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PARTICULATE DETERGENT COMPOSITIONS

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The present invention relates to particulate organic detergent compositions which are especially suitable for handling and packaging by automatic packaging machinery.

The successful commercial packaging of particulate organic detergent compositions is a highly complex matter, fraught with many difficulties. Such a product, to be satisfactory for use in modern high speed packaging machinery, must possess certain physical properties. This is so in part because such machinery is normally volumetric in operation, filling each previously prepared and printed carton or package with a fixed volume of product, whereas the filled package is sold on a gravimetric basis, viz. the carton is marked as containing a specified weight of product, the weight normally being printed on the carton before filling. Since it is uneconomical and aesthetically undesirable to market a carton which is not substantially full of particulate material, it can be understood that in order to always produce a package which contains, and is subtantially completely filled by, the marked net weight of particulate detergent, the bulk density of the particulate product must be maintained within narrow limits. Of course it is essential that the particulate detergent not be too "light" (of insufficient bulk density), or the carton will not be large enough to hold the weight of material marked thereon. Formerly, any such "light" material has generally been scrapped or "worked off" by addition of small amounts thereof to heavier material. The present invention is concerned, in part, with a means to conveniently increase the uncompacted bulk density of particulate organic detergent compositions in a commercially suitable manner.

In order to package a particulate detergent composition at a maximum rate, it is desirable that it possess suitable dynamic flow characteristics (referred to hereinafter as "flowability"), that is, particulate products being packaged should flow into and through packaging machinery as rapidly and freely as possible. In addition to suitable dynamic flow characteristics, or "flowability," such products must posess satisfactory static properties, viz. they must start flowing with a minimum of effort after having once become static. The tendency of particulate detergent products to cohere on relatively short periods of standing is referred to hereinafter as "tackiness." The property of tackiness is of particular importance in relation to the tendency of particulate detergents to bridge at restrictions in supply ducts and filling machinery. Lack of satisfactory static properties is also evidenced to the household user as an apparent "laziness" of the detergent composition in starting to pour from the carton. In such a case the carton is tipped, and when little or no powder pours out, is shaken or rapped. This frequently results in a sudden and unexpected delivery of an undesired large portion of powder.

Particulate organic detergent products must also be relatively free of tendency to cake after packaging and should be non-dusty and non-irritating to the nasal passages.

Various strategems have been proposed in the past for dealing with these problems. The bulk density of particulate organic detergent products has been increased by drying the product to a relatively low moisture content, but this increases the cost of drying and also causes increased thermal degradation of the organic materials present. Volumetric filling machines may be operated below normal output capacity in order to package products having poor flowability. However, this is unsatisfactory in that the machines are then operated at an uneconomically slow rate. Bridging in bins and ducts has been partially relieved by installing mechanical hammers thereon, but this involves added expense, subjects the bins and ducts to added mechanical wear, and may be only partially effective. Various additives such as starch, talc, chalk and certain hydrous magnesium silicates have been suggested for use to reduce caking. Unfortunately these materials are not always satisfactorily efficient, may be quite dusty and irritating of themselves, and when admixed with particulate organic detergent may produce compositions which are also dusty and irritating.

In accordance with the present invention an organic detergent product in particulate form having improved physical properties consists essentially of organic detergent in granular form admixed with powdered essentially anhydrous aluminum silicate. By the term "granular form" or its equivalent it is intended to include detergent compositions in any particulate form (e. g. spray dried, drum dried, etc.) such that a major part of the particles of the order of about 50% and preferably at least 75% may generally be retained upon a standard U. S. No. 100 sieve whereas the "powdered" form of the essentially anhydrous aluminum silicate materials generally has reference to a finer state wherein the major amount thereof may pass through a similar type sieve. The term "anhydrous aluminum silicate" is used to refer to non-hydrated aluminum silicate.

