United States Patent Office 3,247,123 Patented Apr. 19, 1966

3,247,123

MANUFACTURE OF DETERGENT TABLETS

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No Drawing. Filed July 30, 1962, Ser. No. 213,117
11 Claims. (Cl. 252—135)

The present invention relates to a detergent tablet which is readily disintegrable in water and dissolves completely therein, while being of sufficient strength to withstand shipping and dropping, without breaking. The invention includes a process for making a briquetted detergent tablet.

Tablets or briquettes produced by compacting beads or granules of detergents have been used as pre-measured detergents and have been found especially useful in laundry applications. With such products it is important that the composition should be completely water soluble or dispersible, so that no undissolved constituents of the detergent composition will remain adhering to the washed materials. Also, even when the entire composition is completely water soluble, problems sometimes arise due to the comparatively slow rate of solubility of tablet particles which become entrapped in the textiles being used. Sometimes, detergent particles held closely against laundry being washed cause objectionable discoloration thereof. In an attempt to assure the quick and complete dissolution of detergent briquettes, they have been pressed at comparatively low pressures and have been made to contain a sufficient percentage of voids of adequate size to promote flow of the wash water through the briquette body, with resultant quick break-up of the briquette, as the adhering portions of the detergent particles are dissolved. Use of low compacting pressures results in a tablet which tends to be of lesser strength than tablets produced at higher pressures. Thus, it has been found difficult to transport such tablets by commercial shippers, without causing breakage or disintegration of the product. If shipping difficulties were not controlling, many detergent briquette compositions, although composed of water soluble ingredients, would still be unsatisfactory because of a tendency to break apart into comparatively large pieces, when dropped into the wash water, after which they sink and become somewhat gelatinous or pasty on the surfaces thereof. Such adherent and cohering pieces of detergent will not be readily swept into the moving wash water and will sometimes be surrounded by a volume of detergent solution at a relatively high concentration, which further inhibits dissolution of the briquette.

To overcome poor surface properties of lightly compacted detergent briquettes, they have been subjected to treatments after pressing. Water has been applied to form a more continuous surface film, to harden and strengthen the briquette at its surface and to prevent undesirable chalking and to increase the briquette strength. Film-forming organic polymers have been employed to coat the lightly compacted detergent briquette. Solutions of silicates have been applied to the particles of synthetic detergent composition before compacting and particles have been pre-moistened, before pressing into final shape.

Such methods have permitted the production of commercially acceptable detergent briquettes, which disintegrate and dissolve sufficiently quickly in the water in commercial washing machines and which can be shipped in well-designed packages without objectionable breakage. However, a goal of research of detergent chemists and engineers, working to improve detergent tablets and processes for their manufacture, has been to make a strong, yet quickly dissolving tablet which requires no post-treatment, thereby avoiding the time required for

such an operation and the expense incurred, while producing a product which has an even faster dissolution rate, due to the absence of surface films, which are often of relatively poor solubility characteristics. This goal has been attained by the present invention.

In accordance with the present invention a detergent tablet of desired shape is made by producing a particulate detergent composition comprising 2 to 20% of a water soluble, non-cationic, synthetic organic detergent, 20 to 50% of a water soluble metal silicate of metal oxide to silica ratio between about 0.3 and 1, 20 to 50% of a water soluble polyphosphate salt and containing less than 13% of water, adding 2 to 35% water to the particulate detergent, to raise the moisture content thereof to 15 to 35%, continuously moving and circulating the moistened detergent composition particles, whereby the moisture is substantially uniformly distributed throughout the mass of said particles, the polyphosphate is substantially hydrated and speed of solution of the alkali metal silicate is increased, and lightly compacting the resulting particles to form retaining tablets, which are readily disintegrable in wash water, soluble therein and resistant to breakage, when subjected to shipping shocks. Also within the invention is a detergent tablet, such as may be produced by the foregoing method, which comprises 2 to 20% of a water soluble non-cationic synthetic organic detergent, 20 to 50% of a water soluble metal silicate of metal oxide to silica ratio between about 0.3 to 1, 20 to 50% of a water soluble polyphosphate salt and 15 to 35% of water, the tablet being comprised of particles of such composition, lightly held to one another, in which the polyphosphate is substantially hydrated and the silicate is readily soluble in water. Such a briquette is readily disintegrated in wash water, dissolves completely and may be shipped without fear of breakage.

