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METHOD OF GRANULATING DETERGENT COMPOSITIONS CONTAINING AN ALKALI METAL METABORATE

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ABSTRACT OF THE DISCLOSURE

A method of forming a granular detergent composition by incorporating a crystalline alkali metal metaborate in a powdered detergent composition, heating the composition and applying a motion to the composition in order to form a granular product which is not apt to agglomerate.

BACKGROUND OF THE INVENTION

The present invention relates to a method of granulating a detergent composition essentially comprising inorganic salts and more particularly it relates to a method of granulating a powdered mixture containing as the necessary components (a) a crystalline alkali metaborate and (b) at least one member selected from the group consisting of an alkali bicarbonate, an alkali sesquicarbonate, an alkali chloride, an alkali pyrophosphate, an alkali carbonate monohydrate, an alkali perborate, an alkali tripolyphosphte, an alkali sulfate, an alkali silicate and an alkali phosphate, and further containing, if necessary, a sodium carbonate or other inorganic compound, and/or at least one of organic compounds such as carboxymethyl cellulose, a fluorescent dye, a surface active agent and the like, by applying a proper motion to said mixture under heating, whereby a detergent composition having a coarse grain size is prepared.

DESCRIPTION OF THE PRIOR ART

In general, detergent compositions mainly consisting of inorganic salts have numerous advantages, such as, the raw materials are available as powders and also several raw materials may be compounded to provide a product. However, a product intended for domestic purposes is generally used a considerable period of time after it is produced and in this case, if the product is a simple mixture of several detergent raw materials as mentioned above, the product tends to become agglomerated. If the product is agglomerated, the commercial value of the product is reduced and it becomes inconvenient to use.

In order to prevent agglomeration, various granulation methods have hitherto been proposed. There has generally been employed a method in which the powdered detergent composition is mixed with water and a suitable binder. The resulting mixture is granulated by an extrusion granulating method, a press granulating method or a spray-drying granulating method. However, such a method usually requires further steps of, e.g., drying and curing directly after granulation, which makes the method complicated. Furthermore, in the case of granulating by the extrusion granulating method or the press granulating method, the solubility of the granulated product in water is reduced, which makes the use of the product inconvenient. Moreover, in the case of granulating by a spray-drying granulating method, the powdered composition is mixed with a large quantity of water to provide a slurry and the slurry is dried by a high temperature hot blast. Therefore, there are such drawbacks that a very expensive drying apparatus is required and it cannot be applied to the composition containing easily decomposable components.

Therefore, an object of the present invention is to provide a novel and useful method of granulation which is not accompanied by the aforesaid drawbacks of the conventional granulation methods for detergent compositions.

SUMMARY OF THE INVENTION

According to the method of this invention, a coarse granular detergent composition having a comparatively high bulk density can be easily prepared by applying, while heating, a motion such as a rotary motion to a powdered detergent composition essentially comprising an alkali salt such as a crystalline sodium or a potassium salt of metaboric acid, as a nucleating particle agent or a binder, and at lest one of the aforesaid granulatable inorganic salts.

The granulatable inorganic salts to be compounded with the crystalline alkali salt of metaborate for granulation in the method of this invention are, as mentioned above, an alkali bicarbonate ($MHCO_3$ wherein M is an alkali metal such as Na and K. M has the same definition throughout the following formulas), an alkali sesquicarbonate ($MHCO_3 \cdot M_2CO_3 \cdot 2H_2O$), an alkali chloride (MCl), an alkali pyrophosphate ($M_4P_2O_7$), an alkali carbonate monohydrate ($M_2CO_3 \cdot H_2O$), an alkali perborate ($MBO_2 \cdot H_2O_2 \cdot 3H_2O$), an alkali tripolyphosphate ($M_5P_3O_{10}$), an alkali sulfate (M_2SO_4), an alkali silicate ($xM_2O \cdot ySiO_2$; $x/y=0.25$–2), and an alkali phosphate (M_3PO_4).

