INTEGRAL DETERGENT-SPONGE STRUCTURE
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This application is a continuation-in-part of copending application Serial No. 196,038, now abandoned, filed May 16, 1962, which is a division of application Serial No. 86,956, filed February 3, 1961 now Patent No. 3,076,298.

This invention relates to an integral product formed of dissimilar materials, and more particularly relates to a layer of detergent material having strongly attached thereto, by virtue of a plurality of laminas, a sponge.

In the past, attempts have been made to attach a soap to a sponge. Herbetofo two major methods of attaching a soap layer to a sponge layer have been used. A first method has been to mechanically attach the soap to the sponge. This could be accomplished in various ways. It has been proposed to form a sponge in the shape of a pouch by slitting the sponge longitudinally or by attaching two sponges at their edges. A cake of soap would then be placed in the pouch whereby the sponge encompasses the soap. This method has been unsatisfactory primarily because of the tendency of a sponge to hold water for long periods of time. This causes a prolonged contact of the soap with water thereby causing the soap to soften giving the article an unpleasant feel while concurrently wasting large quantities of soap because of the softening and the tendency of soap to dissolve in water.

An alternative mechanical attachment means herefore proposed has been the use of a soap molded in an odd shape. The soap is forced into the sponge having a complementary shape whereby the interlocking protruberances on the soap and sponge hold them together. This method of attaching soap to sponge has also been found to be unsatisfactory because of the property of sponges to hold water. These protruberances on the soap bar quickly soften and dissolve thereby causing separation of the soap from the sponge.

A second method herefore attempted was the attachment of soap to sponge by the use of various adhesives. The problem of finding an adhesive which satisfactorily adheres to a soap surface has been difficult, and even when such an adhesive was found, the adhesion became unsatisfactory when the bar was wetted. This was true even where a water insoluble adhesive was used. Under ordinary washing conditions, a soap and a sponge which are merely adhesive adhered soon became separated.

The present invention solves this longstanding problem in the art and provides an improved and practicable soap-sponge combination which will remain together throughout use until the soap is substantially completely consumed during normal washing operations. The novel product made in accordance with this invention have been found to have the ability to remain attached during use even when the article is repeatedly subjected to solutions of alkaline detergent materials in warm water and to the compressive tending and shearing forces which accompany washing actions.

In accordance with the present invention, it is now possible to securely attach a synthetic sponge laminae to a detergent material layer by applying to a layer of synthetic sponge a coating of a water insoluble adhesive, adhering a thin flexible water impermeable lamina to said coating, and applying a second coating of a water insoluble adhesive on said water impermeable lamina. A layer of solid detergent material selected from the group consisting of water soluble soaps of higher fatty acids having an average of 8 to 20 carbon atoms, water soluble synthetic organic detergents having an average of 8 to 20 carbon atoms and mixtures thereof is fastened by the second coating to the water impermeable lamina which in turn is held to the sponge layer by the first coating.

Advantageously, the article may be formed by first attaching the sponge layer to the water impermeable lamina by use of a water insoluble adhesive and then applying the second coating of water insoluble adhesive to the opposite side of the water impermeable layer. Preferably, the second coating which is to lie between the water impermeable lamina and the detergent layer is a pressure sensitive adhesive so that a pre-formed sponge, adhesive, lamina, adhesive laminate can be attached to the deterrent layer by merely pressing the pre-formed laminate against the detergent layer and maintaining it in position, pressed against the bar, for a sufficiently long period of time to hold the water impermeable lamina tightly against the detergent with the adhesive covering and adhering to substantially all the contiguous water impermeable lamina and detergent bar surfaces.

The article of this invention can be formed in a number of shapes and sizes. It is possible, for example, to form a laminate having dimensions that are large multiples of the desired final size and to subsequently cut the laminate into a plurality of articles. In its preferred embodiment, the article of this invention will be a layer of soap having attached thereto a sponge. This integral article, in order to be commercially acceptable, must be capable of retaining its structure throughout the useful life of the soap and without delaminating. By virtue of the novel attaching means of this invention, such an article can be obtained. The integral article has a large number of benefits, some of which are outlined below.