The bulk density of particulate detergent products to which the essentially anhydrous aluminum silicate of the present invention is added is increased significantly in excess of any increase which would be expected from the presence of an added material of relatively high specific gravity. Thus, it is frequently possible, in cases where a "light" product has been prepared, to increase the bulk density thereof sufficiently to enable placing the desired weight of material in a carton of predetermined size, whereas in the absence of such additive the desired weight of particulate detergent product occupies a volume greater than that of the said carton. Surprisingly though, this increase in bulk density has no deleterious effect, as might be expected, on the dynamic or static flow properties of such detergent products, nor on their tendency to cake on aging after packaging. In fact, in cases where flowability, tackiness or caking are unusually troublesome, the addition of the powdered essentially anhydrous aluminum silicate of the present invention may substantially improve these properties. A further surprising property of the compositions of the present invention is their apparent lack of dustiness and irritation, even though the average particle size of the additive may be as small as 1 micron. The reason for this is not understood, as normally the presence of as little as about 1 part per thousand of such a finely divided material in a granular detergent composition is sufficient to cause dustiness and irritation. Nevertheless, the additive of the instant invention either alone or in admixture with particulate detergents is comparatively non-dusty and non-irritating.

The present invention is applicable to organic synthetic detergents broadly. Thus powdered essentially anhydrous aluminum silicate may be mixed with any detergent, anionic, non-ionic or cationic, which is in

particulate form. Where these detergent compounds are liquids under normal conditions, such as non-ionic detergents generally and certain cationic detergents, they are prepared in particulate solid form by adsorption upon diatomaceous earth or inorganic salts or other such agents by procedures well known to the art.

The invention is also applicable to detergent compositions containing as the esssential ingredient thereof mixtures of organic detergents per se or with foam and detergency adjusting agents known to the art.

Referring to the organic detergents employed in the compositions of the present invention, they, as stated, may be any water soluble anionic, cationic or non-ionic compound having detersive properties. Examples of suitable anionic detergents which fall within the scope of the invention include the soaps, such as the water soluble salts of higher fatty acids or rosin acids such as may be derived from fats, oils and waxes of animal, vegetable or marine origin, e. g. tallow, grease, coconut oil, tall oil; and the sulfated and sulfonated synthetic detergents, particularly those having about 8 to 26 and preferably about 12 to 22 carbon atoms to the molecule. As examples thereof there may be cited the higher alkyl mononuclear aromatic sulfonates such as the higher alkyl benzene sulfonates, (e. g. sodium salt of hexyl, octyl, nonyl, decyl, dodecyl or keryl benzene sulfonates) and the higher alkyl toluene, xylene and phenol sulfonates; alkyl naphthalene sulfonates, such as sodium diisopropyl naphthalene sulfonate, ammonium diamyl naphthalene sulfonate, and sodium dinonyl naphthalene sulfonate; sulfated aliphatic alcohols such as sodium dodecyl and hexadecyl sulfates, triethanolamine dodecyl sulfate, and sodium oleyl sulfate; sulfated and sulfonated fatty oils, acids or esters, such as the sodium salts of sulfonated castor oil and sulfated red oil; sulfated hydroxyamides such as sulfated hydroxy-ethyl lauramide; sodium salt of lauryl sulfo-acetate; sodium salt of dioctyl sulfo-succinate; and the sodium salt of oleyl methyl tauride.

Also included within the ambit of the invention are the sulfuric acid esters of polyhydric alcohols incompletely esterified with higher fatty acids, e. g. coconut oil monoglyceride monosulfate, tallow diglyceride monosulfate; and the hydroxy sulfonated higher fatty acid esters such as the higher fatty acid esters of low molecular weight alkylol sulfonic acids, e. g. oleic acid ester of isethionic acid.

The non-ionic surface active agents are well known to the art and include such agents as the condensation products of alkyl phenols with ethylene oxide, e. g. the reaction product of isooctyl phenol with about 6 to 30 ethylene oxide units; condensation products of alkyl thiophenols with 10 to 15 ethylene oxide units; condensation products of higher fatty alcohols such as tridecyl alcohol with ethylene oxide; condensation products of tall oil with ethylene oxide; ethylene oxide addends of monoesters of hexahydric alcohols and inner ethers thereof such as sorbitan monolaurate, sorbitol mono-oleate and mannitan monopalmitate; the condensation products of polypropylene glycol with ethylene oxide; and the higher fatty acid alkylolamides, e. g. the diethanolamide of coconut oil fatty acids.

