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LIQUID SOAP

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This invention relates to a concentrated base for the preparation of liquid soap, the process of making the base, and the process of making a clear liquid soap.

One of its objects is to make a substantially dry soap base which when dissolved even in hard water will form a clear liquid soap preparation.

Another of its objects is to make a liquid soap which is clear even in hard water.

Another object is to make such a liquid soap preparation whose alkalinity can be varied at will so as to make a mild preparation suitable for toilet and shampoo, or a more alkaline preparation suitable for other purposes.

Liquid soap preparations which are essentially relatively concentrated solutions of soap have been in common use for many years and are of two classes, one of which is of suitable concentration to be used in dispensers at washstands and for shampoo purposes, etc., while the other is a more concentrated solution which is intended to be diluted for use in dispensers, etc. The concentrations commonly used in dispensers, etc., range from about five per cent to twenty-five per cent while the more concentrated solutions before dilution may range up to about forty per cent soap. In diluting these more concentrated solutions for dispenser use, clear solutions cannot be obtained with the use of hard water such as is commonly available at the point of use. It has been necessary, therefore, not only for dilution, but also in making the original more concentrated solution, to use only a soft water or distilled water. Sometimes alcohol has also been used to assist in obtaining a clear solution.

For toilet use, in washstand dispensers for example, a satisfactory liquid soap preparation must be mild in its action on the skin, have good sudsing and cleansing power, and be clear and free flowing, even at moderately low room temperatures. For industrial uses similar requirements prevail except that mildness is not always essential.

Most natural waters are more or less "hard", due mainly to the presence of salts of calcium, magnesium, etc., and when soap is dissolved in such hard water, a cloudiness or precipitate forms because some of the soap reacts with these metals to form insoluble precipitates, commonly called "lime soaps" regardless of whether they are due to calcium or magnesium, etc., so that it is impossible in such cases to obtain a clear liquid soap solution by merely dissolving the soap in such hard water. Such water may be "softened" by treatment with the usual water softening agents such as sodium carbonate, sodium silicate, borax, trisodium phosphate, etc., in which case a precipitate of the corresponding salts of calcium, magnesium, etc., forms, and the water thus softened, or soap solutions made with same, must necessarily be filtered or otherwise treated to obtain a clear soap solution. Water thus softened, and soap solution made with same, is apt to be somewhat alkaline and harsh on the skin. This is also true when water containing temporary hardness is softened by the relatively expensive zeolite treatment.

We have discovered that it is possible to make a clear and mild liquid soap preparation meeting all the aforementioned requirements by dissolving soap in any ordinary natural water, even of a considerable degree of hardness, without having any precipitation or cloudiness develop from formation of insoluble soaps with the metals causing hardness of the water, provided there is also present a sufficient quantity of a water-soluble pyrophosphate, the sodium and potassium salts being especially suitable and readily available. The advantages of being able to use any ordinary hard water for this purpose are obvious. The expense of previously distilling or softening the water, or of filtering the solution is saved. An even more important saving is in the transportation charges for shipping large quantities of water from the point of manufacture to the consumer, which saving may be obtained by shipping our concentrated base from which the complete liquid soap preparation may easily be prepared even with hard water. The concentrated base for the preparation of the liquid soap has only a fraction of the weight of the final product which is made up at the point of consumption. For the consumer to make up the final product from a concentrated base has heretofore been impracticable because the consumer is not equipped to treat hard water or filter the soap solution, which operations would ordinarily be necessary with any concentrated base hitherto known.

We refer in this connection to the co-pending application of Walter C. Preston on a Soap builder of adjusted alkalinity, Serial No. 20,423 filed May 8, 1935.

Hard water for the purpose of the present invention is any water that forms a precipitate of "lime soap" at room temperature when a pure, easily soluble alkali metal soap, such as potassium oleate, has been dissolved therein to form a solution containing five per cent of actual soap.

A clear soap solution in hard water, within the meaning of our invention, is one that is as clear

as a solution of the same soap in distilled water having the same concentration of soap, at ordinary room temperatures; that is, there will be no precipitate or turbidity caused by formation of insoluble soaps with the metals causing hardness of the water. "Ordinary room temperatures" include temperatures as low as 70° F., although many soap solutions coming within the scope of our invention will be clear at considerably lower temperatures.

It should be understood that our invention is not intended to apply to the preparation of clear soap solutions of concentrations as used in laundry work, which usually contain less than one per cent soap for example, and in which dilute solutions much larger relative proportions of pyrophosphate would be required, but only to the preparation of what may properly be termed a liquid soap or the concentrated base for making same.