The synthetic sponge, being lighter than water, increases the buoyancy of the product and causes even milled soaps and detergents to float. The sponge furnishes a convenient rest for the detergent, facilitating drainage and decreasing smearing or sloughing of detergents onto clothing. This is especially important when the detergent material is a synthetic detergent bar or a combination soap-synthetic detergent bar because these bars are usually more soluble than is desirable. The sponge rest also has a higher sliding friction than detergent, thereby preventing slipping of the article from inclined washstands and surfaces and giving the user a better grip.

The integral sponge aids in producing a copious lather and acts as a wash cloth, helping to clean the skin. Because the surface properties of the sponges can be readily regulated in production, firm or soft washing surfaces can be made, as desired. The sponges can be molded, pressed, cut or printed with permanent decorative material, advertising, trade names or instructions for use.

Finally, all these additional advantages over ordinary soaps are attainable with only a small increase in production costs. In some instances, where pressing is omitted (being now unnecessary because the sponge may be preprinted with trade name and decoration) the cost of the sponge bar may be even less than the cost of an equivalent sized detergent bar.

The product of this invention has the additional advantage that it is particularly useful in the field of medicated detergent bars. It is possible, with the bar of the invention, to add medication for many purposes, such as the relief of acne, pimples, dry skin, etc. The medication can be incorporated either into the detergent layer of the sponge layer. If desired, different medications which cannot be mixed with each other but which can advantageously be used together, placed in the different layers whereby the user of the soap can obtain the benefit of both medications using a single bar. The sponge layer
used for the article can be made in a variety of hardnesses so that the purchaser can select a bar having a desired hardness.

The invention and its various objects and advantages will be apparent from the following description taken in conjunction with the accompanying drawings in which

FIGURE 1 is a perspective view of the improved lamina 3 of this invention.

FIGURE 2 is a vertical cross-sectional view taken on lines 2–2 of FIGURE 1, and

FIGURE 3 is a perspective view of the product of the invention, intended for better illustration, after consumption of substantially all of the detergent in normal washing usage.

The novel product as illustrated in FIGURES 1 and 2 comprises a layer 10 of detergent material having a composition described more fully hereinafter. The layer 10 has a coating 12 thereon, which coating is preferably a water insoluble, pressure sensitive adhesive. Flexible water impermeable lamina 14 is fastened to said detergent material 10 by said adhesive 12 and a second coating 16 of water insoluble adhesive is coated on said lamina 14. A synthetic sponge layer 18 is fastened by said coating 16 to said lamina 14 whereby there is formed an integral product comprising layer 10 of detergent material, water insoluble adhesive 12, water permeable lamina 14, water insoluble adhesive coating 16 and layer 18 of sponge material.

While the article is shown as a rectangular object, the shape and size thereof can be varied at will to produce a product having various configurations. The shape of the bar can be varied for any desired reason such as for aesthetic purposes or for ease of assembly.

In FIGURE 3 there is shown a thin sliver 20 of detergent material which is all that is left of the original soap layer 10 of the article of FIGURES 1 and 2 after normal hand washing or bath use. If desired, it is possible, by intentionally flexing the sponge layer 18 and lamina 14 and applying force thereto, to remove the sponge layer 18 along with the lamina 14 from the soap. However, to accomplish such separation it is necessary to remove, with the layer 18, a film of detergent material from the detergent layer. This is true because the adhesive bond between the water insoluble adhesive 12 and the detergent material is actually stronger than the cohesion of the detergent material. In normal careful use of the layers of the article will remain attached so that the entire layer of detergent material can be used down to a thin sliver as shown by numeral 20 in FIGURE 3.

Surprisingly, after consumption of the detergent material, the pressure sensitive adhesive coated lamina 14 will remain clean looking and will not pick up dirt when wet. The coatings 12, 16 and the lamina 14 serve, in addition to its primary use, to hold the sponge together and thereby prevent its disintegration during use.

The sponge layer which is to be combined with the detergent cake should be substantially water insoluble and resilient. It is preferably very light in weight, much less than the density of water, and contains an interconnected cellular network, the cells being filled with gas, usually air. With this structure the sponge is able to take up moisture throughout its body, when it is collapsed by pressure, expelling the air, and then released, allowing replacing of the air by wash water. Such continuous compression and expansion of the sponge face facilitates the mixing of air and detergent solution in films and promotes the development of a copious foam. The small interconnected cells of the sponge are substantially uniform in size to the eye and generally range from 0.005 to 0.100 inch.