The non-cationic synthetic organic detergent is usually a nonionic detergent, preferably one comprising both hydrophilic and hydrophobic portions in the molecule of which at least the hydrophilic portion includes a plurality of lower joined alkylene oxide groups. A preferred detergent of this type is an alkyl phenol having a poly lower alkoxy alkanol joined to the phenolic oxygen. Nonyl phenoxy polyoxyethylene ethanol, comprising about 9 to 10 ethoxy groups, has been found to be an excellent nonionic detergent of the present invention. Usually, instead of nonyl, the alkyl group may be of 6 to 14 carbon atoms and the alkoxy chain may be of 4 to 12 alkoxy units, each unit comprising from 2 to 4 carbon atoms. Although the above-mentioned phenolic derivatives are of a special importance in this invention, mixtures of nonionic detergents may also be employed. Thus, other nonionics including the block copolymers of ethylene oxide and propylene oxide (Pluronics), reaction products of higher fatty alcohols and lower alkylene oxide (Emulphogene), polyoxyethylated higher fatty acids (Emulphor), polyethoxy and poly lower alkoxy esters and ethers of poly alcohols, especially of sorbitol and mannitol (Span, Tween) may be used with the alkyl phenoxy polyoxyalkylene alkanol and in replacement thereof, where desired. Whether a single type of nonionic detergent or a mixture thereof is used, the proportion should be within the range of 2 to 20%, preferably 5 to 15% of the detergent briquette.

All percentages of constituents in this specification and in the appended claims are on a tablet weight basis.

In addition to the nonionic detergent one may have present in the detergent tablet, as replacement of some of the nonionic detergent, an anionic detergent, usually added primarily to produce additional foam, when desired and to contribute its cleaning power to the composition. In some cases it may be found desirable to replace nonionic detergent with a suitable anionic material. A

preferred anionic detergent is sodium alkyl benzene sulfonate, especially sodium tridecyl benzene sulfonate. This material is a mixture of detergents produced by alkylating benzene with a blend of propylene tetramer and pentamer. The alkyl groups are highly branched but other alkyls of relatively straight chain configuration are also useful in these compounds, providing that they are of 12 to 18 carbon atoms. The anionic detergents are generally employed as their water soluble sodium salts but other water soluble metallic salts, such as the alkali metal salts, e.g., potassium salts, may be used too, usually in partial replacement of some of the sodium salt. Instead of alkyl aryl sulfonates, other anionic organic detergents of the sulfated or sulfonated type are useful. Of these, one may mention sodium lauryl sulfate, sodium coconut oil fatty acids monoglyceride sulfate and sodium salts of a higher fatty acid amide of N-methyl taurine. It will be seen that these compounds contain a fatty alkyl or acyl group of 10 to 18 carbon atoms, as the lipophilic portion of the molecule and are utilized as their water soluble salts, preferably alkali metal salts. The proportion of anionic detergent which may be used to make a detergent tablet is complementary to that of the nonionic detergent. In other words, the sum of both types of detergent material present should not be in excess of about 20% and not less than about 2% of the detergent briquette.