As suitable cationic detergents there are the long chain alkyl quaternary ammonium compounds such as lauroyl pyridinium bromide. Within this group are included those salts wherein the nitrogen atom may be part of an open chain or heterocyclic structure, such as cetyl trimethyl ammonium chloride and cetyl pyridinium chloride. Another suitable cationic detergent is diethylene amino ethyl oleyl amide.

The anionic and cationic surface active agents are generally used in the form of their water soluble salts. Preferred salts of the synthetic anionic compounds include the alkali metals such as sodium, potassium, and lithium and the ammonium salts, although other salts such as amine, alkylolamine, and the alkaline earth metals such as calcium and magnesium may be used as salt-forming agents if desired. Suitable salt-forming agents for the cationic detergents include the bromide, chloride, acetate and sulfate.

The concentration of these active ingredients and mixtures thereof in the detergent compositions of the present invention vary widely according to the contemplated field of application. Thus, with regard to household detergent compositions in particulate form, the composition may consist of practically pure organic detergent (e. g. soap) with little if any builder or may contain a substantial quantity of builders such as soda ash, phosphates, borax, etc., together with the organic detergent. Typical synthetic detergents designed for household and industrial cleaning generally contain at least about 10% and preferably about 20% of active ingredient by weight of total solids. Compositions with very high concentrations of synthetic active ingredient of the order of up to about 90% are prepared for specialized uses generally. With built compositions however, it is preferred to use an active ingredient content of about 10 to about 50% concentration. The remainder of the composition generally comprises inorganic salts such as sodium sulfate, sodium chloride, phosphates, carbonates, etc.

The essential additive of the present invention is a powdered, essentially anhydrous aluminum silicate. The amount of chemically combined water is normally less than 1% by weight. It is preferred to use an aluminum silicate containing about 42 to 45% alumina and 52 to 52½% silica, the remainder of the additive being minor amounts of impurities such as titanium and iron compounds. The material should be used in the powdered state wherein approximately 99.0% or more of the product passes through a 325 mesh screen.

As referred to previously the invention is applicable to mixtures of organic detergents per se or with foam and detergency adjusting agents. Thus the present additive is effective in improving the physical characteristics of particulate organic detergent compositions containing as their essential active ingredient a mixture of the sodium salt of the sulfuric acid esters of polyhydric alcohols incompletely esterified with higher fatty acids, e. g. sodium salt of monosulfated monoglyceride of coconut oil fatty acids, and the sodium salt of a higher alkyl aryl sulfonic acid, e. g. sodium dodecyl benzene sulfate. Typical of particulate compositions containing a mixture of an organic detergent with a foam and detergency adjusting agent is a mixture of sodium alkyl sulfate or sodium alkyl benzene sulfonate and a higher fatty alcohol, e. g. hexadecyl alcohol, dodecyl alcohol, or a mixture of one of said detergent salts and a higher fatty acid alkylolamide, e. g. lauric diethanolamide, lauric monoethanolamide, palmitic diethanolamide and the diethanolamide of coconut oil fatty acids. Other suitable mixtures comprise higher fatty alcohol sulfates in the form of their alkali metal salts admixed with higher fatty alcohols.

A suitable aluminum silicate material which gives particularly satisfactory results has the following characteristics:

Moisture at 100° C.	0–0.5
Ignition loss at 950° C.	0–0.9
Alumina	42.1–44.3
Silica	51.9–52.4
Iron oxide (Fe_2O_3)	0.38–0.44
Titanium dioxide	1.20–2.50

This material has a specific gravity of about 2.63, a pH in water of about 5.8 to 6.3, and a particle size averaging about 1 micron, 99.9% of the material passing through a 200 mesh screen.

The powdered essentially anhydrous aluminum silicate of the present invention may be in any convenient manner. One suitable procedure for the preparation thereof consists of calcining natural kaolinite, e. g. at about 760° C.

To produce anhydrous aluminum silicate having the approximate formula $Al_2O_3.2SiO_2$. The presence of minor amounts of relatively inert ingredients normally occurring in this mineral is contemplated within the scope of the invention, provided the same has no material deleterious effect upon the desired improvement to be accomplished with the additive. These impurities include such things as silica, iron oxide, titanium dioxide, etc.