The material of which the sponge layer is made should be dimensionally stable and little affected by the presence of moist or dry conditions, insofar as expansion and contraction are concerned. Such a sponge will not tend to warp or distort during use due to alternate moistening and drying of the detergent cake and will not tend to pull away from the surface of the detergent. It is also desirable for the material of the sponge, itself, to be relatively non-absorbent, to promote faster draining and more rapid drying of the product.

Among suitable sponge materials are the various synthetic products, especially those based on substances commonly referred to as plastics. Natural animal sponges do not have the properties or structure to be suitable in the inveneted combination article. Ordinary cellulose sponges may not be used because their dimensional instability and capillary action make them less suitable than other synthetics. In the group of satisfactory materials which may be made into sponges useful in this invention there may be mentioned those made by foaming rubber, either natural or synthetic, as well as sponges made by foaming resilient plastics such as polyethylene, polyesters, polystyrene, acrylics and other compounds of similar properties.

The most satisfactory plastic sponges found to date are those made from polyurethane, preferably of the polyester type for harder and medium sponges and of the polyether type for those desired to be softer. These sponges have good color, high resilience, and low water absorption, and they are non-swellable in water which will contribute an excellent massaging action on the skin without irritation. These polyurethane sponges do not lose their desirable tactile properties when wet. As with most plastics the polyurethanes are available in a wide variety of colors which contribute toward the esthetically pleasing appearance of the combination soap and sponge. In the molding or trimming process the polyurethane sponge may be shaped to include a trade name or decoration which, unlike the case with soap alone, will not be removed as the product is consumed. If desired, the sponges may be printed with suitable identification.

The detergent material which is a part of the invented article of manufacture is an organic detergent which may be selected from the group consisting of higher fatty acid soaps and water soluble synthetic organic detergents. Mixtures of soaps, mixed synthetic organic detergents and soap-synthetic organic detergent combinations may be employed. These materials are water soluble and normally solid so that they are suitable for manufacture in bar and cake form. In forming an article containing both soap and synthetic detergent it is possible to impregnate the sponge layer with one of the detergent materials and form the detergent layer with the other.

Among the more suitable detergents it is preferred to utilize those which are anionic or non-ionic. As suitable anionics there may be mentioned the fatty alcohol sulfates, fatty acid monoglyceride sulfates, sulfated oxyethylated fatty alcohols, alkyl aryl sulfonates, alkyl sulfonates, higher fatty esters of isethionic acid, higher fatty amides of fatty acids and N-methyl taurine, higher fatty amides of sarcosine, higher fatty sulfonates and sulfated higher fatty alkylolamides. The higher alkyl and acyl groups mentioned in the above description are those containing 8 to 20 carbon atoms, preferably 12 to 18 carbon atoms. Usually it is preferred that the carbon atoms of the acyl and alkyl groups should be in straight line configuration but often, in the case of the alkyl benzene sulfonates, branched chain groups may be employed in limited minor amounts. All the anionic synthetic organic detergents are used as water soluble salts, preferably as alkali metal salts. Alkaline earth metal salts, ammonium salts, triethanolamine salts and other metal salts used but the salts of sodium and potassium, especially the former, are preferred because they usually possess better water solubility and are of sufficient hardness to be made into a cake product.

The higher fatty acid soaps are those which are water soluble and normally solid. Such soaps are usually of 8 to 20 carbon atoms and are obtained by saponification of
the usual soap making oils such as coconut oil, tallow, hydrogenated coconut oil and tallow, lard, grease, babassu oil, palm oil, palm kernel oil and other well-known materials of similar types. The soaps are usually made in the forms of their sodium salts although other alkali metal salts such as those of potassium may also be found to be satisfactory. Triethanolamine soaps or soaps of other organic bases can be used but are not usually as efficient as those of sodium. The alkaline earth metal soaps and the magnesium soaps are not included within the scope of water soluble higher fatty acid soaps, although these materials may be added to the bar composition as fillers or for other purposes.

