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PROCESS FOR PRODUCTION OF DETERGENT TABLETS

Charles Frederick Fischer, Jersey City, N.J., assignor to Colgate-Palmolive Company, New York, N.Y., a corporation of Delaware

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ABSTRACT OF THE DISCLOSURE

A strong, rapidly disintegratable, non-tacky improved detergent tablet comprising a polyphosphate and an organic detergent is produced by treating the compressed composition with a critical amount, 0.04% to 0.2% by weight of the tablet of water and then immediately heating the tablet in less than eight seconds to a surface temperature above 850° F. with dry heating to obtain a tablet having substantially the same moisture content as before the contact with water.

This invention relates to a new and improved process for preparing detergent tablets. More particularly it relates to a process for making detergent talets in commercial production which will have sufficient strength to permit packaging and handling without breakage yet be capable of being easily removed from the package and of rapid disintegration under ordinary washing machine use.

The prior art has shown various detergent tablets and methods for producing such tablets. The use of detergent tablets, particularly in the laundering of textiles or soiled clothes, permits the consumer to utilize a premeasured quantity of detergent material thereby eliminating the need for measuring devices such as are used with detergent granules and liquids. Tablets also eliminate the usual problems of spillage and over and under-usage encountered with the use of detergent granules or liquid.

The prior art has disclosed a number of means of producing detergent tablets but such means have not been completely satisfactory from a commercial standpoint. In general, the tablets of the prior art have not had the necessary physical strength to completely withstand the shipping and handling which occurs prior to use by the consumer. Where the physical strength has been adequate, the tablets would often not readily disintegrate in the requisite period of time. Furthermore, tablets having the necessary physical strength quite often adhered to each other in the package as a result of processing, thereby making it extremely difficult for the consumer to separate the tablets prior to use.

It has now been discovered that detergent tablets which have the physical strength to withstand high speed packaging and shipping while being substantially free of tackiness may be obtained by rapidly heating detergent tablets with dry heat in less than about eight seconds to a surface temperature of above about 850° F. before packaging.

The term "tackiness" as used in the present invention refers to the adhesive force which holds two or more detergent tablets together in the consumer package making it extremely difficult for the consumer to separate the tablets. The term "dry heat" is heat provided from a source other than steam.

The tablets after discharge from the tablet forming equipment are rapidly heated to a surface temperature above 850° F. in less than about eight seconds, preferably to a surface temperature above about 1100° F.–1400° F. in less than three seconds. Detergent tablets so treated exhibit unusual properties when placed in water at room temperature or above. The surfaces appear to peel or shed from the tablet core thus greatly increasing the tablet surface area exposed to the water with a concurrent reduction in the tablet disintegration time.

According to another embodiment of the present invention, the prepared tablets after being removed from the tablet forming equipment and before being rapidly heated are contacted with water, preferably in the form of a fine mist although other common means of contacting such as brushing or blotting may also be employed. The water is applied at a level of about 0.04% to 0.2% by weight of the tablet so as to uniformly contact the tablet surface. The tablets are then immediately heated in less than eight seconds to a surface temperature above about 850° F. Preferably, the tablets are heated in one to five seconds to a surface temperature of 900° F. to 1600° F. and more preferably in one to two seconds to a surface temperature of 1000°–1400° F.

It has been found that the process of the present invention provides a greatly strengthened detergent tablet and at the same time avoids the undesirable tackiness which was common in the products prepared by prior art processes. The prior art in general teaches the need to increase the moisture content of the tablet by either water addition or steaming followed by air drying or moderate temperature drying requiring at least 1.5–10 minutes. In the present invention, it is of the utmost importance that the tablet moisture content immediately after being heated is substantially the same as the moisture content before treatment with water.

The tablets may be treated according to the present invention by either a batch or continuous method on a continuous belt conveyor. While both sides of the tablet may be treated simultaneously, it is preferred to treat one side of the tablet at a time. The talets after heat treatment are ready for packaging.