The admixture of the additive and the organic detergent of the present invention may take place in any suitable manner permitting the additive to achieve the desired results. Normally the additive must be dry mixed with the other components of the detergent composition, and thus it may conveniently be added by mechanical tumbling or fluidizing of the detergent particles while they are being conveyed to filling machines, or by any other suitable means for mechanical admixture or incorporation. It is preferred to employ the additive in minor amounts, generally within the proportions of the order of from about ¼ to 10% by weight of the finished detergent composition, and preferably up to about 5%.

The following data and examples are additionally illustrative of the present invention and it will be understood that the invention is not limited thereto. Terms used in the examples and the methods by which certain data appearing therein are obtained are set forth in the ensuing paragraphs.

Bulk density represents the weight of a given volume of particulate product. It is conveniently measured by filling a tared vessel of known volume, taking care not to compact the powder, and determining the net weight of powder contained therein. For purposes of this specification, bulk density is represented by the weight of powder (in grams) occupying a volume of 237 milliliters.

Flowability, as used herein, is analogous to viscosity. It is a measure of the rate of flow of material under the influence of its own weight. The effect of the present additive on the flowability of detergent powders is conveniently ascertained by determining the time required for a given volume of product to drain, under the influence of gravity, through a venturi having a minimum throat diameter of ⅝ inch. This period of time is compared to the period required for the same volume of bone dry sand to drain similarly, and the "Percentage Relative Flowability" is calculated as:

$$\text{Percentage relative flowability} = \frac{\text{Effluent time of sand}}{\text{Effluent time of detergent}}$$

In carrying out this test a 2 quart square glass jar (Mason jar), perforated by a normally closed ⅛ inch diameter hole through its base, is filled to overflowing with the material to be tested. Any excess is scraped off the top of the jar with a straight edge and the previously described venturi nozzle is placed across the top of the jar. The jar is inverted and held vertically and the total effluent time is measured, the hole in the base of the bottle being opened at the time of inversion so as to admit air to the interior of the bottle.

The sand used for calibration purposes is a sand which passes substantially completely through a 20 mesh but remains substantially completely on a 60 mesh screen (U. S. standard sieve). The sand is dried in an oven for approximately 2 hours 110° C. just prior to the calibration.

Tackiness, which is typically evidenced by "bridging" of particulate detergent compositions in ducts and bins, is somewhat analogous to thixotropy and represents cohesive tendencies that particulate detergents exhibit on standing at rest for relatively short periods, e. g. a few minutes. This property is generally particularly troublesome immediately after drying, e. g. spray and drum drying. Frequently, but not always, such tackiness diminishes on aging. Caking on the other hand, is used herein in the commonly used sense, viz. in relation to the latent tendency of particulate detergent compositions to lose an initial free-flowing characteristic and to become a more or less compact mass on aging over a relatively long period of time while in contact with moisture.

Tackiness is conveniently measured by a compressive strength test wherein a cylinder of a specified volume of particulate detergent is compacted by a piston for a given period of time under a known load, and the compressive strength of the cylinder along its axis is then determined. In practice the testing device employed consists of a split cylindrical form fabricated from a 5 inch length of 3½ inch steel pipe and a piston, travelling in the cylinder, which can be loaded to compact the spray product as desired.

The cylinder is completely filled with particulate product and levelled off at the top. The piston is rested on the top of the column of detergent particles, and a 14 pound load is applied by means of the piston. After a given period of compression, the load and piston are removed, the split cylinder is disassembled, and the compacted cylinder of powder is then again compressed by the loaded piston, the load being increased in small increments. The load at which the unsupported cylinder is crushed is determined and the compressive strength of the compacted cylinder is calculated in pounds per square inch.