Normally solid water soluble non-ionic detergents are those which usually contain chains of lower alkylene oxide to increase their hydrophilic properties. Included in this group are the higher fatty acid esters of polyoxyethylene alcohols ethylene oxide-propylene oxide block copolymers of higher molecular weight, e.g., 5,000 to 20,000, ethylene oxide adducts of lower diacylphons, other polynkyloxylated lipophilic stems and higher fatty esters of multiply-hydroxy compounds such as sugars, polyglycols and so forth.

Between detergent and sponge is a water impermeable barrier in the form of a lamina. This lamina should be thin enough to be readily washed, but not easily peeled loose from the detergent and sponge to which it is fastened. The barriers that have been found to be most useful are those made from synthetic organic plastics, usually in thicknesses of 0.25 to 5 mils, preferably about 1 mil.

The plastics used are impermeable or substantially impermeable to water and prevent transmission of moisture through to the adhesive bonding detergent and barrier thus preventing or inhibiting the weakening action of water on such adhesive. Although some wash water may contact the edges of the lamina layer under the barrier, this will not sufficiently weaken the bond to cause the separation of barrier film from detergent.

It has been found that layers of water insoluble adhesives alone will not perform the function of a thin continuous plastic film, apparently because the adhesives, even though carefully applied, contain perforations through which water may penetrate to loosen the detergent-barrier bond. This fault is accentuated when thin adhesive layers are used. Although sheet plastics also sometimes contain minute openings, usually these are few enough and small enough that even very thin lamina are substantially impermeable to water.

Among the useful barrier films, the most preferred is polyethylene terephthalate, known as Mylar. Other polyesters, such as those of alpha, omega-glycols and symmetrical aromatic dicarboxylic acids; vinylidene chloride-vinyl chloride copolymers (Saran); polymeric amides, such as the polyamers of hexamethylene diamine and adipic or sebacic acid (nylon 66 and nylon 610); plasticized polyvinyl chloride (Tygon, Geon); rubbers, both natural and synthetic, such as neoprene, butyl rubber, rubber hydrochloride, polysoprene, and GR-S are also useful, being capable of being made as water impermeable, thin, flexible and resilient films. These materials usually should have water absorbing capacities of less than 3% and preferably less than 0.5%, as measured by ASTM test D570. Such plastics are considered to be substantially impermeable to liquid water.

Cellulosic plastics, such as cellulose acetate and acetobutyrate, have rather high moisture absorption and transmission rates and are less flexible than the other plastics listed but may be useful in certain applications. The "waxy" plastics, such as polyethylene and polypropylene are good barriers, having moisture absorptions of about 0.01% or less but are more difficult to fasten firmly to soap and barrier. Other barrier film materials than the plastics, e.g., aluminum foil, prevent moisture penetration and can be cemented but they are relatively unyielding in washing, causing some skin irritation during use, and are easily creased or marked in handling.

The water insoluble adhesive employed to hold the sponge to the barrier film may be any suitable composition that can withstand repeated wettings with a solution of organic detergent and the accompanying flexing of the sponge and barrier film in ordinary use. It has been found that the ordinary rubber based adhesives are satisfactory and especially, those based on nitrile rubber, particularly when dissolved in solvent. A suitable cement is that sold as EC 847 by Minnesota Mining and Manufacturing Co. However, other synthetic and natural rubbers such as polyisobutylene, polyisoprene, neoprene, GR-S and Thiodol can also be used. Often combinations of rubbers and resins are employed, e.g., nitrile rubber and phenolic resin.

Instead of rubbers, other elastomeric or flexible cements may be used, including silicone elastomers, polyethylene, polyvinyl acetate, polyvinyl butyral, pressure-sensitive adhesives and vinyl n-butyl others, to mention only a few. Even the harder plastics may be used, such as the epoxy resins, protein based water insoluble glues, melamine formaldehyde, the phenolics, e.g., phenol formaldehyde, urea formaldehyde, Versamid, synthetic polyamides (nylon type). Of course the choice of adhesive will be somewhat dependent on the nature of the synthetic sponge and the barrier used and should usually be selected for the greatest degree of adhesion under the conditions of use. Also, in the case of alkaline reaction, e.g., soap, the cement should be resistant thereto so that it is not hydrolyzed or otherwise adversely affected in use.