The water soluble metal silicate is the constituent of the present briquette which has the unusual effect of aiding the production of a briquette which is form-retaining and resistant to breakage, although pressed at a low pressure, and still disintegrates rapidly in aqueous media and dissolves completely in a short time. The silicates allow making of tablets of the low bulk density and do not require coating of the tablets. Of the silicates that have been found useful, those which are alkali metal salts, especially sodium silicates, and which are of a ratio of metal oxide to silica, by weight, of about 0.3 to 1 are most often used. A highly preferred silicate is sodium metasilicate having a $Na_2O:SiO_2$ ratio of 1:2.35. However, other silicates of the general type described may also be included in the present briquettes, either together with or in replacement of this particular silicate, to obtain similar effects.

The water soluble polyphosphate is a metal salt, usually an alkali metal salt and preferably the sodium salt of a polyphosphoric acid. Among such salts, the most preferable are pentasodium tripolyphosphate and tetrasodium pyrophosphate. Other polyphosphates of satisfactory builder action, which also enable one to produce improved briquettes, according to the present invention, may be employed in mixture with the described sodium polyphosphates or in replacement thereof. Either the sodium or potassium salts of these materials are used, depending upon the particular properties of the final product desired.

In addition to the fourth constituent of the invented briquettes, water, other adjuvants, useful to give the detergent briquettes special desirable properties, may be included. Among such substances are additional builders, foam enhancers or suppressors, coloring agents, perfumes, bleaches, solvents, fluorescent dyes, anti-redeposition agents and so forth. The total proportion of adjuvants employed should be a minor one, to avoid any interference with the desirable physical properties of the detergent briquette.

The proportions of non-cationic detergent, silicate, polyphosphate and water should be regulated in accordance with the following teachings so as to obtain a product which can be economically and efficiently manufactured by the method herein described and which will still be of satisfactory strength and solubility properties. The proportion of the synthetic organic detergent should be held within the range of 2 to 20% and is preferably 5 to 15%. It has been found that, in conjunction with the silicate and phosphate, such a percentage of organic detergent will give excellent cleaning results and will not interfere with the production of a strong, yet quickly dissolving tablet. Lesser proportions than the minimum of this detergent will not have a satisfactory cleaning effect and higher proportions will often interfere with the desired tablet properties. The water soluble phosphate present should be from 20 to 50%, preferably 25 to 40% of the briquette. Such percentages of these materials contribute excellent building and detergent properties to the product and complement the silicate to allow the production of a quick dissolving tablet of adequate strength and abrasion resistance. Also, such proportions of the polyphosphate may be completely hydrated by some of the water present, leaving additional moisture to aid in making the silicate more readily soluble in the wash water.

The water soluble silicate comprises 20 to 50% of the briquette and it has been found that such a proportion of silicate is desired to obtain a product which will dissolve rapidly and yet which will be of excellent resistance to breakage during normal shipping. A preferred proportion of silicate is 25 to 40%. The silicate constitutent of these products, when employed in these proportions, exhibits a dramatic effect in modifying the tablet properties, making the tablet lighter, yet stronger, helping the particles to be joined together more tightly, so as to diminish a tendency to break under rough handling, yet promoting very rapid solubility. These beneficial results may be obtained without surface coating the detergent briquettes, which is unexpected, in view of the known tendency for silicates in uncoated briquettes to become less soluble on storage. The proportion of water present in these briquettes is important to obtain a satisfactory product having the properties discussed previously. The water substantially or completely hydrates the polyphosphate and also greatly improves the solubility of the silicate, so that virtually no insoluble grains are found in wash water into which briquettes have been placed. Fifteen to 35% of water in the invented briquettes will accomplish these results and it is preferred to employ 20 to 30% of water in most of the invented compositions, whereby substantial hydration, e.g., 75% hydration or more, of the polyphosphate takes place. Moisture added to the particulate detergent is 2 to 35%, preferably 7 to 30%. It has been found that within the ranges mentioned more water can be included in the briquettes when silicates of lower ratios of $Na_2O:SiO_2$, within the 0.3 to 1 range, are used.