Our liquid soap preparations for use without dilution in dispensers, for example, may contain from about three to about thirty per cent of soap, but usually about five to twenty-five per cent. Alcohol, glycerine, perfumes, coloring matters, etc., may also be used in our liquid soap preparations, but these are not essential in the practice of our invention.

The soluble pyrophosphates which we use have the faculty, when used in sufficient excess over the theoretically calculated amount, of softening water by converting the calcium, magnesium, etc., into such form that they remain dissolved in the water without the power to precipitate soap. The reaction is believed to be according to the following typical equation, using calcium as an example:

$$Na_4P_2O_7+CaCl_2=Na_2(CaP_2O_7)+2NaCl$$

The calcium or other water hardening element appears after this reaction to be bound in a water-soluble complex pyrophosphate ion, and to be no longer capable of precipitating soap.

Tetrasodium pyrophosphate, $Na_4P_2O_7$, has an alkalinity nearly as strong as that of sodium carbonate and for this reason may exert a harsh action on sensitive skins and fabrics when used in soaps, but we find that its alkalinity can be reduced by the addition of suitable acid salts, or of acids, as hereinafter described, to a point substantially equal to that of soap or to any intermediate point, without losing its property of softening hard water without precipitation. The corresponding potassium salt has similar properties and its alkalinity can be reduced in a similar manner. The base metal of the pyrophosphate need not necessarily be sodium but must be one which forms a water-soluble compound but does not form an insoluble soap. Thus the sodium and potassium pyrophosphates are the most suitable for our purpose. Potassium pyrophosphates, for example, may advantageously, but not necessarily, be used with potassium soaps.

For purposes of simplicity we will describe our invention as applied with the use of sodium pyrophosphate, but it should be understood that other mono-valent alkali metal pyrophosphates, and especially potassium pyrophosphates, are also equally applicable.

We prefer to use in making a mild liquid soap preparation for toilet use a mixture of tetrasodium pyrophosphate with sufficient disodium-dihydrogen pyrophosphate or other alkali metal hydrogen pyrophosphate to reduce the alkalinity or the pH value to substantially that of soap. We may, however, also use a mixture of tetrasodium pyrophosphate with a small amount of an acid capable of reacting with same, such as hydrochloric, nitric, nitrous, sulfuric, sulfurous, pyrophosphoric, orthophosphoric, carbonic, acetic, citric, tartaric, lactic, or a higher fatty acid, or with an acid salt of an alkali metal such as sodium hydrogen sulfate, potassium hydrogen sulfate, sodium dihydrogen phosphate, sodium hydrogen carbonate, etc., to accomplish the same object. The extent of the reduction of alkalinity may be varied according to the proportion of the acid reacting material added. For use in toilet preparations where mildness and clarity are essential, sufficient of the acid reacting material may be added to reduce the pH value to a point not substantially below that of soap.

In reducing the alkalinity of $Na_4P_2O_7$ by any of these means and controlling the alkalinity of such mixtures, various procedures may be used. Solutions of pyrophosphate mixtures in various proportions may be prepared, each having the desired concentration, and likewise solutions of soap having the desired concentration. The alkalinity of each of these various solutions as shown by their pH value may then be determined. The direct determination of the pH value of soap solutions, however, is rather difficult and inaccurate, and for practical purposes indicators may be used in the various solutions and these will indicate with sufficient accuracy by their color whether the pyrophosphate solution is more or less alkaline than the solution of soap. Another method consists in adding the pyrophosphate mixture to a soap solution and observing whether an increased cloudiness results, or not. Any increased cloudiness in solutions having such concentrations of soap and pyrophosphate as would ordinarily be used in liquid soap preparations would indicate too low a degree of alkalinity of the pyrophosphate mixture. By any of these methods it is possible to select a pyrophosphate mixture having an alkalinity substantially equal to that of soap solutions or of any desired intermediate degree of alkalinity.

We are not limited, however, to the use of pyrophosphates of reduced alkalinity substantially equal to that of soap, but may use also any normal tetra metal pyrophosphate without reduction of its alkalinity, or any pyrophosphate mixtures of reduced alkalinity having an alkalinity less than that of tetrasodium pyrophosphate but not substantially less than that of soap. The exact degree of alkalinity to be used will depend upon the use to which the liquid soap product is to be put. For certain industrial uses, no reduction of alkalinity is required. In general, mixtures containing more than about 1 part by weight of $Na_2H_2P_2O_7$ to 4 parts by weight of $Na_4P_2O_7$ in solution have too low a pH value to be used in our present invention while mixtures containing less than about 1 part of $Na_2H_2P_2O_7$ to 4 parts of $Na_4P_2O_7$ come within its scope. Mixtures in the proportion of 1:4 will have the approximate apparent formula:

$$Na_{3.54}H_{0.46}P_2O_7$$

Thus, in general, the mixtures usable in our present invention have an average general formula of

$$M_xH_{4-x}P_2O_7$$

where M represents an alkali metal and x is any value not greater than 4 and not less than about 3.54.

