be readily soluble. There is no necessity for removing the fines, since the very fine material of the borax has value in apparently serving to coat the metaphosphate particles.

The borax may be added to the metaphosphate in an amount from 3 to 20% of the mixture, preferably from 4 to 10% of the mixture. In utilizing the commercial sodium hexametaphosphate containing about 10% of the sodium pyrophosphate, I prefer to use from 6 to 8% of intumesced borax in the mixture. As a specific example, I have made a mixture consisting of 93% of the commercial sodium metaphosphate containing 90% sodium hexametaphosphate and 10% sodium pyrophosphate, mixed with 7% powdered intumesced borax as the non-caking agent.

For ordinary domestic use it ts desired that the water treated with the sodium metaphosphate form a slightly alkaline solution. The borax in the amount used serves to adjust the aklalinity of the solution to about the proper alkalinity for domestic washing purposes, giving an alkalinity sufficient for good detergent purposes but not high enough to be objectionable, as is the case with the ordinary water softeners, such as soda ash and trisodium phosphate.

The commercial mixture which is now made and which is extensively sold for conditioning water in boiler plants contains about 90% sodium-hexametaphosphate and about 10% sodium pyrophosphate, the sodium pyrophosphate serving to neutralize the acidity of the metaphosphate and produce a dilute solution of a pH value of about 6.5 to 7. With this material 6 to 8% of the intumesced borax will give an alkalinity having a pH value of about 8 to 8.5, which is a mild alkalinity suitable for domestic washing, such as washing dishes, clothing, the body, hair, walls, etc.

A commercially produced substantially pure sodium hexametaphosphate is somewhat acid, and when the substantially pure sodium metaphosphate is used somewhat more borax should be added to adjust the alkalinity, or the alkalinity may be adjusted by adding a small amount of anhydrous trisodium phosphate or other suitable alkaline agent.

The effect of the intumesced borax is apparently to effect a relatively wide spacing-apart of the particles of the sodium metaphosphate and thus prevent their caking together. It is apparently the low volume density thus imparted to the mixture which is responsible for converting the powdered sodium metaphosphate from a condition in which it would readily cake and deliquesce into a condition in which it can be stored on shelves or in open packages for long periods of time and still remain free-flowing in ordinary climate. In very damp climates the material in an open package may form a readily friable crust on top, but the material is such that it does not form a hard cake.

The ground material is the sodium metaphosphate or a material consisting principally of sodium metaphosphate, and when I speak of sodium metaphosphate I intend to include not only substantially pure sodium metaphosphate, but also a metaphosphate which may contain other substances, such, for example, as the commercial product above referred to containing about 90% sodium hexametaphosphate and 10% sodium pyrophosphate.

The preferred form of the sodium metaphosphate is the sodium hexametaphosphate known as "Graham's salt", which can be readily produced by quickly cooling the molten sodium metaphosphate.

While I prefer to use sodium hexametaphosphate, the hexametaphosphates of the other alkali-metals may be used, such as potassium hexametaphosphate, ammonium hexametaphosphate, lithium metaphosphate, etc.

While I prefer to use sodium borate or borax as the material to be intumesced as the non-caking agent, the intumesced borates of the other alkali-metals may be used, such as intumesced potassium borate or lithium borate.

My material, as above explained, can be put up in small packages and sold in a non-caking condition for the domestic trade where it will be used primarily as a water softener. The material, however, has good detergent properties and may be advantageously employed for its detergent purposes even with naturally soft waters.

The material has a low and controlled alkalinity compared with the usual water softeners on the market, such as those composed of trisodium phosphate and sodium carbonate, which are very harsh and irritating to the skin, as well as damaging to materials being washed, such as clothing. The alkalinity imparted by the borax is so low that it does not irritate the hands of the user.

It can be also advantageously employed as a bath salt for bathing or for washing the hair. When put up in the form of a bath salt, delicate perfumes can be added, since the low alkalinity does not interfere with or destroy the perfumes, as do highly alkaline substances such as trisodium phosphate and sodium carbonate.

While I have specifically described the preferred embodiment of my invention and the best procedure in practicing it, its is to be understood that the invention is not so limited but may be otherwise embodied and practiced within the scope of the following claims.

I claim:

1. A water softener or detergent containing an alkali-metal metaphosphate which sequesters calcium and magnesium in a but slightly ionized condition and an intumesced alkali-metal borate.

2. A water softener or detergent containing sodium hexametaphosphate and intumesced borax.

3. A water softener or detergent containing a powdered alkali-metal hexametaphosphate and a powdered intumesced alkali-metal borate.

4. A water softener or detergent containing a powdered alkali-metal hexametaphosphate and powdered intumesced borax.

5. A water softener or detergent containing powdered sodium hexametaphosphate and about 3 to 20% of powdered intumesced borax.

6. A water softener or detergent containing powdered sodium hexametaphosphate and about 4 to 10% of powdered intumesced borax.

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