To manufacture the present detergent tablets, a particulate detergent is produced in which the organic detergent, silicate and polyphosphate are present. It is highly preferred that such detergent composition constituents be homogeneously distributed throughout the particles and spray dried detergent beads have been found to be an excellent starting material for making these briquettes. In the spray drying operation, one makes a solution or slurry of the detergent materials in an aqueous medium, usually adding to this "crutcher mix" useful adjuvant substances which are not adversely affected by spray drying. Normally the crutcher mix will be of a solids content within the range of about 40 to 60%. This aqueous dispersion or solution is then pumped through spray nozzles and is dried in a path of heated drying gas, through which it usually falls to a collector. The particles produced may be cooled, screened and classified to remove objectionably large or small material. The product resulting may be somewhat irregular in shape but is usually considered to be composed of bodies which are hollow and of approximately spherical shape. Those of particle size such that over 90% pass through an 8 mesh sieve and do not pass a 100 mesh sieve, U.S. Standard Sieve Series, are excellent beads to be converted into briquettes or tablets. During the drying operation most of the water present in the crutcher mix is removed but there may be left in the particles up to about 13% of moisture, and usually at least 1% is present.

The homogeneous detergent composition particles may be produced by other methods than spray drying. For example, spray cooling, agglomeration, even crushing, followed by screening and classification, may be employed to produce the desired particles. Also, a portion of the product may be spray dried and to this may be separately added organic detergent, silicate and phosphate. However, it is considered important to have a substantial proportion of the silicate present, at least about 75% thereof, present with the phosphate and organic detergent and distributed throughout each of the particles, as in a spray dried composition.

The particles of detergent composition, high in silicate content, as described above, are placed in continuous motion as in a tumbling drum, and while moving, moisture is sprayed onto the particle surfaces in fine droplet form and in amount to produce a final product having a moisture content of 15 to 35%, preferably 20 to 30%. The continuously moving and circulating particles may adhere lightly to a number of other particles, in the course of spraying and circulating them but the circulating movement should be such that large lumps of detergent composition are not produced. Lumping or objectionable aggregation can be minimized by maintaining the detergent bed in continuous motion and keeping it thin enough so that agglomerating or compacting pressures exerted on the lowermost particles are not excessive. Also, lumping is minimized by careful distribution of the moisture, avoiding the creation of any areas of excessively high moisture content. Before moistening, the detergent beads are of an apparent density of about 0.3 to 0.6 gram per cubic centimeter. After moistening, this density may be altered somewhat, usually being decreased, e.g., by as much as 30%. This result is attributable to the moistening of the relatively large proportions of silicate together with polyphosphate and the resulting swelling of materials and increase in average particle size.

Adequate and uniform moistening of the detergent beads or granules high in silicate content maintains the silicate in a readily soluble condition so that no undissolved silicate deposits on clothing being washed. This is of importance to the detergent chemist because silicates tend to become more insoluble when heated to drive off the moisture accompanying them, as is done in spray drying. Also, the polyphosphates preferentially attract moisture, thereby often tending to reduce the silicate to a less soluble state. Even when placed in an excess of water, as in the washing machine, such silicates may not dissolve completely during the wash cycle, leading to objectionable particles left on the articles being laundered. On the present detergent briquettes however, due to the relatively high concentration of silicate solution produced when the composition high in silicate content is moistened, any silicate of lower solubility is soon made more soluble. This more soluble form or condition persists for long periods of time after moistening, and the briquette produced therefrom is still completely soluble, months after it is made. A most even distribution of moisture in the detergent and an absence of excessive agglomeration are noted when the material being moistened is kept in continuous motion and the moisture is applied in fine droplet form. Mixing, moistening, agglomeration, removal and pressing to cake or tablet form should be conducted continuously and without more than momentary halts, so as to obtain a satisfactory product by a feasible process. After moisture has been added to the silicate-containing detergent particles, they are pressed at a low pressure into a desired briquette form. The pressure employed may be any suitable low pressure, it having been found that pressures from 3 to 25 pounds per square inch may be used advantageously in pressing a tablet, which is most often from about ¾ to 1 inch thick. Pressures over 100 pounds per square inch should be avoided. Pressing is preferably effected between opposed dies having Teflon or chrome plated surfaces and cavities. After pressing, it is unnecessary to submit the product made to any special treatment or aging period before it may be shipped although a significant increase in strength is observed within about an hour after pressing. The detergent briquettes prepared are of sufficient strength to withstand shipping without breaking or being severely abraded and they may be packed in any usual way. It has been noted that the briquettes made often have highly desirable low densities, making a tablet whose larger volume is easier for the user to employ and which facilitates subdivision into small units, where accurate control of the detergent concentration employed is considered important. Surprisingly, the lighter briquettes are even stronger than comparable heavier materials made with less silicate. They are made by a more efficient process and can be produced by tableting and briquetting equipment of conventional design. Due to the elimination of a coating operation, heretofore considered to be necessary and still considered important for other detergent tablet formulations, production rates and efficiency can be increased. Furthermore, all this is accomplished without the necessity for inclusion of comparatively expensive conditioning or adjuvant materials in the detergents.

