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(54) Title: MULTI-PART CHEMISTRY SYSTEM

(57) Abstract: The present invention provides methods, kits and compositions that are nontoxic color changing compositions. The compositions include a mixture having a first component and a second component, wherein the first component comprises a color changing dye and the first component in combination with the second component such that the color of the nontoxic color changing dye is of a different color than the color changing dye in the first component.

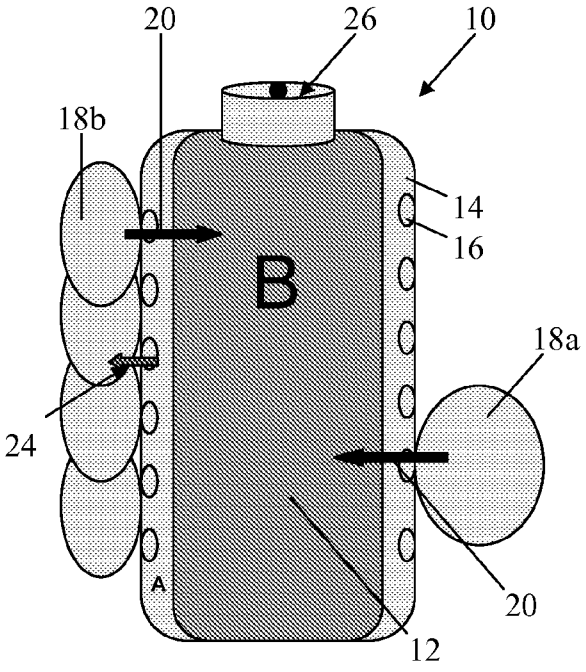

FIGURE 1

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MULTI-PART CHEMISTRY SYSTEM

TECHNICAL FIELD OF THE INVENTION

The invention generally relates to systems and compositions for mixing multiple substances to produce a final substance during dispensing and use. More particularly, the invention relates to formulations for compositions that provide feedback and multiple functionalities during use, e.g., that provide the user with enhanced feel.

BACKGROUND OF THE INVENTION

It is often desirable to provide consumer products like household toiletries such as soaps, shampoos with pleasant colors. Such colors are provided to household toiletries using dyes and pigments. Color-change has been a fascination of individual for long time. Traditionally, compounds that exhibited the ability for color change are leuco dyes. Leuco dyes are of limited use to produce materials that begin as colored and end as colorless since three components are generally required to effect the transition. Generally, a color former (the leuco dye), a developer (such as phenolic compound) and a reversible matrix, such as long chain alcohol, are combined. An often noted drawback with leuco dye systems is their water insolubility. Other limitations of leuco dye systems are commercial availability of all the colors and the cost.

There remains a need for compositions that will give an indication of when sufficient use has occurred. It is an object of this invention to provide such a use indicating soap. Conventional soaps used for hand washing do not indicate whether the soap has been used for an appropriate amount of time for the process to be effective. As a result, hands are often washed for too short an amount of time for the process to be effective in cleansing hands. Properly washing your hands is one of the best ways to prevent infection and the spread of diseases. Doctors, nurses and other people who work in medical settings have to wash their hands frequently to avoid spreading of infective agents. Those who prepare food must keep clean hands so they do not put germs into the food they are making. Children and many adults do not always take the appropriate time needed to effectively clean their hands. It is, therefore, quite important for children and adults to spend adequate time cleaning hands and learn the correct way of completing a key hygiene task. In order for proper hand cleaning habits to form, the teaching and monitoring must be done in a non-threatening and natural manner. One way of accomplishing this would be introduce an element of fun and novelty so that children and adults enjoy completing the task while building better hygiene habits. Another way would be to give them a sense of accomplishment by providing a feedback signal they can easily understand and associate with correctly completing the task.

There remains a need for cleansing products that will provide useful feedback such as an indication of when sufficient use has occurred. For example conventional soaps used for hand washing do not indicate whether the soap has been used for an appropriate amount of time for the process to be effective. As a result, hands are often washed for too short an amount of time.

Properly washing your hands is one of the best ways to prevent infection and the spread of diseases. This is important to everyone, especially doctors, nurses, food workers, and children. Children would benefit from understanding thorough cleaning through non threatening signals such as color changing soaps. Color changing soaps can provide fun and novelty, as well as a sense of accomplishment. They also provide an easy feedback signal avoiding the more elaborate and cumbersome methods such as looking at dyes under a black light.

These formulations may include antimicrobials. However it has been shown that sufficient hygiene can be achieved without antimicrobials simply through proper washing technique [1]. Proper washing without the use of antimicrobials can thereby avoid dry hands, environmental concerns, microbial resistance and other factors associated with their use.

There have been numerous attempts to create a feedback mechanism in cleaning products so as to ensure the proper amount of washing has taken place. Of particular interest are products utilizing color change technology so the starting color and finishing color are different. This mechanism provides both feedback and novelty. The challenge has been to deliver dynamic chemistry in a product that creates a color change in a reasonably safe and affordable platform for use.

The single phase chemistry of color changing products remains challenged by controlling the reactivity between components that are stored together. The need to physically separate a solution has led to adaptations found in the prior art such as double barreled dispensers, and variations thereof. These are generally limited by the cost of production.

SUMMARY OF THE INVENTION

In one embodiment, the present invention includes compositions and methods for making a nontoxic color changing composition comprising: a first component and a second component, wherein the first component comprises a nontoxic color changing dye and the first component in combination with the second component combine to form a nontoxic color changing dye that is of a different color than the nontoxic color changing dye in the first component. In one aspect, the dye changes color with change of pH and the pH is different in the first component in combination with the second component than in the pH in the first component. In another aspect, wherein the first and second components each comprise a first and second analyte,

respectively, wherein the concentration of the analytes is different in the first component that the second component. In another aspect, the nontoxic color changing dye is an anthocyanin compound. In another aspect, the composition further comprises an antibacterial composition, an antimicrobial compound, an antibiotic, a lipid composition, nanoparticles, metals, or mixtures thereof. In another aspect, the composition changes color in the presence of at least one of an analyte, a metal, a chelating agent, ATP, Ca^{++}, a surfactant and organic molecules that are positive, negative, neutral or zwitterionic. In yet another aspect, the composition changes color at a pH greater than 7 or a pH less than 7. In another aspect, the composition comprises a coagulated polymer and the dye is crosslinked to the polymer. In another aspect, the composition is substantially biodegradable.

Another embodiment of the present invention is a nontoxic color changing kit comprising: a first component comprising a nontoxic color changing dye; and a second component, wherein the first component and the first component in combination with the second component such that color of the nontoxic color changing dye is of a different color than the nontoxic color changing dye in the first component. In another aspect, the pH is different in the first component in combination with the second component from the pH in the first component. In another aspect, the nontoxic color changing dye is an anthocyanin compound.

Yet another embodiment of the present invention includes a color changing composition comprising: a cleanser having a colorimetric dye disposed therein, wherein a change in pH changes the color of the colorimetric dye, the composition comprising a coagulated, biodegradable polymer and the dye is at least partially crosslinked to the polymer. In one aspect, the dye comprises a nontoxic color changing dye. In another aspect, the dye is an anthocyanin compound. In another aspect, the composition further comprises an antibacterial composition, an antimicrobial compound, an antibiotic, a lipid composition, nanoparticles, metals, or mixtures thereof. In another aspect, the composition changes color in the presence of at least one of an analyte, a metal, a chelating agent, ATP, Ca^{++}, a surfactant and organic molecules that are positive, negative, neutral or zwitterionic.

Yet another embodiment of the present invention is a nontoxic color changing composition comprising: a mixture comprising a first component and a second component, wherein the first component comprises an nontoxic color changing dye and the first component in combination with the second component such that the color of the nontoxic color changing dye is of a different color than the nontoxic color changing dye in the first component. In one aspect, the pH is different in the first component in combination with the second component than in the pH in the first component.

Another embodiment is a method of forming a nontoxic color changing composition comprising the steps: providing a mixture comprising a first component and a second component; and mixing the first component and the second component, wherein the first component comprises a nontoxic color changing dye and the first component in combination with the second component such that the color of the nontoxic color changing dye is of a different color than the nontoxic color changing dye in the first component.

BRIEF DESCRIPTION OF DRAWINGS

For a more complete understanding of the features and advantages of the present invention, reference is now made to the detailed description of the invention along with the accompanying figures and in which:

Figure 1 shows a squeeze bottle with an inner chamber to release substance B, and an inner chamber to release substance A through the porous outer surface onto the user's hand. The pressure from squeezing the bottle causes dual dispensing of substances A and B through the upper nozzle and the porous outer surface area of the outer chamber.

Figure 2 shows a separate priming apparatus, containing substance A and a sponge covering a reservoir filled with substance A, with an adhesive undersurface that can be placed on or near a cleansing container with an appropriate formulation. Depression of the sponge for the purposes of dispensing will leach the priming substance onto the hand.

Figure 3 shows examples of delivering substance A to any dispenser containing substance B. Priming substance A can be delivered by any method, a spray bottle and powdered shaker are shown by way of example, to any and all parts of a dispenser especially those likely to come in contact with the user.

Figure 4. Dual chambered showing two-part dispensing.

Figure 5. Dual chambered showing the components after dispensing before mixing.

Figure 6. Dual chambered composition during mixing of the components.

Figure 7. Dual chambered composition after mixing and incorporation of dye into formed polymer matrix.

DETAILED DESCRIPTION OF THE INVENTION

While the making and using of various embodiments of the present invention are discussed in detail below, it should be appreciated that the present invention provides many applicable inventive concepts that can be embodied in a wide variety of specific contexts. The specific embodiments discussed herein are merely illustrative of specific ways to make and use the invention and do not delimit the scope of the invention.

To facilitate the understanding of this invention, a number of terms are defined below. Terms defined herein have meanings as commonly understood by a person of ordinary skill in the areas relevant to the present invention. Use of the singular herein includes the plural and visa versa unless expressly stated to be otherwise. That is, "a" and "the" refer to one or more of whatever the word modifies. For example, "a colorant" includes one such agent, two such agents, etc. Likewise, "the layer" may refer to one, two or more layers and "the polymer" may mean one polymer or a plurality of polymers. By the same token, words such as, without limitation, "layers" and "polymers" would refer to one layer or polymer as well as to a plurality of layers or polymers unless, again, it is expressly stated or obvious from the context that such is not intended.

As used herein, words of approximation such as, without limitation, “about”, "substantial" or "substantially" refers to a condition that when so modified is understood to not necessarily be absolute or perfect but would be considered close enough to those of ordinary skill in the art to warrant designating the condition as being present. The extent to which the description may vary will depend on how great a change can be instituted and still have one of ordinary skilled in the art recognize the modified feature as still having the required characteristics and capabilities of the unmodified feature. In general, but subject to the preceding discussion, a numerical value herein that is modified by a word of approximation such as “about” may vary from the stated value by at least ±15%.

The present invention takes advantage of using separate, multiple components and/or compartments to produce a final mixture that enhances the use of the composition. The sensorial enhancements provided by the present invention enhance the user’s enjoyment of the product to improve the products use, e.g., a young child’s willingness to use soap by looking at the change in color, feel or smell. The enhanced organoleptic properties of the mixed components improve the products use and user compliance. As used herein the phrase “sensorial enhancement” refers to the synergistic organoleptic properties of the combined components and their effect on the user’s compliance and/or willingness to use the composition.

The present inventors have recognized that one way to overcome the cost of physical separation and the limited performance of single phase agents is to isolate a reactive molecule or component from the composition. It is then ideally placed in a simple and discrete manner within an area of a dispensing apparatus likely to be contacted. This will ideally be somewhere contacted during or in conjunction with the act of dispensing. The incorporation of the reactive substance or molecule into the cleansing composition is then done without deliberate knowledge

or effort by the user through the normal actions of using the product. This avoids the challenges associated with stably storing the reactive chemistry of the color change product.

In one example, the present invention is directed to producing color changing soaps to facilitate promotion of hygiene and proper cleansing. Disclosed herein are novel chemistries for, e.g., cleansing compositions, for use in various two-part dispensing systems. Novel two-part dispensing systems and apparatuses are also disclosed herein. The two-part chemistries disclosed may be used with generally available non-novel double barrel dispensing technology as well as with the novel apparatuses and systems disclosed.

The coupling of first component, e.g., "A", also referred to as the priming substance, with the dispenser can be accomplished in a number of ways including spraying onto the dispenser, powdering the dispenser, and including substance A in a uniquely designed squeeze bottle such that squeezing leaches out the priming substance, further disclosed below. A second component, e.g., "B", or additional components, e.g., "C" are used to change the characteristics of A, e.g., by changing pH, ionic content (increasing or decreasing), temperature, the presence of additional compounds (e.g., ATP, catalysts, co-factors, intercalators, resonance donors, quenchers or acceptors), can be used to modify A, e.g., change its color. In certain embodiments the components can be mixtures of, e.g., a solvent, liquid, gel or powder, which include the color changing dyes, soap, antimicrobial or antiviral agents, solvents and/or detergents.