Example I

An aqueous detergent slurry is spray dried in a spray tower. The spray dried product contains 20% of the sodium salt of an alkyl benzene sulfonic acid, wherein the alkyl group is a propylene tetramer, 6% of lauric diethanolamide, 38% of pentasodium tripolyphosphate, 9% of sodium silicate, 18% sodium sulfate, 8½% moisture and the remaining ½% is a mixture of sodium carboxymethyl cellulose, fluorescent dye, and perfume. It is immediately and continuously transported by a vibratory conveyor from the base of the spray drier to the base of a vertical pneumatic lift. The detergent granules are fluidized by air and carried upwardly by the lift to a settling chamber. Particulate detergent recovered from the settling chamber is passed through a duct to a rotary drum wherein it is tumbled for 9 minutes while being sprayed with perfume. The perfumed product leaving the drum is screened to remove any oversized particles, and is then allowed to flow by gravity through ducts to packaging machines. The aforesaid product, after the handling described, exhibits insufficient flowability and bulk density for satisfactory packaging on modern high speed packaging machines, flowing so slowly as to starve the machines if it is attempted to operate at normal rates, and being of substantially lower bulk density than desirable.

While handling and processing normally reduce both bulk density and flowability, it is possible to more than overcome these decreases by means of the additive of the present invention. The data in Tables I and II below illustrate the effects, on relative flowability and bulk density respectively, of powdered anhydrous aluminum silicate of the formula $Al_2O_3 \cdot 2SiO_2$ which has been prepared by calcining kaolinite at about 760° C. The additive, of which 99.5% passes through a 325 mesh screen, is mixed with the aforesaid spray dried detergent composition in an amount equal to 1% of the final mixture. The additive is mixed with the detergent composition at either of two points; at the vibratory conveyor at the base of the pneumatic lift (represented in the tables by "lift") or at the entry to the rotary drum (represented by "drum"). The addition of the additive causes the bulk density of the additive-containing product to increase to a satisfactory level so as to enable filling of a standard size container with the customary weight of detergent and also causes the composition to flow at an adequate rate for use with modern high speed packaging equipment.

Table I

PERCENTAGE RELATIVE FLOWABILITY OF SPRAY DRIED DETERGENT COMPOSITIONS

Run	Vibratory Conveyor	Bottom of Product Collector	Drum Outlet	Change in Percent Relative Flowability	Place of Incorporation of Aluminum Silicate
A	56.3(3)		[1] 70.5(11)	+14.2	Lift.
B		[1] 79.9(4)	[1] 70.2(3)	−9.7	Do.
C		56.8(15)	[1] 69.0(19)	+12.2	Drum.
D	50.9(9)	51.0(9)	[1] 74.5(9)	+23.5	Do.
E	48.9(6)	52.5(6)	[1] 72.7(6)	+20.2	Do.
F		58.5(3)	[1] 72.4(3)	+13.9	Do.
G		53.7(6)	[1] 75.1(11)	+24.4	Do.

[1] Represents readings on additive-containing material.

Table II

BULK DENSITY OF SPRAY DRIED DETERGENT COMPOSITIONS, GRAMS/237 ML.

Run	Vibratory Conveyor	Bottom of Product Collector	Drum Outlet	Change in Bulk Density, Grams	Place of Incorporation of Aluminum Silicate
H	65.8(5)		[1] 80.4(11)	+14.6	Lift.
J		[1] 88.8(5)	[1] 78.7(3)	−10.1	Do.
K		73.9(15)	[1] 82.8(21)	+8.9	Drum.

[1] Represents readings on additive-containing material.

The above data are averages, figures in parentheses showing the number of readings taken to obtain each average.

The data of Tables I and II illustrate the diminution of relative flowability and bulk density caused by handling (runs B and J respectively). The data also illustrate the improvement brought about by the powdered aluminum silicate in increasing the relative flowability and bulk density of the detergent composition.

Samples of the additive-free composition and the additive-containing composition are tested for caking by packaging them in small standard fiberboard cartons and exposing the filled cartons to 90° F. and 90% relative humidity for 48 hours. At the end of this period the packages are opened and the contents thereof are examined visually and tactily. The additive-free product has formed a number of large lumps and is considered unsuitable for sale to the public for household use, whereas the material containing the aluminum silicate is virtually completely in its original form as packaged and is quite suitable for public usage.

EXAMPLE II

The influence of mechanical handling on the relative flowability and bulk density of the detergent compositions similar to those of Example I is studied by tumbling such compositions in various pieces of apparatus. The results of such experiments are tabulated in Tables III and IV below.