Nitrile rubber, epoxy resin and polyisobutylene adhesives on the invented products retain their adhesive powers, even in strong soap solutions.

While the fastening of barrier film to sponge may be affected by various means and the selection of an adhesive is not extremely critical, the problem of sealing a material to a detergent is more difficult of solution. It has been found, after extensive experimentation that many water insoluble adhesives that are capable of adhering to dry soap and other detergent materials are easily removed when the detergent becomes wet or moist.

The provision of a barrier between sponge and soap mitigates this adverse effect but it is still highly preferable to employ certain types of adhesives for best adherences.

It has been found that the non-resilient and inflexible adhesives, such as epoxy resins, phenol and formaldehyde derivatives, proteinaceous gluces and so forth leave an objectionable hard, sometimes crystal-like deposit on the barrier after the detergent has been consumed. This rough surface is esthetically undesirable. The coating of rigid cement also stiffens the barrier, decreasing its flexibility and its ability to distort slightly when stressed, rather than to be torn away from the detergent. This loss of flexibility causes the sponge to part from the soap before the soap is substantially consumed, decreasing the utility of the product. It is therefore desirable to employ the flexible and resilient adhesives, such as those commonly referred to as being pressure-sensitive. These remain resilient almost permanently and adhere to the soap or detergent, even when repeatedly immersed in water. If loosened, the pressure sensitive adhesives can be rejoined to the detergent when dry by slight manual pressure. In this respect it is noted that for best adhesion the bar should be hard and dry to the touch when the sponge-barrier is first put in place.

The moisture content of such a bar will be 5-20%. With bars containing a major proportion of soap a moisture content less than 5% will cause difficult plodding and above 20% will usually be unduly soft.

Among the pressure sensitive adhesives, that found best is one based on butyl rubber. Polyisobutylene compositions, available from Richards, Parents & Murray, New York, N.Y., can be applied to a roll or piece
of polyurethane sponge which has been covered on one face with barrier film. The applied adhesive, usually about equal in thickness to the Mylar films described earlier, is coated with non-adherent backer and may be stored until needed for application to the detergent, such application preferably being effected by an automatic device, such as the Tuck Labeler made by Technical Tape Corporation, New Rochelle, N.Y.

Like other pressure sensitive adhesives those based substantially on polyisobutylene are usually composed of a plasticized high molecular weight elastomer, the plasticizer in this case being a low molecular weight fraction of the same material, polyisobutylene. Other elastomers such as the rubbers and organic polymers described earlier may also be plasticized to form pressure sensitive products, according to known methods. Usually the plasticizer used will be a suitable hard resin dissolved in an oil, the resin and oil producing a tackiness and the resin imparting adhesive strength. Still other types of pressure sensitive adhesives are known and may be employed, e.g., those based on a polyester of castor oil and maleic ester.

In applying the pressure sensitive adhesive to the barrier film before sealing to the detergent core should be taken to ensure that it covers all the film and portions thereof unencrusted. This decreases the chance of moisture loosening the adhesion of sponge to detergent. Furthermore, the pressure exerted in fastening the sponge to the detergent should be enough to press all the pressure sensitive adhesive into contact with the detergent surface.

In accordance with a preferred embodiment of the invention, as set forth hereinabove, the article of the invention as shown in the drawings will preferably comprise a polyurethane sponge layer 16 having a nitrile rubber adhesive coating 18 thereon. Fastened to layer 18 by said adhesive 16 is a lamina 14 of polyethylene terephthalate having a thickness of about one mil. Lamina 14 has thereon a pressure sensitive polyisobutylene adhesive coating 12, and secured thereto by said adhesive is a synthetic detergent bar 10.

As was previously, the sponge units, less detergent, may first be assembled, then stored and applied to detergent when desired, either as individual pieces or as strip or sheet which is subsequently cut with the detergent bar. Thus the manufacturing processes are simplified and made more flexible and may be carried out using presently available equipment to a substantial extent.

Together with the processing advantages of the invention there are also obtained very important product advantages. The improved adhesion of detergent and sponge attributable to the present invention has been discussed at length and is of vital importance in the production of an acceptable, as well as economical article. This enables the user to obtain the full benefit of the combination article for a greater period, in effect, increases the useful life of the product.