In view of the deficiencies of the prior art, it would be highly desirable to provide an inexpensive yet dynamic color-changing cleansing composition system communicating effective cleansing. There is a need for an effective way of cleansing the hands while providing an indication that the cleansing is in fact effective. The current invention provides such compositions, an apparatus, and useful embodiments.

Approaches ensuring effective hand cleansing include antibacterial hand rubs. One drawback with such hand rubs is that such rubs may dry hands more than washing with soaps. Another approach known involves applying a dye that glows under a black light to hands prior to washing hands followed by washing hands and then analyzing the effectiveness of hand-washing process by examining the hands under a black light. In addition, some hospitals use electronic devices that alert an employee, if the employee's hands were not effectively washed. Such approaches may be expensive and fail to achieve widespread use.

Separate from the interest in removing microbes from the hands for hygiene, the greater scope of the effects of antimicrobial agents upon the environment and its effects upon bacterial resistance provide a driving force through which to accomplish the former, while minimizing the latter. The object of this invention further provides a method through which proper hygiene is achieved

by thorough washing for a minimum of 20 seconds using surfactants. It has been noted by [insert refs] sufficient hygiene can be achieved without the use of antimicrobial agents such as triclosan or quaternary ammonium salts. The invention provides color changing formulations containing both antimicrobial agents and without. Through the use of a color changing agent that works over a repeatable time window, the user confidently can use these formulations to achieve proper sanitation, without antimicrobials. The formulation without antimicrobials impact the environment by decreasing the load of antibacterial agents released into water supplies and contributing to the problem of microbial resistance.

In view of the deficiencies of the prior art, it would be highly desirable to provide a color-changing cleansing composition, method and kit using nontoxic, non-staining colorants which provides an effective cleansing. Therefore, there is a need for an effective way of cleansing the hands while providing an indication that the cleansing is easy, effective, safe and inexpensive. The current invention provides such a composition, method and kit.

The current invention discloses formulations and an apparatus for combining formulations A and B, to produce, C. The nature of the invention and its formulations is such that the anticipated actions by the user results in A and B mixing to produce C. Substances can be combined through the rubbing of the hands or fingers after the dispensing of a cleansing composition. The creation of C provides feedback to the user or some additional functionality useful to the product.

Through dispensing, A is placed onto the hand in contact with the dispenser. B is dispensed from the dispenser, and A and B are then mixed on the hands as washing begins. At the commencement, or during, or at the end of washing by rubbing the hands together C is produced.

The priming composition A is of one particular formulation designed to react with the washing composition B, which is of another formulation. Combining the two will provide some functionality, such as a visible color change on the hands while washing. Primed with substance A, is whichever hand, or body part, of the user is in contact with the soap dispenser in order to actuate the dispensing of the soap.

The nature of the disclosed invention is such that the act of dispensing by the user causes a transfer of one formulation [A] onto the skin of the dispensing hand. The hand is thus "primed" in a manner largely, though not necessarily, unnoticeable to the user. The priming composition and the dispensed washing composition are combined on the hands with the commencement of washing. The two compositions, or components within, react with each other to produce, for

example, a visible and dramatic color change in the cleansing composition during use. This change in color serves to be indicative of the thoroughness of cleansing.

There are numerous ways of accomplishing the priming of the user's hands. One of these is the unique disclosed apparatus to be used with the disclosed formulations for cleansing compositions (Figure 1). The nature of the apparatus is such that its use as a squeeze bottle to dispense its contents (substance B), results in the release of substance A (the priming substance) from the outer chamber onto the hand. This apparatus in conjunction with the disclosed formulations could be used, for example, to give off a signal that the proper amount of washing time has been achieved through an observable color change in the cleansing composition. This unique apparatus is shown in Figure 1.

Figure 1 shows a squeeze bottle 10 with an inner chamber 12 to release substance B, and an inner chamber to release substance A from outer chamber 14 through the porous outer surface 16 onto the user's hand (thumb 18a, fingers 18b). The applied pressure (arrows 20) from squeezing the bottle 10 causes dual dispensing of substances A and B through the upper nozzle 26 (arrow 24) and the porous outer surface area 16 of the outer chamber 14.

Figure 2 shows a separate priming apparatus 30, containing substance A 32 and a sponge 34 covering a reservoir filled with substance A, with an adhesive undersurface 38 that can be placed on or near a cleansing container with an appropriate formulation. Depression of the sponge 34 for the purposes of dispensing will leach a substance A 32 onto, e.g., a hand (not shown).

Figure 3 shows examples of delivering substance A to any dispenser containing substance B. Priming substance A can be delivered by any method, a spray bottle 40 and powdered shaker 42 are shown by way of example, to any and all parts of a dispenser especially those likely to come in contact with the user that combine A and B (44).

Many separate priming apparatuses may also be utilized in conjunction with an already existing or in place dispenser containing some dye and a cleansing formulation. A novel example is a sponge outfitted with an attachable undersurface (Figure 2). This could be placed and utilized by the user as a priming device for priming of the hand with other cleansing containers ideally containing a cleanser and dye(s) or any other components potentially reactive in a useful way with the priming substance to indicate a thoroughness of use. It may also be placed in areas or objects associated with the soap dispenser. It may also be placed on areas or objects associated with where the soap dispenser is generally located and used.

Additionally a spray or powder formulation could be applied directly to the soap dispensing apparatus coating it with the priming composition, thus adding functionality or feedback to the normally in use dispenser. Across all embodiments of this invention the user is likely, though

not necessarily, unaware that any transfer of substance A to the skin has occurred. After transfer, substance A is ideally clear and largely invisible on the skin.

Combining substances A and B, to produce substance C, could result in many observable physical characteristics resulting from chemical changes to the composition. These include but are not limited to; a change in color, temperature, viscosity, texture, solubility, foaming qualities, creating bubbles or the releasing of gases; the sequestration of gases or bubbles; a change in pH; the formation and appearance of a precipitate; the solubilization or breakdown of a precipitate or granule; dissolution of an encapsulated substance and other similar desired properties.

In certain embodiments, C could function as a color changing soap. Priming composition A could be, for example, a formulation comprising EDTA, citric acid, or boric acid, and cleaning composition B, it's formulation comprising surfactants, dyes, metal ions, anions or complexes for between them. In such examples the color change could be elicited by chemical interactions characterized as, including but not limited to, acid-base reactions, color mixing, chelation, redox reactions, buffering, quenching, complex formation, reversible chemical reactions.

Formulations for A, or the "priming composition", include but are not limited to buffered solutions of EDTA ethylene diamine tetracetic acid, and its salts, combined with one or more surfactants targeted for a particular soap property obvious to those skilled in the art. Formulations for B, or the "washing composition", include but are not limited to buffered surfactants, emollients and foaming agents formulated to provide a desired soap formulation designed for the target end consumer, such as children, or health care workers.

Formulations for A could also be anionic polymers such as Xanthan, carboxy-methylcellulose, or algenic acid. Useful formulations for B to be coulpled with these anionic polymers would include be calcium and other divalent metal ions.

Table 1. Lists examples of reactants that could be utilized in compositions A and B to enable the aforementioned reactions and observable changes in the cleansing compositions as represented by C.

Table 1.

embodiments		
observable change	**reaction**	**reactants (A + B)**
color change	chelation	EDTA/metal ion
	acid-base	red cabbage/bicarbonate
	thermochromic	leuco dyes/heat
pH change	acid-base	red cabbage/bicarbonate
viscosity	chelation/crosslinking	edta/boron
		ca+/algenic acid
		ca+/xanthan
		ca+/carboxy methylated guar
	un-crosslinking	calcium algenic polymer/EDTA
temprature	exothermic	thiohydantoin/H2O2, or FeO3, or NaOH2
	endothermic	NH4Cl,
texture	precipitation	red 36/surfactant
	solublize	bicarbonate/H2O
bubbling	CO2 release	H2CO3/citric acid
sequestration of gasses/bubbles	crosslinking	polyallyamine

Additionally, any or all of the above components of substances A and B, could be combined and used together in different variations to elicit multiple changes in substance C. These could occur simultaneously or in an pre-calculated order or in a random cascade. For example … A and B could be combined to first produce a change in viscosity followed by a change in color. Another example is A and B could be combined to first produce a change in viscosity followed by both a change in color and the release of gaseous bubbles. A further example would be a composition that begins to foam and crackle releasing gaseous bubbles as it lathers and changes from one color to the next. This number of embodiments is disclosed by way of example and many other possible combinations that are not disclosed are included.

The change in color is dependent upon both thoroughness of the hand washing and or the designed reaction time. It can be fine tuned to complete the change in color at an appropriate time indicating thoroughly washed hands.

A single embodiment and specific example of a priming composition combined with a cleansing formulation and apparatus is given: The squeeze bottle, shown in Figure 1, containing the cleansing composition (substance B) in a large inner chamber. An outer chamber holds the priming substance A, a composition comprising EDTA within its formulation. The inner container chamber contains a hand cleansing composition comprising a metal ion such as copper within its formulation. Upon dispensing of the soap by squeezing the dispenser, an amount of EDTA is transferred from the outer chamber through the porous outer surface to the skin. Next when the user begins to scrub his or her hands together the EDTA begins to mix with the metal ion in the cleansing composition and the soap begins to change color on the hands while

washing. When the EDTA and the metal ion have completely mixed together and fully reacted the color change will be complete. The system will be designed to show a complete color change in the soap to the user at an appropriate time to indicate complete and thorough washing ideally around 20 to 30 seconds. This is the ideal washing time, however the system could be designed anywhere between 1 second and 5 minutes.

Another specific example and embodiment is given of a two-part chemistry system combining a color change reaction with an induced change in viscosity. The reactants calcium chloride and algenic acid are used here as listed in Table 1 under disclosed enabling reactants. In this case a generic dual dispenser is used to facilitate the combining of a composition containing in part calcium chloride and second composition containing in part alginate. Dye may be included in one or both compositions for this example and specific embodiment. After dispensing and upon mixing the reaction of the first composition containing calcium chloride with the second containing alginate causes a polymerization forming a calcium alginate polymer of gelatinous consistency that both causes a substantial change in viscosity as well as sequestration of dye molecules from the surfactant solution into the polymer. In addition to a change in viscosity, this produces a visible change in color. This is a novel mechanism of dye removal from solution in a cleansing composition. The rate at which the dye is removed from the solution can be controlled and fine tuned through manipulation of the speed of the calcium chloride + alginate reaction.

A further embodiment of the previous example is the utilization of EDTA to breakdown during washing the calcium alginate polymer created during the same wash step. This can be accomplished by, for example, encapsulated EDTA included in one or both of the two compositions that upon dispensing and washing breaks apart and through shearing forces is released from its encapsulation into the cleansing solution thereby breaking up the calcium alginate polymer created in the first instance. This embodies a reversible change in viscosity and potentially a change between three colors that can occur over a period of time to indicate different cleansing functionalities.

The above embodiments provide clear examples by which many reactants are combined to produce a change in viscosity and sequestration of dye. This demonstrates that viscosity is a mechanism causing color change or dye removal and further illustrates the claim previously stated here that many of the enabled reactions and specific embodiments of the current invention can be used in combination.

Attributes of the composition that can be engineered to tune the rate and nature of polymerization and hence rate of dye-polymer incorporation or release include but are not

limited to the following: temperature through direct heating or cooling, temperature though secondary exothermic or endothermic reactions within composition, surfactant type, surfactant mixture, surfactant concentration, pH, viscosity of alginate, concentration of calcium, stir rate, molecular weight of alginate, hydration time of alginate, temperature at crosslink (rate), identity of divalent metal ion (calcium magnesium, zinc, etc), pH of alginate (too high a pH causes precipitation of calcium).

The above examples are just one of many embodiments. The apparatus could realistically be any depicted in the disclosed figures. Likewise the reactants and reaction could be any listed in Table 1 as disclosed and used with the any of the embodiments or inventions disclosed in the figures.

The user may therefore use the change in color as a timing mechanism, or indicator of thoroughness, to assure the complete washing of the hands. This invention is distinct in many ways from the prior art. Particularly of note is that the interaction with the dispenser providing for the priming of the hand is likely to be largely unnoticed by the user and is not intended to mark or be of note in and of itself [5, 6].

Algenic acid (algenate), in its form as a gum, when extracted from the cell walls of brown algae, is used by the foods industry to increase viscosity and as an emulsifier. It is also used in indigestion tablets and the preparation of dental impressions. Sodium alginate has no discernible flavor and is used as a thickening agent for soups and jellies.

Alginate is used extensively as a mold-making material in dentistry, prosthetics, lifecasting, and in textiles. Used for reactive dye printing, where it is used in the textile industry.

Calcium alginate is used in different types of medical products, including burn dressings that promote healing and which can be removed with less pain than conventional dressings. Also, due to alginate's biocompatibility and simple gelation with divalent cations such as Ca 2+, it is widely used for cell immobilization and encapsulation. Sodium alginate is a good chelator for pulling radioactive toxins such as iodine-131 and strontium-90 from the body which have taken the place of their non-radioactive counterparts.