Although it is unnecessary to coat the detergent to make a satisfactory product of this invention, moisture may be sprayed onto the surfaces of the finished briquettes, if so desired. Also, it may sometimes be considered desirable to deposit a thin film of organic polymer, such as sodium carboxy methyl cellulose or polyvinyl alcohol on the products made, to further harden them and make them suitable for withstanding extremely severe handling. Other variations of the described process will be apparent to one of skill in the art but the described invention makes a useful product and modification of the production method is not necessary, although it may sometimes be desirable. In some cases it is possible that the moistening solution may include adjuvant materials not stable to heat, e.g., emulsified perfumes. Some sodium silicate may be added with that solution. Products produced may subsequently be perfumed, colored, wrapped and packed for shipment. It is preferred to pack them in moisture tight wrappers, e.g., sleeves of polyethylene film, but they are still resistant to breakage and are usefully soluble, even when stored for months at atmospheric conditions.

Products made according to this invention have been subjected to severe testing and usually a briquette can stand at least five shocks equivalent to a free fall of four feet onto a hard surface before it starts to break apart. Also, when packed in polyethylene sleeves, they do not become abraded objectionably, despite repeated shaking in a package, which simulates a type of rough handling to which they may be subjected in shipping. Still, despite their great strength, the tablets dissolve quickly and completely, usually disintegrating completely within 45 seconds and most often in 10 to 30 seconds. The following examples are included to illustrate embodiments of the invented process and products. They are not to be considered as limiting the invention. All proportions are by weight, unless otherwise indicated.

Example I

Ingredient:	Parts
Nonyl phenol polyoxyethylene ethanol, avering about 9.5 oxyethylene groups, per molecule	9.4
Sodium tripolyphosphate, anhydrous	28.9
Sodium silicate ($Na_2O:SiO_2$ ratio of 1:2.35), solids basis	33.4
Water	27.7
Perfume, coloring agents, other adjuvants	0.6
	100.0

The above formula describes the composition of a final

detergent briquette or tablet which was found to be of excellent cleaning power, quickly disintegrable in wash water and extremely strong and resistant to breakage and abrasion. The briquettes were made by mixing together in a crutcher the nonionic detergent, sodium tripolyphosphate, sodium silicate and coloring agents, producing a uniform aqueous slurry therefrom of approximately 50% solids content and spray drying this slurry in a drying gas in a conventional spray tower. The product resulting was of conventional bead shape and was classified and sieved to be within the 8 to 100 mesh range. The moisture content of the powder produced was approximately 8% thereof.