Table III

PERCENTAGE RELATIVE FLOWABILITY OF TUMBLED DETERGENT COMPOSITIONS

Tumbling Action		Percentage Relative Flowabilities at Various Mixing Times			
Additive Free	Contains 1% Aluminum Silicate	2 Min.	3 Min.	4 Min.	60 Min.
Q		49	47	35	
	Q	63	63	62	49
R		43	34		
	R	64	63	63	61
S		37			
	S	62	66	62	40

(The initial relative flowability of the additive-free starting material is about 52%.)

Table IV

BULK DENSITY OF TUMBLED DETERGENT COMPOSITIONS, GRAMS/237 ML.

Tumbling Action		Bulk Density at Various Mixing Times		
Additive Free	Contains 1% Aluminum Silicate	4 Min.	10 Min.	60 Min.
Q		64	66	
	Q	78	75	67
R		62		
	R	75	69	61
S		64	63	
	S	75	74	66

(The initial bulk density of the additive-free starting material is about 71 grams/237 ml.)

In both Tables III and IV:

Q=a twin shell blender (Paterson-Kelly),
R=a rotary drum with internal flights, and
S=a rotary drum without internal flights.

The data of Tables III and IV strikingly illustrate the effects of powdered essentially anhydrous aluminum silicate on flowability and bulk density.

EXAMPLE III

Several similar detergent slurries are spray dried to produce compositions each containing about 35% sodium salt of alkyl benzene sulfonate wherein the alkyl group contains from 12 to 15 carbon atoms, 40% pentasodium tripolyphosphate, 7½% sodium silicate, 7½% sodium sulfate and 10% of a mixture of sodium chloride, sodium carboxymethyl cellulose and moisture. The products exhibit satisfactory dynamic flow properties, but if within a short period after drying they are allowed to stand at rest, they tend to bridge across ducts, orifices and throats of storage bins.

Powdered, essentially dry aluminum silicate containing 0.5% water of hydration and having the approximate formula $Al_2O_3 \cdot 2SiO_2$ is dry mixed with a portion of each of these preparations immediately after drying. The thus modified products are found to handle quite satisfactorily and exhibit little tendency to bridge across ducts, orifices and throats of storage bins.

The tackiness of both the modified and unmodified products is determined in accordance with the compressive strength test set forth previously. Results of such tests appear in Table V.

Table V

TACKINESS OF SPRAY DRIED DETERGENT COMPOSITIONS

Aluminum Silicate, Percent	Tackiness, Pounds per Square Inch				
	Run 1	Run 2	Run 3	Run 4	Run 5
0	0.24	0.24	0.14	0.24	0.24
½	0.082				
¾		0.14			
1			0.01	0.04	
1½					0.04

The compositions of run 4 of this example are tested for caking by exposing small standard fiberboard cartons filled therewith to 90° F. and 90% relative humidity for 48 hours. Of the two compositions tested, the aluminum silicate-containing composition is found on visual and tactile examination to cake to a noticeably less extent than the blank.

EXAMPLE IV

An aqueous slurry is spray dried to produce a particulate detergent composition containing about 35% sodium alkyl benzene sulfonate and 65% inorganic salts. The dried product is continuously perfumed in a rotary drum, and then falls through ducts to pockaging machines. If powdered synthetic hydrated magnesium silicate having the approximate formula $MgO \cdot 2.5SiO_2 \cdot H_2O$, 99% of which passes through a 325 mesh screen (U. S. standard sieve), is added to the spray dried particles in an amount equal to 1% of the final mixture, such final mixture is exceptionally dusty and irritating. A cloud of dust envelopes the packaging machinery, irritates the mucous membranes of personnel in the vicinity of the machines and interferes with the mechanical operation of the machines causing frequent breakdowns thereof. Dust is also produced in usually large quantities when the product is used in the household.

For comparison purposes, a similar composition is prepared containing in place of 1% hydrated magnesium silicate, an equal amount of powdered anhydrous aluminum silicate of which 99.9% passes through a 325 mesh screen and which has the formula $Al_2O_3 \cdot 2SiO_2$. The aluminum silicate composition is not discernably more dusty than the additive-free spray dried product, does not interfere with the operation of filling machinery, and does not cause discomfort to personnel in the vicinity of such machinery nor to the ultimate user of the packaged product.