Xanthan, is a useful matrix component for drug delivery systems. It forms stable drug suspensions in aqueous media and soft gels with locust bean gum or guar gum. Food uses are prevalent and is used in salad dressings and sauces. It helps to stabilize the colloidal oil and solid components against creaming by acting as an emulsifier. Used in frozen foods and beverage applications and added to ice cream for texture. Used as a binder in toothpaste to keep the product uniform. Also used in gluten-free baking to impart the dough or batter with "stickiness"

that would otherwise be achieved with the gluten. Used in the oil industry to thicken drilling liquid.

Carboxymethylcellulose (CMC) in food science is used as a viscosity modifier or thickener, and to stabilize emulsions. Detergents, soaps, food products (especially dietetic foods and ice cream), where it acts as water binder, thickener, suspending agent, and emulsion stabilizer. It is also used in many non-food products, such as K-Y Jelly, toothpaste, laxatives, diet pills, water-based paints, detergents, textile manufacturing (sizing); coating paper and paper board to lower porosity, drilling muds, emulsion paints, protective colloid, pharmaceuticals, cosmetics. CMC is used as a lubricant in non-volatile eye drops (artificial tears). Sometimes it is methylcellulose (MC) which is used, but its non-polar methyl groups (-CH3) do not add any solubility or chemical reactivity to the base cellulose.

The present invention fulfills the above-stated objective and overcomes these problems by broadly providing color-changing soap compositions, methods and kits that can encourage proper hand washing as a way to promote good hygiene.

The inventors have developed novel color-changing soap composition for various cleansing applications. It is therefore one object of the present invention to provide color-changing hand soap composition for effective cleansing. It is also an object of the present invention to provide novel color-changing composition, method and kit. It is a further object of the present invention to develop a new cleansing aid that provides a color-change detectible by a user after a period of time of rubbing hands together. The observable color-change may occur in form a finite time to at most 5 minutes or more particularly 45 seconds, or still more particularly between 25 to 35 seconds. It is an additional object of the present invention to provide a composition that changes color during use includes natural colorants, synthetic colorants, acid-base indicators, FD&C dyes, D&C dyes. In one embodiment, flavin, phthalein or sulfonephthalein or azo compounds may be used as pH indicator.

The method through which a given dye changes its color is provided for with the following embodiments: (1) A color changing hand soap that changes its color due to an decrease in pH brought about by the interaction with atmospheric carbon dioxide with the dye; (2) A surfactant composition interacting with the dye such that the surfactants control the rate through which the color changes; and (3) A surfactant mixture that forms supramolecular complexes with dyes, such as a micelle which controls the rate through which the absorbance of the dye changes.

Absorbance is a physical quantity defined by:

Absorbance (A) = -log10 Transmitance (T) = log Incident Radiant Power (P0)/Transmitted Radiant Power (P).

To the end user, the change in absorbance is observed and a change in the color visible to the human eye. Color refers to the portion of the Electromagnetic spectrum known as visible.

Further embodied by the examples is a color changing soap formulation that changes its color by the presence of an analyte: (1) In such an example, the color of the dye is perturbed by the presence of a metal ion; (2) Reversible of the color caused by the metal ion by a chelating agent such as, but not limited to EDTA or encapsulated EDTA; (3) Restoring the color removed by EDTA through an activator or encapsulated activator; and (4) Further examples of analytes whose presence shifts the absorbance of the dye include small organic molecules that may be positive, negative, neutral or zwitterionic. Other soap formulations whose colors change may be described by the formation of supramolecular complexes formed between the surfactant, the dye and the analyte.

In other formulations, the supramolecular complex is formed between the dye and the surfactant. For the situations where a color is formed when the molecules self-assemble, the color modulation is brought about by a disruption caused when the user rubs the hands together causing, heat, pressure or friction to disrupt the complex. Each of these color changing mechanisms may be further enhanced through the use of a mechanical dispenser designed to foam the soap. The rate of color change, for each of the color changing methods depends on the amount of air entrained by the foamer and the average size of the bubbles formed. It is a further object of the present invention to provide easy, safe and inexpensive color-changing cleansing composition. Finally, it is an object of this invention to provide different color changing mechanisms to embody color on demand technology amenable to a variety on complex media, temperatures, inanimate surfaces, as well as skin and hair.

The present invention can be used in a number of settings including, but not limited to, private homes, hospitals, medical settings, children center, nursing homes, schools, restaurants, airports, food-preparation establishments, food-processing establishments, restrooms, offices, hotels/motels, labs, and commercial places. The details of one or more embodiments of the invention are set forth in the description below. Other features, objects and advantages of the invention will be apparent from the description and from the claims.

In general, a composition for indicating whether hands have been washed for an appropriate predetermined period of time includes natural and synthetic color-changing colorants which may change color by various mechanisms. The colored cleansing composition can be delivered in the

form of a body wash, such as a liquid hand soap, shower gel, a shampoo or a bar soap. The compositions change color from colored to colorless, colorless to colored, one color to another color or one color to second color to third color.

As used herein, the term "surfactant" is recognized in the relevant art to include those compounds which modify the nature of surfaces, e.g., reducing the surface tension of water. Surfactants or surface active agents are amphiphatic in nature, having polar hydrophilic head and non-polar, hydrophobic straight or branched tail. Therefore, they are soluble in water and organic solvents. Surfactants can be wetting agent or foamers. Surfactants lower the surface tension of the medium in which it is dissolved. Surfactants are generally classified by the presence of the charged groups in their head, into four types: anionic surfactants, cationic surfactants, amphoteric or zwitterionic surfactants and non-ionic surfactants.

As used herein, an "anionic surfactant" refers to a surfactant having a head carrying a negative charge, e.g., alkyl, aryl, alkylaryl, linear, branched, sulfates, sulfonates, carboxylates, phosphates, soaps, fatty acids.

As used herein, a "cationic surfactant" refers to a surfactant having a head carrying a positive charge, e.g., quaternary ammonium salts or modified onium salts, where part of the molecule is hydrophilic and the other is straight or branched long hydrocarbon chains such as hexadecyltrimethyl bromide.

As used herein, a "amphoteric or zwitterionic or ampholytic surfactant" refers to a surfactant having a head carrying either a positive charge or a negative charge or no-charge in solution depending on the pH of the water. (e.g., betaines, glycinates). They are compatible with all other classes of surfactants and are soluble and effective in the presence of high concentrations of electrolytes, acids and alkalis.

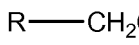
As used herein, a "non-ionic surfactant" refers to a surfactant having a head carrying no electrical charge. (e.g., polyethylene oxide, ethers, fatty alcohols, glucosides, amides). One or more surfactants can be used in the present invention.

Examples of anionic, cationic, zwitterionic or amphoteric and non-ionic surfactants that are suitable for use in present invention are described in Kirk-Othmer Encyclopedia of Chemical Technology (2006) and McCutcheon's Emulsifiers and Detergents, Volume 1, North American Edition (2007), both of which are incorporated herein by reference.

Anionic surfactants can be useful for obtaining foaming and cleaning properties. According to certain embodiments, suitable anionic surfactants include, but are not limited to, linear or branched alkyl sulfates, alkyl alkoxysulfates, alkyl ether sulfates, alkyl monoglyceryl ether sulfates, alkyl sulfonates, alkylaryl sulfonates, alkyl ester sulfonates, olefin sulfonates, alkyl

glycerol sulfonates, fatty acyl glycerol sulfonates, fatty oleyl glycerol sulfonates, alkyl sulfosuccinates, alkyl ether sulfosuccinates, alkyl sulfosuccinamates, alkyl amidosulfosuccinates, alkyl carboxylates, alkyl amidoethercarboxylates, alkyl alkoxy carboxylates, soaps, 2-methyl-1-undecanoic acid, 2-ethyl-1-decanoic acid, 2-propyl-1-nonaoic acid, 2-butyl-1-octanoic acid, 2-pentyl-1heptanoic acid, alkyl succinates, fatty acyl sarcosinates, myristyl sarcosinates and its salts, oleoyl methyl sarcosinates and its salts, fatty acyl amino acids, fatty acyl taurates, fatty alkyl sulfoacetates, lauryl sulfoactates and its salts, myristyl sulfoacetates and its salts, sulfated fatty acid esters, alkyl phosphates, and mixtures thereof. In some embodiments, the anionic surfactants of the present invention include, but are not limited to, salts including sodium, potassium, ammonium, calcium, magnesium, monoethanolammonium, diethanolammonium, triethanolammonium salts of the anionic sulfate, sulfonate, sulfosuccinates, sulfoacetates, carboxylates, sarcosinates, phosphates and mixtures thereof. Other anionic surfactants useful in the present invention include, but are not limited to, alpha sulfonated alkyl ester, phthalates, N,N-disubstituted phthalamic acids, esters and their salts, phosphate esters and mixtures thereof. Examples of certain preferred anionic surfactants include, but are not limited to, as given by the following formulas:

alkyl sulfates of the formula:

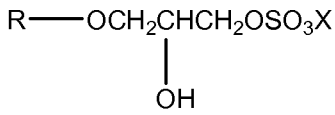


;

alkyl ether sulfates of the formula:

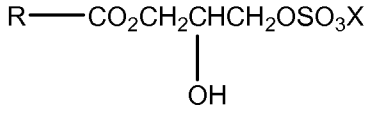
$R(OCH_2CH_2)_yOSO_3X$;

alkyl monoglyceryl ether sulfates of the formula:



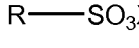
;

alkyl monoglyceride sulfates of the formula:



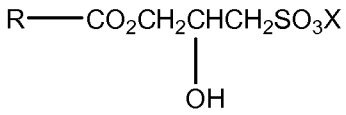
;

alkyl sulfonates of the formula:



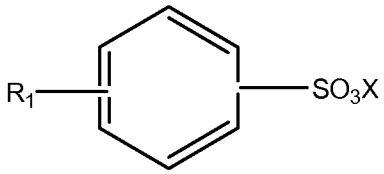
;

alkyl monoglyceride sulfonates of the formula:



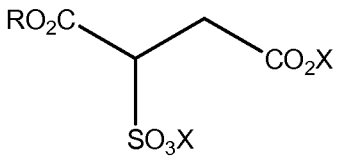
;

alkyl aryl sulfonates of the formula:



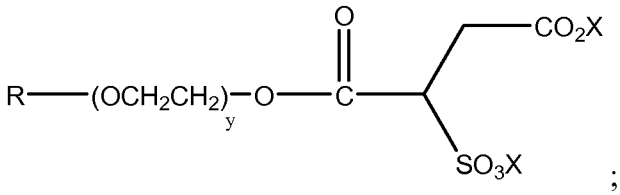
;

alkyl sulfosuccinates of the formula:



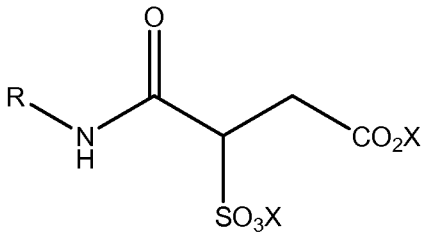
;

alkyl ether sulfosuccinates of the formula:



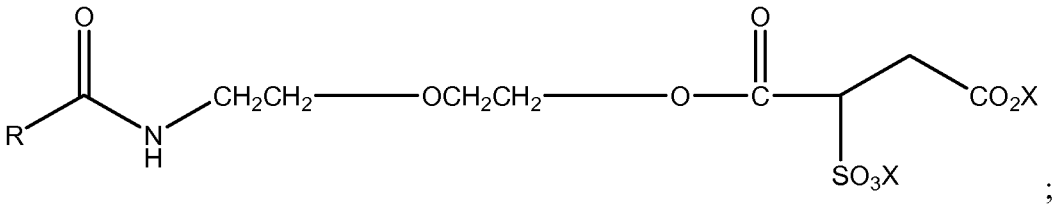
;

alkyl sulfosuccinamates of the formula:



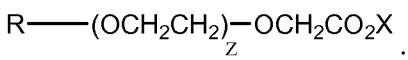
;

alkyl amidosulfosuccinates of the formula:



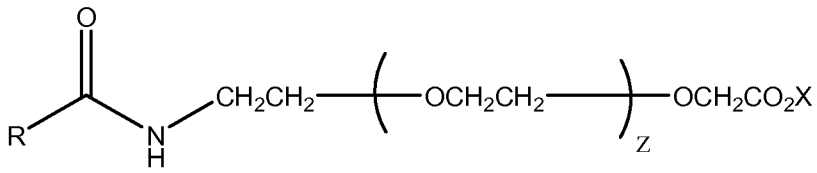
;

alkyl carboxylates of the formula:



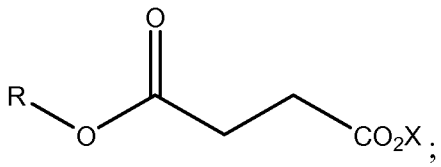
;

alkyl amidoethercarboxylates of the formula:



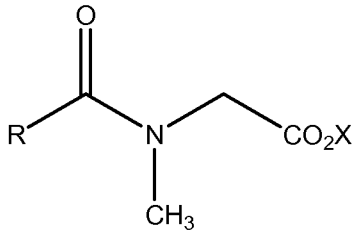
;

alkyl succinates of the formula:



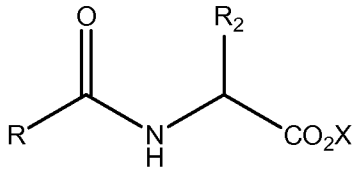
;

fatty acyl sarcosinates of the formula:



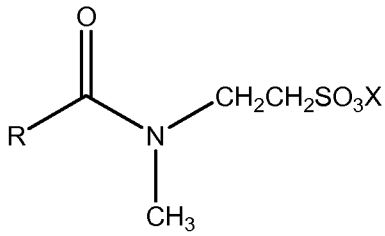
;

fatty acyl amino acids of the formula:



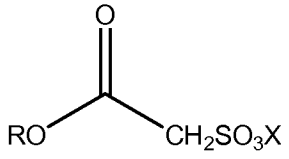
;

fatty acyl taurates of the formula:



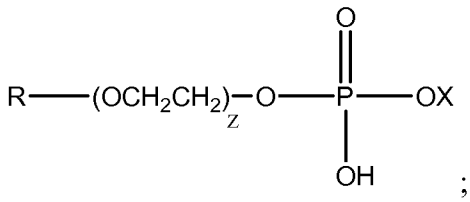
;

fatty alkyl sulfoacetates of the formula:



;

alkyl phosphates of the formula:



wherein

R = alkyl group having from about 6 to about 25 carbon atoms;

R_1 = alkyl group having from about 1 to about 20 carbon atoms;

R_2 = substituent of natural or synthetic I-amino acid;

X = alkali metal ions, alkaline earth metal ions, ammonium ions, ammonium ions substituted with from about 1 to about 3 substituents: substituents may be same or different, consisting alkyl group having from about 1 to about 5 carbon atoms and hydroxyalkyl group having from about 2 to about 5 carbon atoms;

y = an integer from about 1 to about 8;

z = an integer from about 0 to about 20; and

combinations thereof.