The spray dried detergent beads were tumbled continuously in a suitable mixer, e.g., a tilted drum mixer, and moisture was sprayed onto the beads in fine droplet form so as to uniformly moisten them, up to about 28% water content. The perfume was sprayed onto the beads shortly before moistening. After continued agitation to promote an even distribution of moisture, it was found that the bulk density of the product had been decreased, from about 0.4 to 0.3. Tablets were made from this lower density product by pressing 42 grams thereof, into a tablet ⅞ of an inch thick and 2½ inches in diameter. The press employed was set with a fixed stop so as to produce consistently the same thickness of tablet. The pressing pressure effectively transmitted to the tablet was within the range of about 3 to 25 pounds per square inch.

The finished tablets were sufficiently hard to be commercially acceptable and yet it was found that they disintegrate in water, whether hot or cold, within 30 seconds, even when not agitated. Some of the tablets broke apart in as little as 10 seconds. The unusually rapid disintegration and accompanying dissolution could be attributable at least in part to the quick removal of dissolving tablet material, as it descended from the floating remaining tablet portion. The tablets did not fragment into lumps in the wash water but dissolved quickly and in a regular manner. When dropped from a height of 5 feet, repeatedly, the tablets did not break. In the washing machine, it was found that experimentally soiled fabrics could be laundered effectively with these tablets and could be cleaned and whitened as well with a lesser weight of the lighter tablet, as compared to commercial tablets now on the market. Also, the present tablets laundered as well as amounts of heavier duty commercial synthetic detergents which contained higher proportions of organic detergent and sodium tripolyphosphate.

Due to the rapid break-up of the tablet in the wash water, colored tablets containing blueing agents which are objectionably adherent to clothing when the tablet is in contact therewith for appreciable lengths of time were employed without fear of discoloring materials being washed. This was so because the product disintegrated, dispersed and dissolved quickly, before objectionable color could be adsorbed or entrapped by the textile fibers.

Examples II–VI

Ingredient	Parts By Weight				
	II	III	IV	V	VI
Nonyl phenol polyoxyethylene ethanol (averaging 9.5 oxyalkylene groups)	10.0	11.3	11.0	8.6	9.1
Sodium tridecylbenzene sulfonate (80% active detergent)				14.0	
Sodium tripolyphosphate	30.7	34.8	33.8	26.5	27.6
Sodium silicate (solids):					
$Na_2O:SiO_2=1:2.35$	30.2		33.2	26.0	27.2
$Na_2O:SiO_2=1:1.6$		34.3			
$Na_2O:SiO_2=1:1$					18.0
Sodium hydroxide			3.5	2.7	
Adjuvants (Perfume, Blueing, Brighteners, Antiredeposition Agents)	1.2	1.4	1.4	1.0	1.1
Water	27.9	18.2	17.1	21.2	17.0
	100.0	100.0	100.0	100.0	100.0

Detergent tablets of the above formulas were made by essentially the same method as that described in Example I. The tablets made were substantially in the shape of flat cylinders ⅞ inch thick and 2½ inches in diameter and weighed from 37 to 46 grams each, passed tests of disintegration rates (in water), strength (resistance to fracture on dropping) and abrasion resistance. These products are of excellent cleaning and whitening powers. The tablets could be repeatedly dropped from heights of 1 to 4 feet without breaking. They distintegrated in water in from 10 to 30 seconds each. They were not readily abraded when packed together in sleeve wraps of plastic film and subjected to shaking. In all respects mentioned, the products were especially satisfactory for the laundering applications for which they are intended.