Where the pressed tablets are extremely fragile and do not withstand handling during processing, the tablets may be heated to a surface temperature above 850° F. and preferably about 900°–1600° F. and most preferably 1000°–1400° F., contacted with 0.04% to 0.2% water by weight of the tablet and reheated to a surface temperature above 850° F. preferably about 900°–1600° F. and most preferably 1000°–1400° F. The tablets are then again contacted with 0.04% to 0.2% water by weight of the tablets and then immediately heated to a surface temperature of above about 850° F.

The heat source employed may be any conventional dry heat source capable of producing the desired temperature. Typically, the tablets may be heated by radiant heat such as produced by infra-red lamps, quartz lamps and gas flame; or by convection means such as produced by super-heated air or other gases.

While generally tablets will be treated by the process of the present invention immediately after being formed, it is to be understood that tablets that have been stored may also be treated to obtain the desired results.

It has been found in carrying out the present invention that any detergent composition suitable for use in preparing tablets, such as the tablet compositions described in U.S. Patent 2,875,155 to Miles or U.S. 3,081,267 to Laskey are suitable for use in the present invention. The detergent composition is formed into tablets by compressing the desired amount of detergent powder in a tablet press at pressures of between about 3–350 p.s.i.

In general, the tablet compositions which are suitable for use in the present invention will contain a water-soluble polyphosphate such as the alkali metal polyphosphates and a water-soluble, non-soap organic detergent selected from the group consisting or anionic and non-anionic detergents. Such tablets may also contain the usual adjuvant materials such as perfumes, foam stabilizers, foaming agents, whiteners, preservatives, etc.

The anionic detergents are the anionic non-soap synthetic detergents which may be designated as water-soluble salts of organic sulfuric reaction products having in their molecular structure an alkyl or acyl radical of carbon atom content within the range of about 8–18 and a sulfonic acid or a sulfuric acid ester radical. Typical of these anionic detergents are: sodium or potassium alkyl benzene sulfonate in which the alkyl group contains from about 9 to about 15 carbon atoms in either a straight chain or branched chain which is derived from polymers of propylene; sodium and potassium alkyl glyceryl ether sulfonates, especially those ethers of higher fatty alcohols derived from the reduction of coconut oil; the reaction product of higher fatty acid with sodium or potassium isethionate, where, for example, the fatty acids are derived from coconut oil; sodium or potassium alkyl sulfonates and sulfates, especially those alkyl sulfates derived by the sulfonation of coconut or tallow fatty alcohols and mixtures of such alkyl sulfates; di-alkyl esters of sodium or potassium salts of sulfosuccinic acid, for example, the dihexyl ester; sodium and potassium salts of sulfated or sulfonated monoglycerides derived, for example, from coconut oil; sodium or potassium salts of the higher fatty alcohol esters of sulfocarboxylic acids. for example, the sodium salt of the lauryl alcohol ester of sulfoacetic acid; sodium or potassium salts of a higher fatty acid amide of methyl taurine in which the higher acyl radical for example, are derived from coconut oil; and the like.

Non-ionic, non-soap synthetic detergents may be broadly classed as being constituted of a water-solubilizing polyoxyethylene group in chemical combination with an organic hydrophobic compound such as polyoxypropylene, alkyl phenol, the reaction product of an excess of propylene oxide and ethylene diamine, and aliphatic alcohols. The non-ionic synthetic detergents have a molecular weight in the range of from about 800 to about 11,000. Typical of the non-ionic detergents are those made available under the trade name of "Igepal" and "Sterox." These compounds are formed by condensing ethylene oxide with an alkyl phenol. The addition of polyoxyethylene radicals to this hydrophobic base increases the water-solubility of the entire molecule. Liquid products are obtained up to a point, higher proportions of polyoxyethylene rendering the product solid in consistency. Examples of such non-ionic synthetic detergents useful in the present invention are: condensation products of 10–30 moles of ethylene oxide with one mole of an alkyl phenol containing 6–12 carbon atoms, either in a straight or branched chain in the alkyl group (e.g. nonyl or dodecyl phenol); condensation products of 10–30 moles of ethylene oxide with one mole of an aliphatic straight or branched chain alcohol containing 8–18 carbon atoms (e.g. lauryl alcohol or tallow fatty alcohol), condensation products of