In some embodiments, the sulfate surfactants of the present invention include, but are not limited to, sodium laureth sulfate, Steol CS-330, Steol CS-460, sodium coco-sulfate, Stepanol DCFAS-F, Stepanol DCFAS-N, manufactured by Stepan Co., Northfiled, IL; ammonium lauryl sulfate, Colonial ALS, sodium lauryl sulfate, Colonial SLS, manufactured by Colonial Chemical Inc, S. Pittsburgh, TN. In other embodiments, the sulfonate surfactants of the present invention include, but are not limited to, sodium olefin sulfonate, BioTerge AS-40, manufactured by Stepan Co., Northfiled, IL.

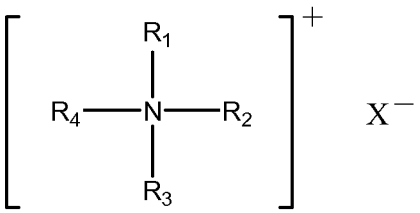
Cationic surfactants can be useful as surface tension reducing agents. According to certain embodiments, suitable cationic surfactants include, but are not limited to, fatty amine salts, fatty diamine salts, polyamine salts, quaternary ammonium salts, polyoxyethyleneated fatty amine salts, quarternized polyoxyethyleneated fatty amines and mixtures thereof.

Cationic surfactants in the form of quaternary ammonium salts include mono-long chain alkyl, tri-short chain alkyl ammonium halides, wherein long chain alkyl group has from about 8 to about 25 carbon atoms and is derived from long chain fatty acids, and wherein short chain alkyl group has from about 1 to about 7 carbon atoms. Examples of quaternary ammonium salts useful herein include, but are not limited to, cetyl trimethyl ammonium bromide (CTAB), lauryl

trimethyl ammonium chloride, octyltrimethyl ammonium chloride, decyltrimethyl ammonium chloride, dodecyltrimethyl ammonium chloride, dodecyltrimethyl ammonium bromide.

Salts of primary, secondary and tertiary fatty amines are also suitable cationic surfactant material of the present the present invention. The alkyl group of such amine salts preferably have from about 10 to about 25 carbon atoms which may be substituted or unsubstituted. Secondary and tertiary amine salts are preferred in the present invention. Examples of amine salts include, but are not limited to, fluoride, chloride, bromide, acetate, phosphate, nitrate, lactate and alkyl sulfate salts. Amine salts derived from amine include, but are not limited to, stearamido, propyl dimethyl amine, diethyl amino ethyl stearamide, dimethyl stearamine, dimethyl soyamine, soyamine, myristyl amine, tridecyl amime, ethyl stearylamine, N-tallopropane diamine, ethoxylated stearylamine, dihydroxyethyl stearylamine, arachidylbehenylamine, stearylamine hydrogen chloride, soyamine chloride, stearylamine formate, N-tallowpropane diamine chloride, stearylamidopropyl dimethylamine citrate and mixtures thereof.

In addition to the above, cationic surfactants particularly useful herein are those of the general formula:



R_1 = alkyl, benzyl

R_2 = alkyl, benzyl

R_3 = alkyl, benzyl

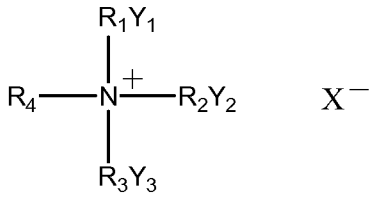
R_4 = alkyl group having C_6 to C_{20};

X = anion include, but not limited to, halogen, sulfate, methosulfate, ethosulfate, sulfonate or carboxylate, acetate, nitrate, phosphate, saccharinate or tosylate.

Other quaternary ammonium compounds and amine salts of the above general formula in the form of ring structures formed by covalently linking two of the radicals which may include heteroatom. Examples of such quaternary ammonium compounds and amine salts include, but are not limited to, imidazolines, imidazoliniums, pyridiniums, 2-heptadecyl-4,5-dihydro-1H-imidazol-1-ethanol, 4,5-dihydro-1-(2-hydroxyethyl)-2-isoheptadecyl-1-phenylmethyl-imidazolium chloride, 1-[2-oxo-2-[[2-(1-oxoctadecyl)oxy]ethyl]amino]ethyl-pyridinium chloride.

Other cationic surfactants include those compounds commonly referred to as "ester quats", and as disclosed in US Patent 5,939,059, which is incorporated herein by reference.

Typically, such materials are of general formula:



wherein

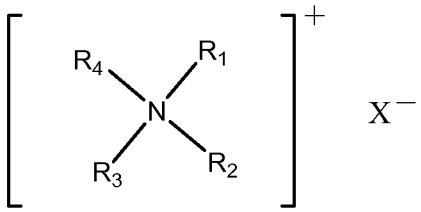
X = an anion;

R_1, R_2, R_3 = same or different, straight or branched chain alkyl group from about C_2 to about C_8;

R_4 = saturated or unsaturated, straight or branched chain alkyl group from about C_1 to about C_{10}, optionally substituted with halogen, hydroxyl, epoxy;

Y_1, Y_2, Y_3 = same or different, H, OH, aliphatic ester having saturated or unsaturated, straight or branched chain alkyl group from about C_{10} to about C_{25}.

Further, cationic surfactants can also be antimicrobial compounds of the formula:



wherein

R_1, R_2 = straight or branched chain having lower alkyl group from about C1 to about C8;

R_3 = straight or branched chain having higher alkyl group from about C8 to about C25, benzyl group or substituted benzyl group;

R_4 = straight or branched chain having higher alkyl group from about C8 to about C25;

X = anion include, but not limited to, halogen, sulfate, methosulfate, ethosulfate, sulfonate or carboxylate, acetate, nitrate, phosphate, saccharinate or tosylate.

In certain embodiments, examples of antimicrobial quaternary ammonium salts useful herein include, but are not limited to, dioctyl dimethyl ammonium chloride, octyl decyl dimethyl ammonium chloride, didecyl dimethyl ammonium chloride, n-alkyl dimethyl benzyl ammonium

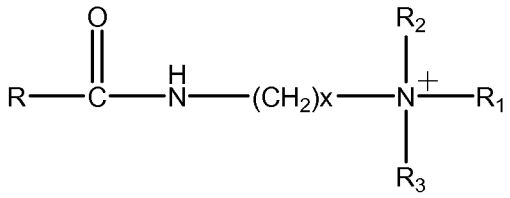
chloride (C_{12}-C_{20}), n-alkyl dimethyl benzyl ammonium bromide (C_{12}-C_{20}), n-alkyl dimethyl ethylbenzyl ammonium chloride (C_{12}-C_{20}), n-alkyl dimethyl ethylbenzyl ammonium bromide (C_{12}-C_{20}), n-alkyl dimethyl benzyl ammonium chloride (C_{12}-C_{20}), n-alkyl dimethyl benzyl ammonium bromide (C_{12}-C_{20}), n-alkyl dimethyl benzyl ammonium saccharinate (C_{12}-C_{20}), n-tetradecyl dimethyl benzyl ammonium chloride monohydrate, dialkyl dimethyl ammonium chloride, dialkyl dimethyl ammonium bromide, and mixtures thereof. This is not an exhaustive list and other quaternary ammonium salts having antimicrobial activity will suffice. The quaternary ammonium salt in the present invention need not be a single entity, but may be a blend of two or more quaternary ammonium salts.

Amphoteric or zwitterionic surfactants can be useful because of their solubility and compatibility with other surfactants. According to certain embodiments, suitable amphoteric or zwitterionic surfactants include, but are not limited to, amphocarboxylates, amphophosphates, phosphorylated imidazolines, caboxyalkyl alkylpolyamines, alkylimino-dipropionates, propionates, amphoacetates, amphoalkyl sulfonates, sarcosinates, imidazolines, cocyl imidazoline, lauryl imidazoline, stearyl imidazoline, behenyl imidazoline, behenylhydroxyethyl imidazoline, alkyl glycinates, alkylamphoglycinates, cocoamphoglycinate, lauramphoglycinate, cocoamphocarboxyglycinate, lauramphocarboxyglycinate, stearamphoglycinate, , tallowamphoglycinate, oleoamphoglycinate, caproamphoglycinate, caprylamphoglycinate, caprylamphocarboxyglycinate, caprylamphopropyl sulfonate, cocamphopropyl sulfonate, stearamphopropyl sulfonate, oleoamphopropyl sulfonate, cocoamphopropionate, cocoamphocarboxypropionate, tallowamphopropionate, alkyl betaines, amidoalkyl betaines, phosphobetaines, pyrophosphobetaines, sulfobetaines, alkyl sultaines, amidoalkyl sultaines, and mixtures thereof.

As used herein, the “amphoteric surfactants” refer to 1) molecules that contain both acidic and basic sites such as, e.g., an amino acid containing both amino (basic) and acidic (carboxylic) functional groups; or 2) zwitterionic molecules which possess both positive and negative charges within the same molecules. The charges of latter may be either dependent on or independent of the pH of the composition. One skilled in the art would readily recognize that under the pH conditions of the compositions of the present invention, the amphoteric surfactants are either electrically neutral by virtue of having balancing positive and negative charges, or they have counter ions such as alkali metal, alkaline earth or ammonium counter ions.

Examples of certain preferred amphoteric or zwitterionic surfactants include, but are not limited to, as given by the following formulas:

amphocarboxylates of the formula:



;

wherein

R = alkyl or alkenyl group having from about C_5 to about C_{22};

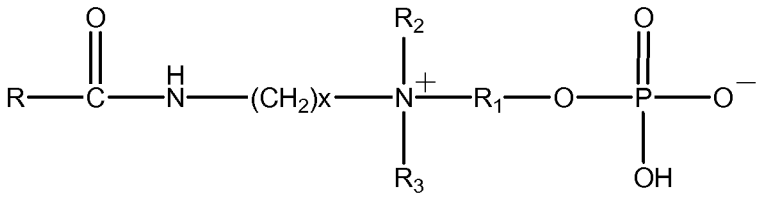
R_1 = hydrogen or carboxyalkyl group having from about C_2 to about C_5;

R_2 = hydroxyalkyl group having from about C_2 to about C_5;

R_3 = carboxyalkyl group having from about C_2 to about C_5;

x = an integer from about 2 to about 8.

amphophosphates of the formula:



;

wherein

R = alkyl or alkenyl group having from about C_5 to about C_{22};

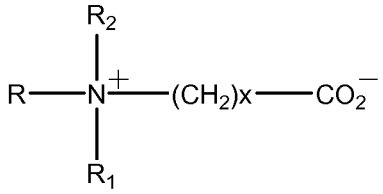
R_1 = alkylene or hydroxyalkylene group having from about C_2 to about C_5;

R_2 = hydrogen or carboxyalkyl group having from about C_2 to about C_5;

R_3 = hydroxyalkyl group having from about C_2 to about C_5;

x = an integer from about 2 to about 8.

alkyl betaines of the formula:



;

wherein

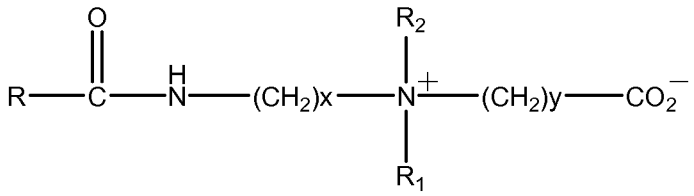
R = alkyl or alkenyl group having from about C_5 to about C_{22};