Example VII

Ingredients:	Parts
Ethoxylated nonyl phenol (averaging 9–10 moles ethylene oxide per mole compound)	10.0
Sodium tripolyphosphate	30.7
Sodium silicate ($Na_2O:SiO_2=1:2.35$)	30.3
Water	21.0
Adjuvants (coloring agents, fluorescent brighteners, perfume, inert materials, etc.)	8.0
	100.0

A tablet of the above formula was prepared substantially by the method of Example I. The moistened particles were screened to be between 4 and 40 mesh. After pressing at low pressure, they were moistened with water over their surfaces and the added water, about 3% of the briquette, was dried off. The product resulting was tested and found to be completely soluble in water (with the exception of insignificant proportions of pigment and inerts, which were dispersible), quickly disintegrable (10 to 30 seconds) and resistant to breakage, withstanding crushing forces of 20 to 30 pounds applied 12 hours after manufacture. The composition was a satisfactory laundry detergent. A useful tablet of this formula can also be made without moistening of the pressed briquette but it is preferred to produce a high strength tablet by moistening with about 2–5% of water, which is dried off.

The invention has been described with reference to several examples thereof. It is not to be limited thereto and its scope is determined by the claims and processes and products equivalent to those claimed.

What is claimed is:

1. A process for manufacturing a detergent tablet which comprises producing a particulate detergent composition comprising 2 to 20% of a water-soluble synthetic organic detergent selected from the group consisting of sulfated and sulfonated anionic detergents and water-soluble nonionic detergents containing both hydrophilic and hydrophobic portions in the molecule of which at least the hydrophilic portion includes a plurality of lower joined alkylene oxide groups or mixtures thereof, 20 to 50% of a water-soluble alkali metal polyphosphate, 20 to 50% of a water-soluble alkali metal silicate having a metal oxide to silica ratio between about 0.3 and 1, moving and circulating a mass of said particulate detergent, adding 2 to 35% water to the moving and circulating particulate detergent to raise the moisture content thereof to 15 to 35% whereby the moisture is substantially uniformly distributed throughout the mass of said particles and lightly compacting the resulting particles at a pressure of 3 to 100 p.s.i. into form retaining tablets which are readily disintegrable in wash water, soluble therein and resistant to breakage when subjected to shipping shocks.

2. A process for manufacturing a detergent tablet according to claim 1 in which the tablet pressure is between about 3 and 25 p.s.i.

3. A process for manufacturing a detergent tablet according to claim 1 in which about 3% water is also applied to the tablet surface.

4. A process for manufacturing a detergent tablet which comprises producing a particulate detergent composition comprising 5 to 15% of a water-soluble synthetic organic detergent selected from the group consisting of sulfated and sulfonated anionic detergents and water-soluble nonionic detergents containing both hydrophilic and hydrophobic portions in the molecule of which at least the hydrophilic portion includes a plurality of lower joined alkylene oxide groups or mixtures thereof, 25 to 40% of a water-soluble alkali metal polyphosphate, 25 to 40% of a water-soluble alkali metal silicate having a metal oxide to silica ratio between about 0.3 and 1 and up to 13% moisture, adding 7 to 30% water to the particulate detergent to raise the moisture content thereof to 20 to 30%, the addition of moisture being effected while the particles are being continuously moved and circulated, whereby the moisture is substantially uniformly distributed throughout the mass of said particles, the polyphosphate is substantially hydrated and the speed of solution of the soluble alkali metal silicate is increased and lightly compacting the resulting particles at a pressure of 3 to 100 p.s.i. into form retaining tablets which are readily disintegrable in wash water, soluble therein and resistant to breakage when subjected to shipping shocks.

5. A process for manufacturing a detergent tablet which comprises making an aqueous crutcher mix of a nonionic synthetic organic detergent containing both hydrophilic and hydrophobic portions in the molecule of which at least the hydrophilic portion includes a plurality of lower joined alkylene oxide groups, water-soluble alkali metal polyphosphate, water-soluble alkali metal silicate having a metal oxide to silica ratio between about 0.3 and 1 and water, in such proportions to be convertible after drying, to a tablet containing 2 to 20% nonionic detergent, 20 to 50% water-soluble alkali metal polyphosphate, 20 to 50% water-soluble alkali metal silicate and 15 to 35% water, drying the crutcher mix to particulate form having a moisture content of less than 13%, continuously moving the dried particulate detergent and spraying on to the moving particles 2 to 35% water to raise the moisture content of the particles to 15 to 35% to substantially hydrate the polyphosphate and increase the solubility of the silicate, the addition of moisture being such that it is distributed uniformly throughout the mass of particles, and lightly compacting the resulting particles at a pressure of 3 to 25 p.s.i. into form retaining tablets which are readily distintegrable in wash water, completely soluble therein and resistant to breakage when subjected to shipping shocks.