Further, in the present invention there may be incorporated in the aforesaid powdered detergent composition, if necessary, an inorganic salt, such as anhydrous sodium carbonate, which is difficult to granulate when mixed with a crystalline alkali metaborate alone and also a small amount of organic detergent components such as a surface active agent, carboxymethyl cellulose, a fluorescent dye and the like.

In the practice of the method of this invention, the compounding percentage of the crystalline alkali metaborate is preferably 5 to 90 percent by weight of the total detergent composition, most preferably 15 to 50 percent by weight. The compounding percentage of one or more inorganic salts which can be granulated when mixed with the alkali metaborate is preferably 5 to 95 percent by weight, most preferably 30 to 85 percent by weight.

It is preferable that the granulation according to this invention is carried out at a temperature higher than 57° C. The heating may be conducted by a hot air blast or by contacting the detergent composition with the surface of a high temperature solid body, but there are no particular limitations about the mode of carrying out the heating step.

For applying a motion to the mixed powders during the granulation thereof, there may be employed a dish-type, drum-type or wave-oscillation-type granulator used in a rolling-type granulating method and a fluid-type granulator.

As mentioned above, since no pressure, such as is employed in an extrusion granulation or a press granulation, is applied during the granulation of the powdered detergent component and also no water is added thereat, and only a proper motion is applied to the detergent composition under heating in the method of this invention, the granulating apparatus used for the method is simple. The granules thus obtained have advantageous properties such that the granules thereof are coarse or rough, they do not agglomerate and they can be dissolved quickly in water. Such advantages are obtained by the use of the crystalline alkali metaborate, which also

has a function of a detergent builder, as nucleus particles for granulation or a binder, by compounding the metaborate with an inorganic salt or inorganic salts which can be granulated when mixed therewith, and by applying a combination of heating and a proper motion to the powdered mixture.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The invention will now be explained by referring to the following examples, in which sodium salts and potassium salts which are available at present most easily and most inexpensively were employed as the aforesaid inorganic salts. However, it should be understood that other alkali metal salts may be similarly employed in the method of this invention and that the inorganic salts shall not be limited to the sodium salts.

Example 1

	A	B
Crystalline sodium metaborate, parts	30	30
Sodium bicarbonate, parts	70	
Sodium carbonate, parts		70

In the above compositions (A) and (B), the crystalline sodium metaborate used was one which passed through a 28 mesh sieve and remained on a 60 mesh sieve, and the sodium bicarbonate and sodium carbonate used were ones which passed through a 100 mesh sieve.

Into a 300 cc. cylindrical bottle was charged 50 g. of each of the above-mentioned compounds (A) and (B). The bottle was closed. When the bottle was rotated for four hours at about 50 r.p.m. in warm water at a temperature of 60° C., compound (A) containing sodium bicarbonate was granulated whereas compound (B) containing sodium carbonate instead of sodium bicarbonate was not granulated.

The size distribution of the particles granulated from composition (A) was as follows:

	Percent by weight
Remained on 16 mesh sieve	26
Remained on 16–28 mesh sieve	48
Remained on 28–60 mesh sieve	21
Passed through 60 mesh sieve	5

The specific volume of the powdered raw material mixture was 1.1 while that of the granulated product was 1.6.

Example 2

	Percent by weight
Crystalline sodium metaborate	25
Sodium bicarbonate	50
Sodium tripolyphosphate	10
Sodium carbonate	12
Sodium alkylbenzene sulfonate (Active components 40%, spray-dried article)	3

In the aforesaid composition, the crystalline sodium metaborate and the sodium bicarbonate had the same grain sizes as in Example 1 and the sodium carbonate and sodium tripolyphosphate used was one which passed through a 100 mesh sieve. When a rotary motion was applied to the composition heated by warm water at a temperature of 70° C., as in Example 1, a coarse granulated product was obtained. The specific volume of the powdered mixture was 1.3, while that of the granulated product was 1.8. The size distribution of the granulated product was as follows:

	Percent by weight
Remained on 16 mesh sieve	21
Remained on 16–28 mesh sieve	53
Remained on 28–30 mesh sieve	18
Passed through 60 mesh sieve	8

Example 3

The following compositions (A)–(I) were granulated as in Example 2.