R_1 = hydrogen or carboxyalkyl group having from about C_2 to about C_5;

R_2 = hydroxyalkyl group having from about C_2 to about C_5;

x = an integer from about 2 to about 8.

amidoalkyl betaines of the formula:



;

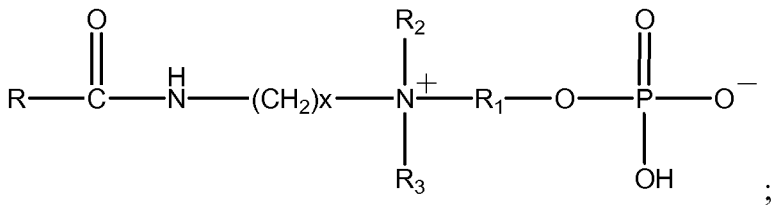
wherein

R = alkyl or alkenyl group having from about C_5 to about C_{22};

R_1, R_2 = alkyl or hydroxyalkyl group having from about C_1 to about C_5;

x = an integer from about 2 to about 8.

phosphobetaines of the formula:



;

wherein

R = alkyl or alkenyl group having from about C_5 to about C_{22};

R_1 = alkylene or hydroxyalkylene group having from about C_2 to about C_5;

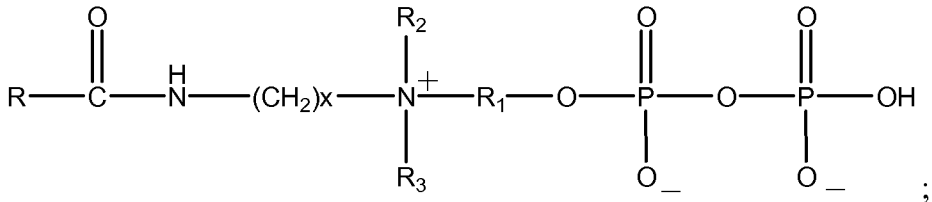
R_2 = hydrogen or carboxyalkyl group having from about C_2 to about C_5;

R_3 = hydroxyalkyl group having from about C_2 to about C_5;

x = an integer from about 2 to about 8.

In one embodiment, the phosphobetaine compounds are those disclosed in US Patents 4215064, 4617414, 4233192, which are all incorporated herein by reference.

pyrophosphobetaines of the formula:



;

wherein

R = alkyl or alkenyl group having from about C_5 to about C_{22};

R_1 = alkylene or hydroxyalkylene group having from about C_2 to about C_5;

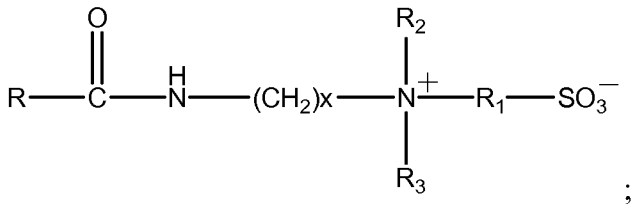
R_2 = hydrogen or carboxyalkyl group having from about C_2 to about C_5;

R_3 = hydroxyalkyl group having from about C_2 to about C_5;

x = an integer from about 2 to about 8.

In other embodiment, the pyrophosphobetaine compounds are those disclosed in US Patents 4382036, 4617414, 4372869, which are all incorporated herein by reference.

amidoalkyl sultaines of the formula:



;

wherein

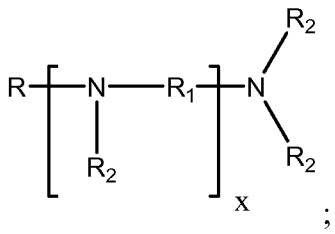
R = alkyl or alkenyl group having from about C_5 to about C_{22};

R_1 = alkylene or hydroxyalkylene group having from about C_2 to about C_5;

R_2, R_3 = alkyl or hydroxyalkyl group having from about C_1 to about C_5;

x = an integer from about 2 to about 8.

carboxyalkyl alkylpolyamines of the formula:



wherein

R = alkyl or alkenyl group having from about C_5 to about C_{22};

R_1 = alkylene group having from about C_2 to about C_5;

R_2 = carboxyalkyl group having from about C_2 to about C_5;

x = an integer from about 1 to about 5.

In some embodiments, the amphoteric surfactants of the present invention include, but are not limited to, cocamidopropyl betaine, Amphosol CA, Amphosol CG, Amphosol HCA, Amphosol HCG, manufactured by Stepan Co., Northfiled, IL; sodium lauroamphoacetate, ColaTerric SLAA, cocamidopropyl betaine, ColaTerric COAB, natural oil derived phospholipids, ColaLipid C, manufactured by Colonial Chemical Inc, S. Pittsburgh, TN.

Nonionic surfactants can be useful for obtaining desirable flow and foam boost properties. According to certain embodiments, suitable nonionic surfactants include, but are not limited to, polyhydroxy, polyalkyloxy compounds such as ethylene glycol, propylene glycol, butylenes glycol, glycerin, alkyl-propanediol, mannitol, corn-syrup, diethylene glycol, dipropylene glycol, polyethylene glycol, polypropylene glycol, other polyhydroxy derivatives and mixtures thereof.

Other suitable nonionic surfactants include, but are not limited to, ethylene oxide, propylene oxide, alkyl polyethylene oxide, alkyl polypropylene oxide, copolymers of poly(ethylene oxide), poly(propylene oxide), amine oxides, phosphine oxides, sulfoxides, ethoxylated oxides, linear or branched oxides, their derivatives and mixtures thereof.

Additionally, suitable nonionic surfactants include, but are not limited to, amides, alkanolamides, cocamide, their derivatives and mixtures thereof.

In some embodiments, the alkanolamide surfactants of the present invention include, but are not limited to, cocamide DEA, ninol 40-CO, lauryl diethanolamide, ninol 30-LL, lauramide DEA, ninol 55-LL, manufactured by Stepan Co., Northfiled, IL; cocamide DEA, ColaMid C,

lauramide DEA, ColaMid AL, ColaMid 0071, manufactured by Colonial Chemical Inc, S. Pittsburgh, TN.

Another class of suitable nonionic surfactants include, but are not limited to, long chain alkyl polyglucosides, which are the condensation product of a) a long chain alcohol containing from about 6 to about 25 carbon atoms, with glucose or glucose containing polymer. Presently preferred glucosides are decyl glucoside, octyl glucoside, and decyl maltoside.

In some embodiments, the blend of surfactants of the present invention include, but are not limited to, sodium laureth sulfate, sodium lauryl sulfate, lauramide DEA, cocamide DEA, cocamidopropyl betaine, Stepanol ABHS-15C, manufactured by Stepan Co., Northfiled, IL.

As used herein a "colorant" refers to a compound or a chemical which imparts color. Colorants can be natural and synthetic. Natural colorants occur in nature, mainly in plants, vegetables and fruits. Synthetic colorants are synthesized in a laboratory. Colorants can be dyes or pigments.

As used herein, the "dyes" refers to compounds or substances which impart color when dissolved in a medium, thus dyes are soluble in a medium. The medium can be water or organic solvents. The dyes can be organic, organo-metallic or inorganic.

As used herein, the "pigments" refers to compounds or substances which impart color when dispersed in a medium. The pigments are insoluble in a medium. The medium can be water or organic solvents. The pigments are sold as large particles, i.e. in the form of agglomerates and aggregates. The pigments are broken down into their primary particle size and are stabilized in their primary particle size. The process is called pigment dispersion. The pigments can be organic, organo-metallic or inorganic.

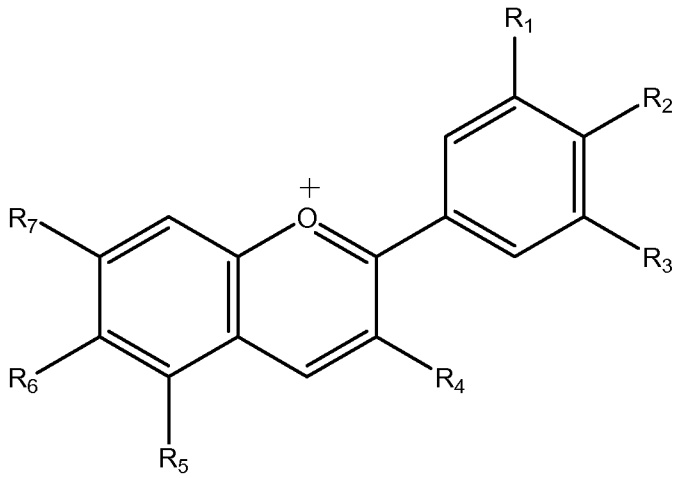
While any compound or any chemical capable of changing color as set forth herein may be used as colorant to construct the color-changing cleansing composition. The process of color-change in the present invention may be achieved by various mechanisms or using different color-changing agents which include, but are not limited to, natural colorants, synthetic colorants, food/cosmetics grade dyes (FD&C, D&C dyes), acid-base indicators, oxidation-reduction indicators, luminescent indicators, thermochromic compounds using heat, photochromic compounds using light, piezochromic compounds using pressure, pigments, organic compounds, inorganic compounds, organo-metallic compounds, metals, encapsulation mechanism, self-assembled mechanism or any other color-changing component or any component changing color by any mechanism. One of ordinary skilled in the art may recognize that the scope of the invention may not be limited to the above list but any color-changing component or any color-change mechanism may be incorporated herein.

Representative examples of natural colorants (some are exempt from certification and certification varies from US, EU and Japan) of the present invention include, but are not limited to, annatto extract, anthocyanines, betalains, carrot oil, β-carotene, β-apo-8'-carotenal, canthaxanthene, caramel, carmine, cochineal extract, gardenia yellow, dehydrated beets, grape skin extract, guanine, lac, riboflavin, monascus, vegetable juices, paprika, paprika oleoresins, saffron, turmeric, turmeric oleoresin, carthamin, iridoids, phycobilins, chlorophylls (chlorophyll a, chlorophyll b, chlorophyll c, chlorophyll d, chlorophyll e), haems, chromium hydroxide green, chromium oxide greens, carbon black, talc, titanium dioxide, ultramarines, ultramarine blue, iron oxides, zinc oxide, calcium carbonate, silver, silicon dioxide and mixtures thereof.

Representative examples of carotenoids natural colorants of the present invention include, but are not limited to, antherxanthin, astaxanthin, β-apo-8'-caroten-8'-al, β-apo-8'-caroten-8'-oic acid ethyl or methyl ester, astaxanthin, bixin, canthaxanthin, capsanthin, capsorubin, α-carotene, β-carotene, citroxanthin, crocetin, β-cryptoxanthin, fucoxanthin, lactucaxanthin, lutein, lycopene, neoxanthin, norbixin, phytoene, phytofluene, violaxanthin, zeaxanthin and mixtures thereof.

As used herein, the term "anthocyanins" is recognized in the relevant art as anthocyanidins plus sugars. Representative examples of anthocyanidins of the present invention include, but are not limited to, apigeninidin, aurantindin, capensinidin, cyanidin, delphinidin, europinidin, hirsutidin, luteolinidin, pelargonidin, malvidin, peonidin, petunidin, pulchellidin, rosinidin, triacetidin and mixtures thereof.

Examples of certain preferred anthocyanidins include, but are not limited to, as given by the following general formula:



;

wherein

Anthocyanidin	R_1	R_2	R_3	R_4	R_5	R_6	R_7
Apigeninidin	-H	-OH	-H	-H	-OH	-H	-OH
Aurantindin	-H	-OH	-H	-OH	-OH	-OH	-OH
Capensinidin	$-OCH_3$	-OH	$-OCH_3$	-OH	$-OCH_3$	-H	-OH
Cyanidin	-OH	-OH	-H	-OH	-OH	-H	-OH
Delphinidin	-OH	-OH	-OH	-OH	-OH	-H	-OH
Europinidin	$-OCH_3$	-OH	-OH	-OH	$-OCH_3$	-H	-OH
Hirsutidin	$-OCH_3$	-OH	$-OCH_3$	-OH	-OH	-H	$-OCH_3$
Luteolinidin	-OH	-OH	-H	-H	-OH	-H	-OH
Pelargonidin	-H	-OH	-H	-OH	-OH	-H	-OH
Malvidin	$-OCH_3$	-OH	$-OCH_3$	-OH	-OH	-H	-OH
Peonidin	$-OCH_3$	-OH	-H	-OH	-OH	-H	-OH
Petunidin	-OH	-OH	$-OCH_3$	-OH	-OH	-H	-OH
Pulchellidin	-OH	-OH	-OH	-OH	$-OCH_3$	-H	-OH
Rosinidin	$-OCH_3$	-OH	-H	-OH	-OH	-H	$-OCH_3$
Triacetidin	-OH	-OH	-OH	-H	-OH	-H	-OH

The term “FD&C” and “D&C” dyes are recognized in the art. In the United States, colorants for food, drug and cosmetics are regarded as “color additives”. The Federal Food, Drug & Cosmetic (FD&C) Act of 1938 made food color additives certification mandatory. Since then Food and Drug Administration (FDA) has been responsible for regulating all color additives used in food, drugs and cosmetics. Each batch to be sold in the United States has to be certified by the FDA. To avoid confusing color additives used in food with those manufactured for other uses, three categories of certifiable color additives were created: 1) FD&C (Food, Drugs & Cosmetics) color additives with application in food, drugs & cosmetics; 2) D&C (Drugs & Cosmetics) color additives with application in drugs & cosmetics; 3) External D&C (External Drugs & Cosmetics) color additives with applications in externally applied drugs & in externally applied cosmetics. Lakes are colorants prepared by precipitating a soluble colorant onto an insoluble base or substratum. A variety of bases such as alumina, titanium dioxide, zinc oxide, talc, calcium carbonate and aluminum benzoate are approved for D&C colorants, while only alumina is permitted as the substrate for manufacturing FD&C lakes. The use of all food colors approved for use in the United States are listed in 21 C.F.R. (Code of Federal regulations), parts 70 through 82 dealing with color additives.