ethylene oxide and the reaction product of propylene oxide and ethylene diamine where the reaction product has a molecular weight of 2,500–3,000, for example, and the condensation product has a polyoxyethylene content of 40%–80%. In addition, other non-ionic non-soap synthetic detergents known in the art such as those known under the trade name "Pluronics" may be employed.

The detergent composition may be formed into tablets by any conventional tablet forming method. The tablets of this invention may be made of any of various shapes and sizes depending upon the purpose for which they are to be used. The tablet surfaces may be scored, if desired, to facilitate division by the consumer.

The following examples are given to further illustrate the means by which this invention can be carried out.

EXAMPLE 1

Detergent tablets weighing about 57 grams and prepared from a spray dried powder containing

	Percent
Sodium sulfate	35.0
Sodium tripolyphosphate	21.0
Nonyl phenol polyethyleneoxy alcohol (9:1)	8.0
Sodium silicate (Na_2O:SiO_2 ratio of 1:2.35)	23.0
Water	10.0
Optical brighteners, coloring, perfume, sodium carboxymethylcellulose and other adjuvant materials	3.0

were, immediately after being formed into tablets, transferred to a three inch wide wire mesh conveyor belt travelling at two feet per second. The tablets on the wire mesh conveyor belt were passed through a spray chamber two feet in length and having two spray nozzles which sprayed 0.05 gram of water at 70°–75° F. on each tablet. The conveyor belt moving at the same rate then passed through a flash heater having a length of seven feet where the surface temperature was increased to 700° F. to 900° F. by the use of non-impinging gas flame radiant burner. The tablets were then transferred to a flip conveyor, turned over and passed through a second spray chamber and flash heater identical to the first spray chamber and flash heater in order to treat the bottom side of the tablets. The tablets emerging from the second flash heater were transferred by conveyor to a wrapping machine for packaging.

The tablets after passing through the flash heater had substantially the same moisture content as before entering the spray chamber. The finished tablets had a firm, hard surface which was non-powdering and non-beading and had a tack strength of approximately 0–4 ounces per square inch after 24 hours. The tack strength was measured by placing two sleeves of nine tablets each on top of each other after packing. At the end of 24 hours the tablets were placed in a device which applied pressure to the side of the top tablet. The shear force required to separate the top tablet from the adjacent tablet was measured as pounds per square inch gauge. Commercially available tablets measured in this manner had a tack strength of 0–40 p.s.i.g. and generally about 20 p.s.i.g. The finished tablets disintegrated in 25 to 40 seconds when submerged in water at 100° F.

EXAMPLE 2

Detergent tablets containing

	Percent
Sodium sulfate	10.0
Sodium tripolyphosphate	50.0
Pentadecylbenzene sulfonate	18.0
Sodium silicate (Na_2O:SiO_2 ratio of 1:2)	6.0
Water	14.0
Optical brighteners, coloring, perfume, sodium carboxymethylcellulose and other adjuvant materials	2.0

were treated by the procedure of Example 1 except that the belt speed was five feet per second and the surface temperature of the tablets was 1500° F.

The treated tablets had the same moisture content as before treatment, the desired physical strength and showed no sign of breaking when subjected to the stresses and handling typical of packaging and transporting. The tablets had a tack strength of 0 to 4 ounces per square inch after 24 hours and disintegrated in 25 to 40 seconds in water at 100° F.