	A	B	C	D	E	F	G	H	I
Crystalline sodium metaborate	35	35	35	35	35	35	30	30	
Potassium pyrophosphate	65						50		50
Sodium sesquicarbonate		65						60	50
Sodium carbonate monohydrate			65						
Sodium phosphate				65					
Sodium tripolyphosphate					65		20		
Sodium carbonate						65		10	

(The figures are all percent by weight.)

The results showed that compounds (A), (B), (C), (D), (E), (G) and (H) were granulated into coarse particles, while compound (F) in which sodium carbonate was used and (I) in which crystalline sodium metaborate was not used, did not form coarse particles.

Example 4

A mixture having the following composition was granulated as in Example 1:

	Percent by weight
Crystalline sodium metaborate	25
Sodium perborate	35
Sodium bicarbonate	40

The crystalline sodium metaborate and the sodium bicarbonate were of the same size as in Example 1 and the sodium perborate employed was one which passed through a 100 mesh sieve.

As the result, coarse particles were formed and the grain size distribution thereof was as follows:

	Percent by weight
Remained on 16 mesh sieve	25
Remained on 16–28 mesh sieve	51
Remained on 28–60 mesh sieve	21
Passed through 60 mesh sieve	3

For comparison, a mixture having the same composition as above was mixed with the same amount of water and heated to 80° C. to form a slurry and was subjected to spray-drying. However, the foam formation was too violent to continue the experiment.

Example 5

The following compositions (A)–(D) were granulated as in Example 1:

	A	B	C	D
Crystalline sodium metaborate,[1] percent	30	25	25	30
Potassium phosphate, percent	70			
Potassium chloride,[2] percent		85		
Potassium sulfate, percent			85	
Potassium bicarbonate, percent				70

[1] 60–28 mesh size.
[2] Passed through 60 mesh sieve.

As a result, all the compositions (A)–(D) were granulated into coarse particles.

Example 6

	Percent
Crystalline sodium metaborate (60–28 mesh size)	20
Sodium bicarbonate	55
Sodium tripolyphosphate	24
Sodium alkylsulfate	1

When the mixture having the above composition was supplied at a speed of 0.2 kg./min. into a rotary drum-type granulator having a length of 1 meter and a diameter of 20 cm. rotated at 10 r.p.m. and the wall of which was heated by warm water at a temperature of 90° C., coarsely granulated particles were obtained from an outlet thereof. The particles were immediately packed in a box of a filter paper and of 5 cm. x 7 cm. x 3 cm. in capacity and stored for seven days at 30° C. and under a relative humidity of 80 percent while loaded with a weight of 250 g. No agglomeration occurred. On the other hand,

when the mixture of the above composition was exposed to the same conditions without being granulated, it did agglomerate. That is, when the contents of the boxes were slowly placed on a metallic screen of 5mm. x 5 mm. mesh, the granulated mixture all passed through the screen while only 47 percent by weight of the composition which had not been subjected to the granulation procedure was passed therethrough.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A method of preparing a detergent composition having coarse granularity which comprises applying a motion to a heated powdered mixture having a temperature higher than 57° C. and consisting essentially of (a) from 5 to 90% by weight of a crystalline alkali metal metaborate and (b) from 5 to 95% by weight of at least one member selected from the group consisting of an alkali metal bicarbonate, an alkali metal sesquicarbonate, an alkali metal chloride, an alkali metal pyrophosphate, an alkali metal carbonate monohydrate, an alkali metal perborate, an alkali metal tripolyphosphate, an alkali metal sulfate, an alkali metal silicate and an alkali metal phosphate.

2. The method as claimed in claim 1 wherein said motion is rotary motion.

3. The method as claimed in claim 1 wherein the proportion of said crystalline alkali metal metaborate is 15 to 50 percent by weight based on the weight of said powdered mixture and the proportion of component (b) is 30 to 85 percent by weight.

4. The method as claimed in claim 1 wherein the mixture also contains a small amount of at least one member selected from the group consisting of anhydrous sodium carbonate, carboxymethyl cellulose, a fluorescent dye, and an organic surface active agent.

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