EXAMPLE V

A particulate soap composition is prepared by spray drying. The dried product contains about 67% by weight of soap, 16% sodium silicate, 9% tetrasodium pyrophosphate and 8% moisture, the soap being a 90:10 by weight mixture of the sodium salts of tallow and coconut oil fatty acids respectively.

The bulk density of the product is 90.5 grams/237 ml. After admixture with powdered, essentially anhydrous aluminum silicate of the formula $Al_2O_3 \cdot 2SiO_2$ in an amount equal to 2% by weight of the mixture, the bulk density of the composition increases to 96.3 grams/237 ml. When mixed with 5% by weight of the additive, the bulk density of the mixture becomes 98.8 grams/237 ml.

The term "consisting essentially of" as used in this definition of the ingredients present in the composition claimed is intended to exclude the presence of other materials in amounts such as to interfere substantially with the properties and characteristics possessed by the composition set forth but to permit the presence of other materials in such amounts as not substantially to affect said properties and characteristics adversely.

While there has been disclosed and described what is at present considered to be the preferred embodiment of the invention it will be understood, of course, that many changes, modifications, and substitutions may be made therein without departing from the true scope of the invention as defined in the appended claims.

What is claimed is:

1. A detergent composition consisting essentially of a water-soluble particulate organic detergent in spray dried form, the major portion of said particles being retained upon a standard U. S. No. 100 sieve, admixed with from ¼ to 10% by weight of the total mixture of powdered anhydrous aluminum silicate prepared by calcining kaolin and having the approximate formula $Al_2O_3 \cdot 2SiO_2$, said composition exhibiting an increased bulk density in comparison to similar spray dried particles which have not been admixed with anhydrous aluminum silicate.

2. A detergent composition consisting essentially of a water-soluble particulate organic anionic detergent in spray dried form, the major portion of said particles being retained upon a standard U. S. No 100 sieve, admixed with powdered anhydrous aluminum silicate prepared by calcining kaolin and having the approximate formula $Al_2O_3 \cdot 2SiO_2$ in an amount from ¼ to 10% by weight of the total mixture, said composition exhibiting an increased bulk density in comparison to similar spray dried particles which have not been admixed with anhydrous aluminum silicate.

3. A detergent composition consisting essentially of a particulate higher alkyl benzene sulfonate detergent salt in spray dried form, the major portion of said particles being retained upon a standard U. S. No. 100 sieve, admixed with powdered anhydrous aluminum silicate prepared by calcining kaolin and having the approximate formula $Al_2O_3 \cdot 2SiO_2$ in an amount from ¼ to 10% by weight of the total mixture, said composition exhibiting an increased bulk density in comparison to similar spray dried particles which have not been admixed with anhydrous aluminum silicate.

4. A detergent composition consisting essentially of a water-soluble mixture of higher alkyl benzene sulfonate detergent salt and a higher fatty acid alkylolamide detergent in spray dried form, the major portion of said spray dried mixture being retained upon a standard U. S. No. 100 sieve, admixed with powdered anhydrous aluminum silicate prepared by calcining kaolin and having the approximate formula $Al_2O_3 \cdot 2SiO_2$ in an amount from ¼ to 10% by weight of the total mixture, said composition exhibiting an increased bulk density in comparison to similar spray dried particles which have not been admixed with anhydrous aluminum silicate.

5. A detergent composition as set forth in claim 1 wherein said water-soluble particulate organic detergent is a water-soluble salt of a higher fatty acid.

6. A detergent composition consisting essentially of about 10 to 90% by weight of a water-soluble particulate anionic organic detergent in spray dried form, the major portion of said particles being retained upon a standard U. S. No. 100 sieve, admixed with powdered anhydrous aluminum silicate prepared by calcining kaolin and having the approximate formula $Al_2O_3 \cdot 2SiO_2$ in an amount from ¼ to 10% by weight of the total mixture, said composition exhibiting an increased bulk density in comparison to similar spray dried particles which have not been admixed with anhydrous aluminum silicate.

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