Representative examples of FD&C dyes, D&C dyes, Ext. D&C dyes of the present invention include, but are not limited to, FD&C Blue 1, FD&C Blue 2, FD&C Green 3, FD&C Red 3, FD&C Red 4, FD&C Red 40, FD&C Yellow 5, FD&C Yellow 6, Citrus Red 2, Orange B, D&C Blue 4, D&C Blue 6, D&C Blue 9, D&C Brown 1, D&C Green 5, D&C Green 6, D&C Green 8, D&C Orange 4, D&C Orange 5, D&C Orange 10, D&C Orange 11, D&C Red 6, D&C Red 7,

D&C Red 17, D&C Red 21, D&C Red 22, D&C Red 27, D&C Red 28, D&C Red 30, D&C Red 31, D&C Red 33, D&C Red 34, D&C Red 36, D&C Red 39, D&C Violet 2, D&C Yellow 7, D&C Yellow 8, D&C Yellow 10, D&C Yellow 11, Ext. D&C Violet 2, Ext. D&C Yellow 7, [phthalocyaninato(2)]copper and mixtures thereof.

Representative examples of azo acid-base indicators of the present invention include, but are not limited to, Acid Blue 89, Acid Blue 92, alizarin yellow GG, alizarin yellow R, benzopurpurin B, benzyl orange, brilliant yellow, calmagite, carbazol yellow, chrome orange GR, chrysoidin, congo red, 4-dimethylamino-2-methylazobenzene, Direct Blue 72, ethyl orange, ethyl red, lanacyl violet BF, metanil yellow, methyl orange, methyl red, methyl red, sodium salt, methyl yellow, α-naphthyl red, nitrazine yellow, orange II, 4-(phenylazo)diphenylamine, propyl Red, solochrome violet RS, thiazol yellow G, tropaeolin O, tropaeolin OO, tropaeolin OOO and mixtures thereof.

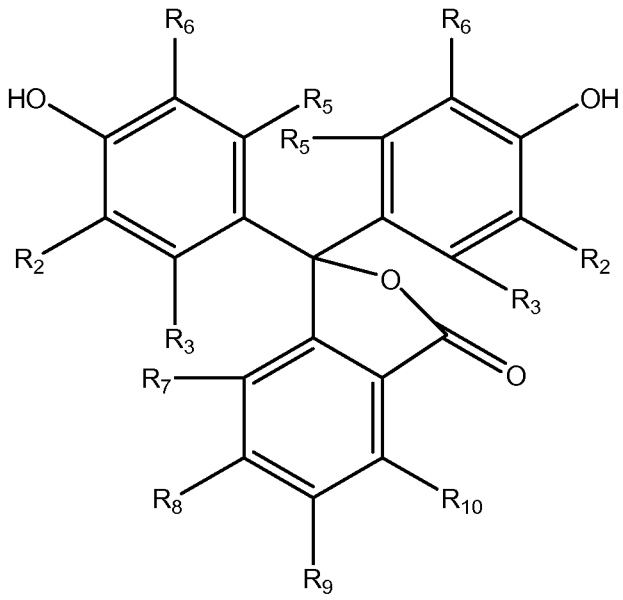
Representative examples of benzein acid-base indicators of the present invention include, but are not limited to, benzaurin, o-cresolbenzein, dibromothymolbenzein, -naphtholbenzein, phenolbenzein, thymolbenzein and mixtures thereof.

Representative examples of fluorescent acid-base indicators of the present invention include, but are not limited to, acridine, 9-amino-6-chloro-2-methoxyacridine, 5-aminosalicylic acid, anthranilic acid, calcein, 5-carboxy-2',7'-dichlorofluorescein, 6-carboxy-2',7'-dichlorofluorescein, 5-carboxy-2',7'-dichlorofluorescein diacetate, 6-carboxy-2',7'-dichlorofluorescein diacetate, 5-carboxyfluorescein, 6-carboxyfluorescein, 5-carboxyfluorescein diacetate, 6-carboxyfluorescein diacetate, 5(6)-carboxyfluorescein diacetate succinimidyl ester, 5-carboxynaphthofluorescein, 6-carboxynaphthofluorescein, 5-carboxynaphthofluorescein diacetate, carboxy SNAFL 1, carboxy SNAFL 2, carboxy SNAFL 1 diacetate, 5-chloromethylfluorescein diacetate, coumarin, dichlorofluorescein, 6,7-dihydroxycoumarin, 3,6-dihydroxyphthalimide, eosin Y, erythrosin B, fluorescein, fluorescein diacetate, fluorescein disodium salt, fluorescein-5-isothiocyanate, fluorescein-5-sulfonic acid, fluorescein-6-sulfonic acid, gallein, harmine, 4-heptadecyl-7-hydroxycoumarin, luminol, lysoSensor blue DND 167, lysoSensor blue DND 192, lysoSensor green DND 189, lysoSensor yellow/blue DND 160, magdala Red, 2-methoxybenzaldehyde, 4-methylesculetin, 4-methylumbelliferone, α-naphthoic acid, β-naphthol, naphthol AS, α-naphthylamine, β-naphthylamine, nigericin, oregon green 488 carboxylic acid, oregon green 500 carboxylic acid, oregon green 514 carboxylic acid, oregon green 488 carboxylic acid diacetate, o-phenylenediamine, p-phenylenediamine, phloxine B, quinine, quininic acid, resorufin, rhodol green, salicylic acid, umbelliferone and mixtures thereof.

Representative examples of nitro acid-base indicators of the present invention include, but are not limited to, dinitrocresol, α-dinitrophenol, β-dinitrophenol, γ-dinitrophenol, ε-dinitrophenol, δ-dinitrophenol, dinitrothymol, ethyl-bis(2,4-dinitrophenyl)-acetate, isopicramic acid, martius Yellow, nitramine, p-nitrobenzhydrazide, p-nitrobenzyl cyanide, 4-nitrocatechol, o-nitrophenol, m-nitrophenol, p-nitrophenol, picric acid, trinitrobenzene, trinitrobenzoic acid, trinitrotoluene and mixtures thereof.

Representative examples of phthalein acid-base indicators of the present invention include, but are not limited to, carvacrolphthalein, o-cresolphthalein, o-cresolphthalein complexon, dixylenolphthalein, guaiacolphthalein, α-naphtholphthalein, phenolphthalein, phenolphthalein, disodium salt, tetrabromophenolphthalein, thymolphthalein, xylenolphthalein and mixtures thereof.

Examples of certain preferred phthalein acid-base indicators include, but are not limited to, as given by the following formula:



wherein

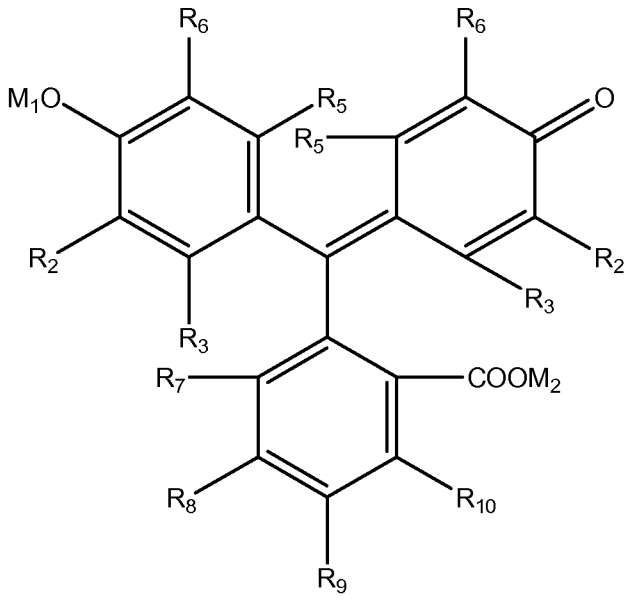
R_2, R_3, R_5, R_6, R_7, R_8, R_9 R_{10} = H, OH, Cl, Br, I, OR', CN, NO_2, NH_2, NHR', NR'R", NHCOR', SH, SO_3H, SO_3M, COOH, COOM, alkyl, alkoxy, aryl, cycloalkyl, hetaryl

R' = alkyl

R" = alkyl

M = metal

Examples of certain preferred phthalein acid-base indicator salts (water soluble) include, but are not limited to, as given by the following formula:



wherein

R_2, R_3, R_5, R_6, R_7, R_8, R_9 R_{10} = H, OH, Cl, Br, I, OR', CN, NO_2, NH_2, NHR', NR'R", NHCOR', SH, SO_3H, SO_3M, COOH, COOM, alkyl, alkoxy, aryl, cycloalkyl, hetaryl

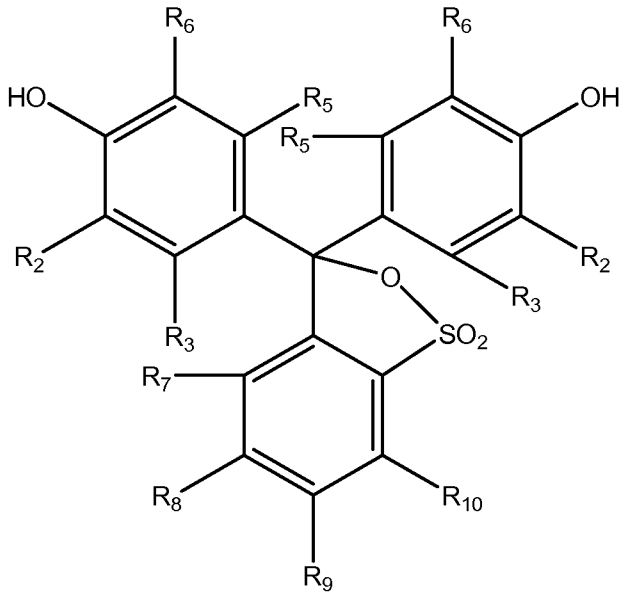
R' = alkyl

R" = alkyl

M_1, M_2 = metal

Representative examples of sulfonephthalein acid-base indicators of the present invention include, but are not limited to, bromochlorophenol blue, bromochlorophenol blue sodium salt, bromocresol green, bromocresol green sodium salt, bromocresol purple, bromocresol purple sodium salt, bromophenol blue, bromophenol blue sodium salt, bromophenol red, bromophenol red sodium salt, bromothymol blue, bromothymol blue sodium salt, bromoxylenol blue, chlorophenol red, chlorophenol red sodium salt, m-cresol purple, m-cresol purple sodium salt, o-cresol red, o-cresol red sodium salt, phenol red, phenol red, sodium salt, thymol blue, xylenol blue and mixtures thereof.

Examples of certain preferred sulfonephthalein acid-base indicators include, but are not limited to, as given by the following formula:



wherein

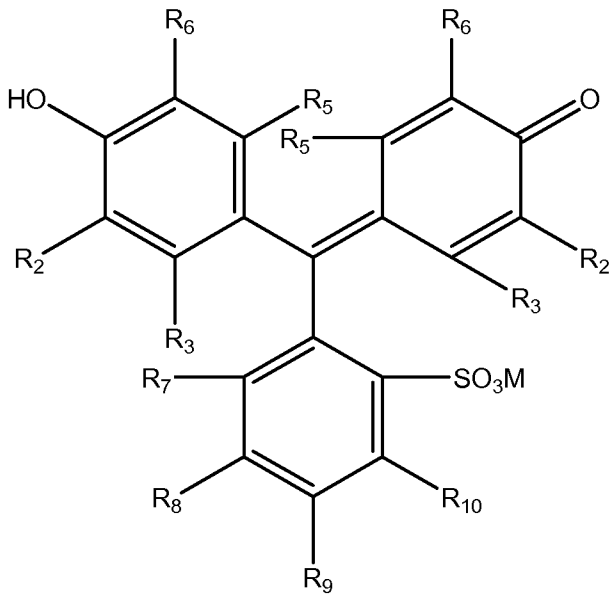
R_2, R_3, R_5, R_6, R_7, R_8, R_9 R_{10} = H, OH, Cl, Br, I, OR', CN, NO_2, NH_2, NHR', NR'R", NHCOR', SH, SO_3H, SO_3M, COOH, COOM, alkyl, alkoxy, aryl, cycloalkyl, hetaryl

R' = alkyl

R" = alkyl

M = metal

Examples of certain preferred sulfonephthalein acid-base indicator salts (water soluble) include, but are not limited to, as given by the following formula:



wherein

R_2, R_3, R_5, R_6, R_7, R_8, R_9 R_{10} = H, OH, Cl, Br, I, OR', CN, NO_2, NH_2, NHR', NR'R", NHCOR', SH, SO_3H, SO_3M, COOH, COOM, alkyl, alkoxy, aryl, cycloalkyl, hetaryl

R' = alkyl

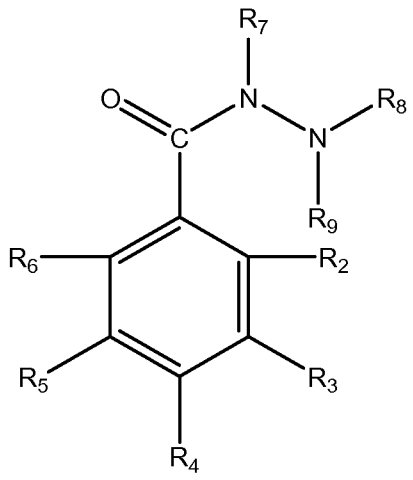
R" = alkyl

M = metal

Representative examples of tripheylmethane acid-base indicators of the present invention include, but are not limited to, acid fuchsin, alkali blue, aurin, crystal violet, ethyl violet, heptamethoxy red, hexamethoxy red, malachite green, methyl green, methyl violet, patent blue V, pentamethoxy red, poirrier blue C 4B, p-rosolic acid, rubrophen and mixtures thereof.