6. A process for manufacturing a detergent tablet according to claim 5 in which the crutcher mix prepared consists of higher alkyl phenol poly lower alkoxy alkanol detergent, water-soluble alkali metal tripolyphosphate, water-soluble alkali metal silicate having a metal oxide to silica ratio of about 0.4 and water and is spray dried and classified to particles between about 8 and 100 mesh and of bulk density of 0.3 to 0.6 gram per cubic centimeter, to which particles moisture is added during continuous mixture which increases the bulk density.

7. A process for manufacturing a detergent tablet according to claim 5 in which the moistened detergent particles are kept in motion without any quiescent periods of more than a minute between moistening and compressing.

8. A detergent tablet which comprises 2 to 20% of a water-soluble synthetic organic detergent selected from the group consisting of sulfated and sulfonated anionic detergents and water-soluble nonionic detergents containing hydrophilic and hydrophobic portions in the molecule of which at least the hydrophilic portion includes a plurality of lower joined alkylene oxide groups or mixtures thereof, 20 to 50% of a water-soluble alkali metal polyphosphate, 20 to 50% of a water-soluble alkali metal silicate having a metal oxide to silica ratio of between about 0.3 and 1, and 15 to 35% water, the tablet being in the form of particles compacted at a pressure of 3 to 100 p.s.i. and being readily disintegrable in water and of a strength to resist breakage in shipment.

9. A detergent tablet which comprises 5 to 15% of a water-soluble nonionic synthetic organic detergent containing both hydrophilic and hydrophobic portions in the molecule of which at least the hydrophilic portion includes a plurality of lower joined alkylene oxide groups, 25 to 40% of a water-soluble alkali metal polyphosphate selected from the group consisting of tripolyphosphate and pyrophosphate, 25 to 40% of a water-soluble alkali metal silicate having a metal oxide to silica ratio between about 0.3 and 1 and 20 to 30% water, the tablet being in the form of particles compacted at a pressure of 3 to 100 p.s.i. and being readily distintegrable in water and of sufficient strength to resist breakage in shipment.

10. A detergent tablet which comprises 2 to 20% of a higher alkyl phenol poly lower alkoxy alkanol detergent, 20 to 50% of a water-soluble alkali metal tripolyphosphate, 20 to 50% of a water-soluble alkali metal silicate having a metal oxide to silica ratio of about 0.4 to 1 and 15 to 35% water, in the form of particles compacted at a pressure of 3–100 p.s.i. to a tablet which is readily disintegrable in water and of sufficient strength to resist breakage in shipment.

11. A detergent tablet which comprises 5 to 15% of a nonyl phenol polyoxyethylene ethanol in which an average number of ethylene oxide groups is between 9 and 10, 25 to 40% of sodium tripolyphosphate, 25 to 40% of sodium silicate having a $Na_2O:SiO_2$ ratio of 1:2.35 and 20 to 30% water, the water present substantially completely hydrating the polyphosphate and increasing the solubility of the silicate over that of a heat dried silicate in the form of spray dried particles compacted at a pressure of 3 to 100 p.s.i. to a tablet which is readily disintegrable in water and of sufficient strength to resist breakage in shipment.

References Cited by the Examiner

UNITED STATES PATENTS

2,875,155	2/1959	Miles	252—138
3,081,267	3/1963	Laskey	252—135

FOREIGN PATENTS

510,555	3/1955	Canada.

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