The above invention has been described with respect to illustrations of preferred embodiments thereof. It is not limited to such articles only, the scope of the invention being as recited in the claims.

What is claimed is:

1. Means for attaching a layer of synthetic sponge material and a layer of detergent comprising a first coating on said layer of sponge material, said first coating comprising a water insoluble, resilient, alkali stable, polyisobutylene adhesive; a flexible water impermeable lamina fastened to said layer of sponge material by said first coating, said lamina comprising a polyethylene terephthalate film having a thickness of about one mil; and a second coating on said lamina, said second coating comprising a water insoluble, resilient, alkali resistant, pressure sensitive, polyisobutylene adhesive having a thickness of about one mil, said layer of detergent being fastened to said water impermeable barrier by said second coating; said layer of detergent comprising a detergent material selected from the group consisting of normally solid water soluble soaps of higher fatty acids having an average of 8 to 20 carbon atoms, normally solid water soluble synthetic organic detergents having an average of 8 to 20 carbon atoms, and mixtures thereof.

2. Means for attaching a layer of synthetic sponge material and a layer of detergent comprising, a first coating on said layer of sponge material, said first coating comprising a water insoluble, resilient, flexible, polyurethane sponge having cells with an average diameter of between about 0.005 to 0.100 inch.

3. Means for attaching a layer of synthetic sponge material and a layer of detergent comprising a first coating on said layer of sponge material, said first coating comprising a water insoluble, resilient, flexible, polyurethane sponge having cells with an average diameter of between about 0.25 to 5 mils; and a second coating on said lamina, said second coating comprising a water insoluble, pressure sensitive polyisobutylene adhesive having a thickness of about 0.25 to 5 mils; said layer of detergent being fastened to said water impermeable barrier by said second coating; and said layer of detergent comprising a detergent material selected from the group consisting of normally solid water soluble soaps of higher fatty acids having an average of 8 to 20 carbon atoms, normally solid water soluble synthetic organic detergents having an average of 8 to 20 carbon atoms, and mixtures thereof.

4. Means for attaching a layer of synthetic sponge material and a layer of detergent comprising a first coating on said layer of sponge material, said first coating comprising a water insoluble, resilient, flexible, water impermeable lamina fastened to said layer of sponge material by said first coating of water insoluble adhesive; and a second coating on said lamina, said second coating comprising a water insoluble, pressure sensitive polyisobutylene adhesive having a thickness of about one mil; said layer of detergent being fastened to said water impermeable barrier by said second coating; and said layer of detergent comprising a detergent material selected from the group consisting of normally solid water soluble soaps of higher fatty acids having an average of 8 to 20 carbon atoms, normally solid water soluble synthetic organic detergents having an average of 8 to 20 carbon atoms, and mixtures thereof.

5. Means for attaching a layer of synthetic sponge to a layer of detergent so strongly that the layers are not separated during use, said detergent comprising a detergent material selected from the group consisting of solid water soluble soaps of higher fatty acids having an average of 8 to 20 carbon atoms, water soluble synthetic organic detergents having an average of 8 to 20 carbon atoms, and mixtures thereof; said means comprising a layer of a water insoluble, pressure sensitive adhesive on said detergent cake, a thin, flexible, water impermeable, synthetic organic plastic lamina fastened to said detergent.
material by said layer of water insoluble, pressure sensitive adhesive and a second layer comprising a water insoluble adhesive on said water impermeable film; said synthetic sponge being fastened by said second layer to said water impermeable barrier.

6. An article of manufacture comprising, a layer of sponge material having thereon a water insoluble adhesive coating, a thin, flexible, water impermeable, synthetic organic polymer lamina fastened to said layer of synthetic sponge by said water insoluble coating, a water insoluble pressure sensitive adhesive coating on said water impermeable lamina, and a layer of detergent material attached to said water impermeable lamina by said water insoluble pressure sensitive adhesive, said layer of detergent comprising a detergent material selected from the group consisting of normally solid water soluble soaps of higher fatty acids having an average of 8 to 20 carbon atoms, normally solid water soluble synthetic organic detergents having an average of 8 to 80 carbon atoms, and mixtures thereof.

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