EXAMPLE 3

Detergent tablets weighing about 57 grams and prepared from a spray dried powder containing

	Percent
Sodium sulfate	35.0
Sodium tripolyphosphate	21.0
Nonyl phenol polyethyleneoxy alcohol (9:1)	8.0
Sodium silicate (Na_2O:SiO_2 ratio of 1:2.35)	23.0
Optical brighteners, coloring, perfume, sodium carboxymethylcellulose and other adjuvant materials	3.0

were, immediately after being formed into tablets, transferred to a three inch wide wire mesh conveyor belt travelling at a rate of five feet per second. The conveyor belt carried the tablets into a preheater section having a length of ten feet in which the tablets were heated with superheated air to a surface temperature of 800° F. The hot tablets were conveyed to a spray section two feet in length and having two spray nozzles wherein 0.05 gram of water at 70°–75° F. was sprayed onto the tablet surface. The tablets were then passed through a flash heater section seven feet in length wherein the surface temperature of the tablets was increased to 1200° F. The tablets were then passed through a second spray section two feet in length and having two spray nozzles wherein 0.05 gram of water was sprayed onto the tablets. The tablets then passed through a second flash heater section seven feet in length wherein the tablet surface was again raised to 1200° F. The tablets discharged from the flash heater were turned over on a flip conveyor and passed through a second bank of heaters and spray chamber identical to the first line and employing the same conditions so as to treat the bottom side of the tablets. The tablets discharged from the last flash heater were fed by conveyor to the wrapping machine.

The treated tablets had the same moisture content as before treatment, the desired physical strength and showed no sign of breaking when subjected to the stresses and handling typical of packaging and transporting. The tablets disintegrated in 25 to 40 seconds in water at 100° F.

While the present invention has been described by the means of the foregoing examples, reference should be had to the appended claims for a full definition of the scope of the invention.

What is claimed is:

1. A process for providing an improved detergent tablet which comprises contacting the surface of a detergent tablet consisting essentially of alkali metal polyphosphate and a water-soluble, nonsoap organic detergent selected from the group consisting of anionics, nonionics and mixtures thereof said polyphosphate constituting a major portion of the mixture of said polyphosphate and detergent with 0.04% to 0.2% water by weight of the tablet, immediately heating said tablet in less than eight seconds to a surface temperature of above 850° F. with dry heat to obtain a dry tablet having substantially the same moisture content as before contacting with water.

2. A process according to claim **1** wherein the temperature employed is within the range of 900° to 1600° F.

3. A process as defined in claim **2**, wherein the temperature ranges from 1000° F. to 1400° F.

4. A process as defined in claim **1**, wherein the tablet is preheated to 850° F. in less than eight seconds with dry heat prior to contacting with the water.

5. A process as defined in claim **4**, wherein the temperatures employed are within the range of 900° F. to 1600° F.

6. A process as defined in claim **5**, wherein the temperatures employed are 1000° F. to 1400° F. and the heating times are from one to two seconds.

7. A process as defined in claim **1**, wherein said tablet is produced by compressing the components thereof at a pressure of from 3 to 350 p.s.i.

8. A process as defined in claim **7**, wherein said polyphosphate is sodium tripolyphosphate.

9. A process as defined in claim **8**, wherein the temperature employed is within the range of 900° F. to 1600° F.

10. A process as defined in claim **9**, wherein the temperature range is 1000° F. to 1400° F.

11. A process as defined in claim **8**, wherein the tablet prior to contacting with the water is preheated to about 850° F. in less than eight seconds with dry heat.

12. A process as defined in claim **11**, wherein the temperatures employed are within the range of 900° F. to 1600° F.

13. A process as defined in claim **12**, wherein the temperatures employed are 1000° F. to 1400° F. and the heating times are from one to two seconds.

14. A process as defined in claim **13**, wherein the water contacting and heating steps are repeated a second time.

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LEON D. ROSDOL, *Primary Examiner.*

B. BETTIS, *Assistant Examiner.*

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