Representative examples of miscellaneous acid-base indicators of the present invention include, but are not limited to, curcumin, hematoxylin, indigo carmine, indophenol, isonitrosothiocamphor, neutral red, phenolmalein, resazurin, alizarin red, alizarin red S, pinachrome, quinaldine red, quinoline blue, anilinesulfonephthalein, benzoflavine, bromopyrogallol red, lacmoid, methyl purple, oxine blue, tobias acid and mixtures thereof.

Additionally, substituted hydrazides based acid-base indicators are useful herein, as given by the general formula:



;

wherein

R_2, R_3, R_5, R_6, R_7, R_8, R_9 R_{10} = H, OH, Cl, Br, I, OR', CN, NO_2, NH_2, NHR', NR'R", NHCOR', SH, SO_3H, SO_3M, COOH, COOM, alkyl, alkoxy, aryl, cycloalkyl, hetaryl

R' = alkyl

R" = alkyl

Representative examples of biological stains (Certified by Biological Stains Commission, USA) of the present invention include, but are not limited to, acid fuchsin, sodium salt, alcian blue, alizarin red, alizarin red S, aniline blue, auramine O, azure A, azure B, bismark brown Y, brilliant cresyl blue, brilliant green, carmine, congo red, cresyl violet, cresyl violet acetate, crystal violet, darrow red, eosin B, eosin Y, erythosin B, ethyl eosin, fast green FCF, giemsa stain, hematoxylin, indigo carmine, janus green B, jenner stain, light green SF, malachite green, methyl violet 2B, methyl green, methyl orange, methylene blue, neutral red, nigrosin, nile blue A, oil red O, orange G, orange II, orcein, phloxine B, pyronin B, pyronin Y, resazurin, p-rosaniline hydrochloride, rose bengal sodium salt, safranine O, stains all, sudan III, sudan IV, sudan Black B, tetrachrome stain, thionine (acetate), toluidine blue O, wright stain and mixtures thereof.

Suitable optional additives to the compositions of the present invention include, but are not limited to, antimicrobial agents, humectants, thickening agents, moisturizers, chelating agents, preservatives, fragrance, etc.

As used herein, unless otherwise specified, the term "antimicrobial" describes a biocidal effect that may be, for example, an antibacterial, antifungal, antiviral, bacteriostatic, disinfecting or sanitizing effect.

Representative examples of antimicrobial agents include, but are not limited to, benzyl alcohol, lactic acid, salicylic acid, iodophores, quaternary ammonium compounds, hypochloride releasing compounds (e.g., alkali hypochloride, hypochlorous acid), oxidizing compounds (e.g., hydrogen peroxide, peracids, hypochlorite), protonated carboxylic acid (e.g., heptanoic acid, octanoic acid, nonanoic acid, decanoic acid, undecanoic acid), Irgasan and Irgasan DP 300, manufactured by Ciba Specialty Chemicals; Nipacide, Nipacide PX-P, Triclosan and mixtures thereof.

As used herein, the "humectants" refer to chemicals which help to retard the evaporation of water from the composition, thus avoiding premature drying during the application. Representative examples of humectants include, but are not limited to, glycerin, ethylene glycol, propylene glycol, diethylene glycol, polyethylene glycol, hydroxylated statches, sorbitol, gelatin, sodium 2-pyrrolidone-5-carboxylate, soluble collagen, dibutyl phthalate and mixtures thereof. Any effective amount of humectants may be used.

Representative examples of thickening agents include, but are not limited to, sodium chloride, methyl cellulose, ethyl cellulose, hydroxypropyl cellulose, hydroxyethyl cellulose, carboxymethyl cellulose, xanthum gum, gum Arabic, gum karaya, guar gum, hydroxypropyl guar, carboxymethyl guar, carboxymethy hydroxypropyl guar, locust bean gum, ghatti gum, hydrolyzed starches, gelatin, chitosan and its derivatives, low molecular weight ethylene oxide polymers, low molecular weight propylene oxide polymers, polysulfonic acids and their salts and mixtures thereof.

Representative examples of chelating agents which are capable of protecting and preserving the composition of the present invention include, but are not limited to, ethylene diamine tetraacetic acid (EDTA), tetrasodium EDTA and mixtures thereof.

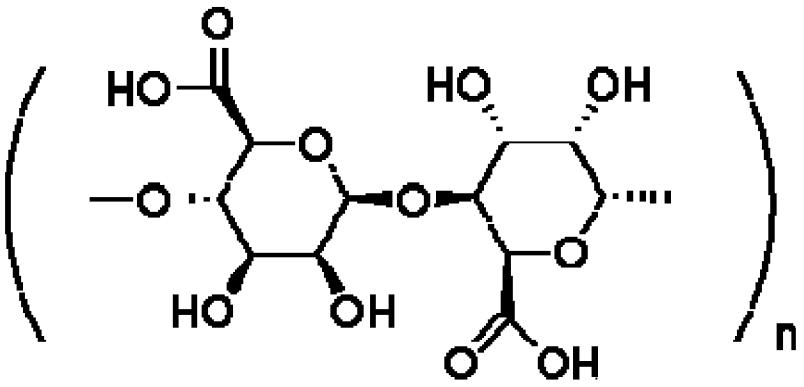
Representative examples of preservatives include, but are not limited to, glutaraldehyde, bicyclic oxazolidones, hydroxybenzoic acid esters, 3-iodo-2-propynyl butyl carbamate, methyl p-hydroxybenzoate, and a biocide comprising 2-methyl-4-isothiazolin-3-one and 5-chloro-2-methyl-4-isothiazolin-3-one. The preservatives often serve as both a bactericide and a fungicide. In some embodiments, the preferred preservatives include, but are not limited to, Liquid Germall Plus (iodopropynyl butyl carbamate), Germall II (diazolidinyl urea), manufactured by ISP (International Specialty Products), Wayne, NJ; Troysan 395 (dihydroxy-dimethyl hydantoin), manufactured by Troy Chemical Corporation, Florham, NJ; and Kathon PFM (isothiazolinones), manufactured by Rohm & Haas Co., Philadelphia, PA.

Pleasant smelling fragrances compatible with soaps may also be added.

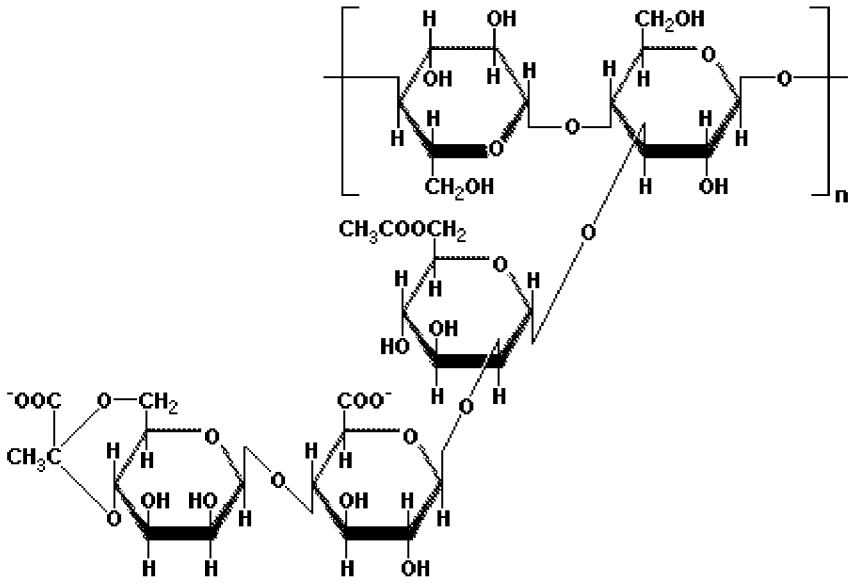
Natural hydrocolloids: Alginic acid - Sodium Alginate NaC6H7O6: A straight-chain, hydrophilic, colloidal, polyuronic acid composed primarily of anhydro-β-D-mannuronic acid residues with 1→4 linkage,

It is a linear copolymer with homopolymeric blocks of (1-4)-linked β-D-mannuronate (M) and its C-5 epimer α-L-guluronate (G) residues, respectively, covalently linked together in different sequences or blocks.

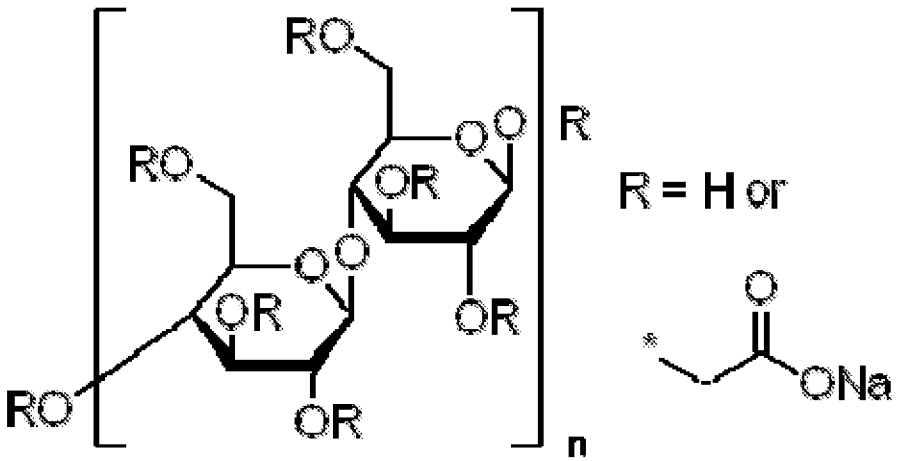
The monomers can appear in homopolymeric blocks of consecutive G-residues (G-blocks), consecutive M-residues (M-blocks), alternating M and G-residues (MG-blocks) or randomly organized blocks.



Xanthan gum: Anionic polysaccharide containing glucose, mannose, potassium glucuronate, acetate and pyruvate. Forms a hydrophilic colloid. Composed of a ß-(1→4)-D-glucopyranose glucan backbone with side chains of (1→3)-α-D-mannopyranose-(2→1)-ß-D-glucuronic acid-(4→1)-ß-D-mannopyranose on alternating residues. Approximately half of the terminal mannose residues are 4,6-pyruvated while most of the inner mannose residues are 6-acetylated.



Semi-synthetic hydrocolloids: Carboxymethylcellulose is a cellulose derivative with carboxymethyl groups (-CH2-COOH) bound to some of the hydroxyl groups of glucopyranose monomers that make up the cellulose backbone in which CH2COOH groups are substituted on the glucose units of the cellulose chain through an ether linkage.



EXAMPLES

The embodiments of the present invention are further illustrated by the following examples. The examples are provided for illustrative purposes only and are not intended nor should they be construed as limiting the scope of this invention in any manner whatsoever.

This is an example of producing a coagulated polymer with dye present in its crosslinked matrix and not on the hands. One skilled in the art may tune the amount of crosslinking agents, the rate at which it forms and its dye absorbing capacity (see Figure 4 -7). Table 2 shows one example

of the present invention in which the middle column is the A component and the right column is the B component.

Table 2.

	%w/w	
D&C RED #28		0.018
FD&C GREEN #3	0.02	
D&C GREEN #8		
STEOL CS-230	20	20
AMPHOSOL HCA	2	2
COLA MID AL	3	3
GLYCERINE USP	0.5	0.5
GERMALL PLUS	0.1	0.1
PURIFIED WATER	74.38	74.382

To 10 mL of the above soap formulation was added 5 mL of 2% solution of alginic acid and 1 gram of calcium chloride. The alginic acid was allowed to fully hydrate before the addition to the soap formulation. The A component and/or the B component may include one or more additional excipients, antimicrobial agents, surfactants, color changing indicators, or compounds that will enhance or effect an improvement in the organoleptic characteristics of the chemicals that may be added to the A or B components.

It is contemplated that any embodiment discussed in this specification can be implemented with respect to any method, kit, reagent, or composition of the invention, and vice versa. Furthermore, compositions of the invention can be used to achieve methods of the invention.

It will be understood that particular embodiments described herein are shown by way of illustration and not as limitations of the invention. The principal features of this invention can be employed in various embodiments without departing from the scope of the invention. Those skilled in the art will recognize, or be able to ascertain using no more than routine experimentation, numerous equivalents to the specific procedures described herein. Such equivalents are considered to be within the scope of this invention and are covered by the claims.

All publications and patent applications mentioned in the specification are indicative of the level of skill of those skilled in the art to which this invention pertains. All publications and patent applications are herein incorporated by reference to the same extent as if each individual publication or patent application was specifically and individually indicated to be incorporated by reference.

As used in this specification and claim(s), the words "comprising" (and any form of comprising, such as "comprise" and "comprises"), "having" (and any form of having, such as "have" and "has"), "including" (and any form of including, such as "includes" and "include") or "containing" (and any form of containing, such as "contains" and "contain") are inclusive or open-ended and do not exclude additional, unrecited elements or method steps.

The term "or combinations thereof" as used herein refers to all permutations and combinations of the listed items preceding the term. For example, "A, B, C, or combinations thereof" is intended to include at least one of: A, B, C, AB, AC, BC, or ABC, and if order is important in a particular context, also BA, CA, CB, CBA, BCA, ACB, BAC, or CAB. Continuing with this example, expressly included are combinations that contain repeats of one or more item or term, such as BB, AAA, MB, BBC, AAABCCCC, CBBAAA, CABABB, and so forth. The skilled artisan will understand that typically there is no limit on the number of items or terms in any combination, unless otherwise apparent from the context.

As used herein, words of approximation such as, without limitation, "about", "substantial" or "substantially" refers to a condition that when so modified is understood to not necessarily be absolute or perfect but would be considered close enough to those of ordinary skill in the art to warrant designating the condition as being present. The extent to which the description may vary will depend on how great a change can be instituted and still have one of ordinary skilled in the art recognize the modified feature as still having the required characteristics and capabilities of the unmodified feature. In general, but subject to the preceding discussion, a numerical value herein that is modified by a word of approximation such as "about" may vary from the stated value by at least ±1, 2, 3, 4, 5, 6, 7, 10, 12 or 15%.

All of the compositions and/or methods disclosed and claimed herein can be made and executed without undue experimentation in light of the present disclosure. While the compositions and methods of this invention have been described in terms of preferred embodiments, it will be apparent to those of skill in the art that variations may be applied to the compositions and/or methods and in the steps or in the sequence of steps of the method described herein without departing from the concept, spirit and scope of the invention. All such similar substitutes and modifications apparent to those skilled in the art are deemed to be within the spirit, scope and concept of the invention as defined by the appended claims.

What is claimed is:

1. A nontoxic color changing composition comprising:

a first component and a second component, wherein the first component comprises a nontoxic color changing dye and the first component in combination with the second component combine to form a nontoxic color changing dye that is of a different color than the nontoxic color changing dye in the first component.

2. The composition of claim 1, wherein the dye changes color with change of pH and the pH is different in the first component in combination with the second component than in the pH in the first component.

3. The composition of claim 1, wherein the first and second components each comprise a first and second analyte, respectively, wherein the concentration of the analytes is different in the first component that the second component.

4. The composition of claim 1, wherein the nontoxic color changing dye is an anthocyanin compound.

5. The composition of claim 1, wherein the composition further comprises an antibacterial composition, an antimicrobial compound, an antibiotic, a lipid composition, nanoparticles, metals, or mixtures thereof.

6. The composition of claim 1, wherein the composition changes color in the presence of at least one of an analyte, a metal, a chelating agent, ATP, Ca^{++}, a surfactant and organic molecules that are positive, negative, neutral or zwitterionic.

7. The composition of claim 1, wherein the composition changes color at a pH greater than 7 or a pH less than 7.

8. The composition of claim 1, wherein the composition comprises a coagulated polymer and the dye is crosslinked to the polymer.

9. The composition of claim 1, wherein the composition is substantially biodegradable.

10. A nontoxic color changing kit comprising:

a first component comprising a nontoxic color changing dye; and

a second component, wherein the first component and the first component in combination with the second component such that color of the nontoxic color changing dye is of a different color than the nontoxic color changing dye in the first component.

11. The composition of claim 10, wherein the pH is different in the first component in combination with the second component from the pH in the first component.

12. The composition of claim 10, wherein the nontoxic color changing dye is an anthocyanin compound.

13. A color changing composition comprising:

a cleanser having a colorimetric dye disposed therein, wherein a change in pH changes the color of the colorimetric dye, the composition comprising a coagulated, biodegradable polymer and the dye is at least partially crosslinked to the polymer.

14. The composition of claim 13, wherein the dye comprises a nontoxic color changing dye.

15. The composition of claim 14, wherein the dye is an anthocyanin compound.

16. The composition of claim 13, wherein the composition further comprises an antibacterial composition, an antimicrobial compound, an antibiotic, a lipid composition, nanoparticles, metals, or mixtures thereof.

17. The composition of claim 13, wherein the composition changes color in the presence of at least one of an analyte, a metal, a chelating agent, ATP, Ca^{++}, a surfactant and organic molecules that are positive, negative, neutral or zwitterionic.

18. A nontoxic color changing composition comprising:

a mixture comprising a first component and a second component, wherein the first component comprises an nontoxic color changing dye and the first component in combination with the second component such that the color of the nontoxic color changing dye is of a different color than the nontoxic color changing dye in the first component.

19. The composition of claim 18, wherein the pH is different in the first component in combination with the second component than in the pH in the first component.

20. A method of forming a nontoxic color changing composition comprising the steps:

providing a mixture comprising a first component and a second component; and

mixing the first component and the second component, wherein the first component comprises a nontoxic color changing dye and the first component in combination with the second component such that the color of the nontoxic color changing dye is of a different color than the nontoxic color changing dye in the first component.

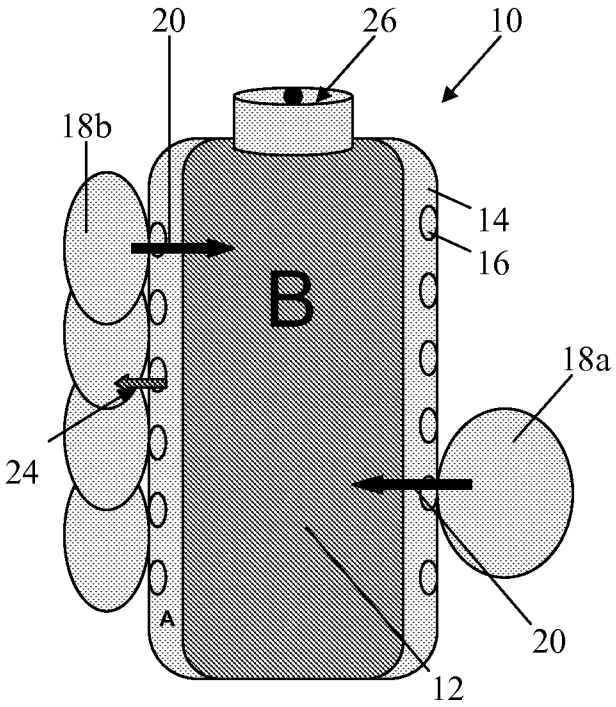


FIGURE 1

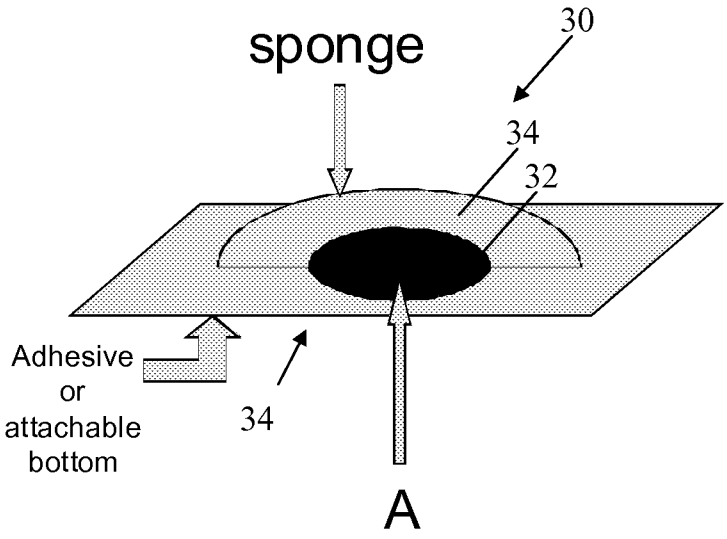


FIGURE 2

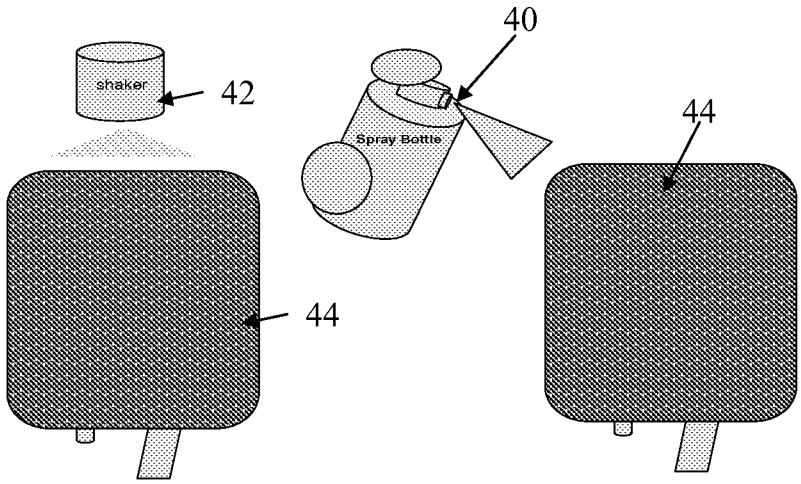


FIGURE 3

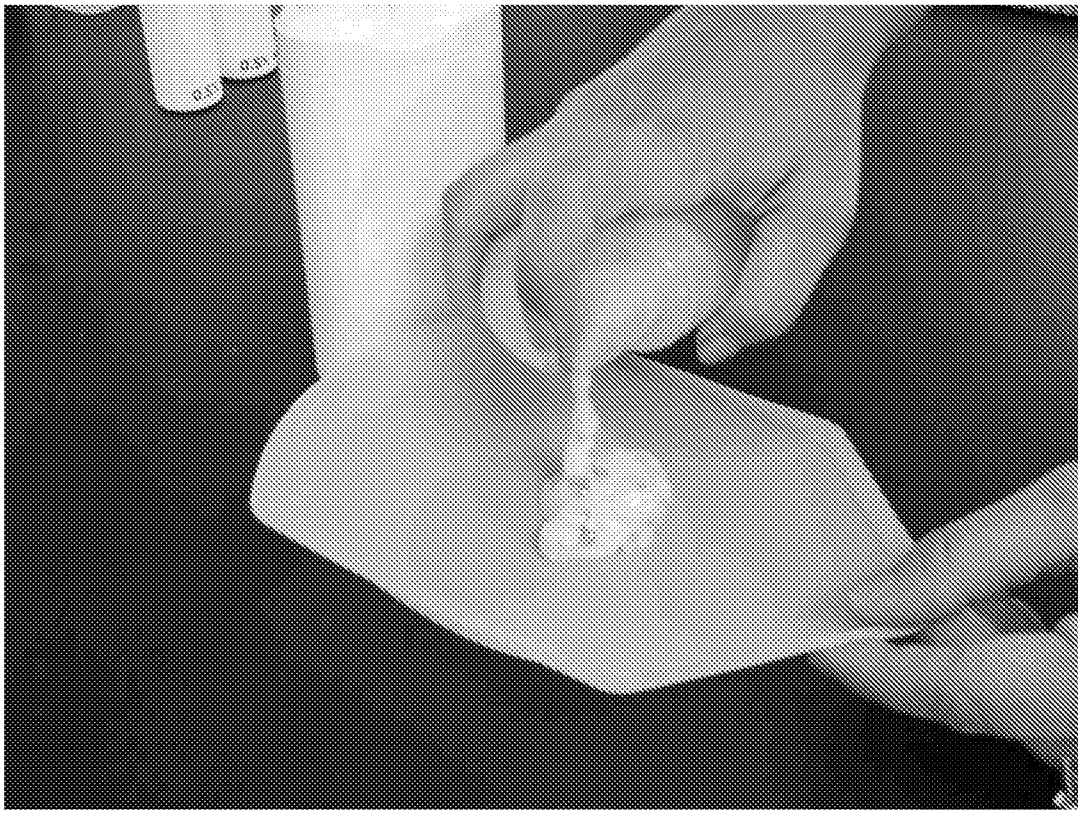


FIGURE 4

FIGURE 5

FIGURE 6

FIGURE 7