In the majority of cases, for toilet use, we prefer to use from 90 per cent to 95 per cent $Na_4P_2O_7$ and from 5 per cent to 10 per cent $Na_2H_2P_2O_7$, such mixtures being most widely applicable. The approximate apparent formulas for the 90—10 and 95—5 mixtures are

$Na_{3.77}H_{0.23}P_2O_7$ and $Na_{3.88}H_{0.12}P_2O_7$

respectively.

The soap to be used for our purpose must be one which is readily soluble in water. The potassium soaps of coconut oil fatty acids, and of "red oil" or commercial oleic acid, are especially suitable. The potassium, ammonium, or substituted ammonium, soaps of some of the common commercial oils such as cottonseed oil, corn oil, and soya bean oil, for example, are also suitable in some cases, especially if high concentrations are not required. Sodium soaps, in general, are usable only when solutions of low concentrations are required. Palm kernel oil and other tropical oils of similarly high saponification number are substantial equivalents for coconut oil for the purposes of the present invention.

In making our liquid soap preparation the pyrophosphate and the soap may be dissolved in the water simultaneously if desired, or either one may be added first; the tetrasodium pyrophosphate and a reducer, such as the disodium-dihydrogen pyrophosphate, for example, or other acid reacting material as before mentioned, may be added separately, if desired. The sequence of adding these materials is relatively unimportant, but in any event the result of practicing our invention is to obtain directly a clear solution of soap even in hard water, whose mildness can be controlled as desired.

Water of various degrees of hardness may be used in making our liquid soap preparations, but less pyrophosphate will be required in the waters of lower degrees of hardness, and particularly where the calcium to magnesium ratio is low. The amount of pyrophosphate required to produce and to maintain a clear soap solution in hard water will always be considerably greater than that required for the apparent chemical reaction between the pyrophosphate and the calcium or magnesium contained in water. The excess pyrophosphate required varies greatly with the hardness of the water, the preponderance of calcium or magnesium in same, and also with the concentration of soap in the solution. It may range, for example, from two times the theoretically calculated amount up to possibly twenty or thirty times this amount in extreme cases. It is necessary to determine by test the minimum amount required in each case, but an excess will do no harm, and the mildness of the liquid soap preparation will not be adversely affected if the alkalinity of the pyrophosphate has been reduced to substantially that of a soap solution.

The following table shows several examples illustrating this invention.

Examples #1 to #4

No.	Water hardness *	Soap		Pyrophosphate		Solution
		Kind	Percent	Kind	Percent	
	Grains					
1	10	K-Coc. oil	15	A	3	Cloudy at 50° F.
	10	do	15	A	4	Clear at 50° F.
2	20	do	15	A	3	Cloudy at room temp.
	20	do	15	A	4	Clear at room temp.
3	30	do	15	A	4	Cloudy at room temp.
	30	do	15	A	5	Clear at room temp.
4	10	K-C. S. oil	10	B	3.4	Clear at room temp.
	20	do	10	B	3.4	Cloudy at room temp.

A=$K_4P_2O_7$ (commercial grade)
B=90% $Na_4P_2O_7$ + 10% $Na_2H_2P_2O_7$
K-Coc. oil=potassium soap of coconut oil
K-C. S. oil=potassium soap of cottonseed oil
*Hardness expressed in grains per U. S. gallon, and consisting of chlorides of calcium and magnesium in the molar ratio Ca:Mg=2.9:1. (This is an approximate average ratio for the U. S.)

The potassium soaps of coconut oil and cottonseed oil, as illustrated in the above examples, are commonly used in the making of liquid soap preparations. Those solutions containing pyrophosphate of reduced alkalinity as represented by B were in all cases as mild as pure soap solutions in their action on the hands.

Clear and mild solutions can likewise be prepared with other soaps and with water of even greater hardness by the use of sufficient soluble pyrophosphate.

While we may make up the complete liquid soap mixture in the way just described, an important phase of this invention involves making a highly concentrated base consisting of soap, pyrophosphates, and more or less water from which clear liquid soap preparations may be made by subsequently merely dissolving in water, soft or hard. The relative proportions of soap and pyrophosphates in such concentrated mixtures may be varied according to the hardness of the water in which it is intended to be dissolved, and the concentration of soap desired in the final liquid soap preparation; the alkalinity of the pyrophosphates may be varied according to the intended use of the product, or a preparation for general use having a suitable composition to give a satisfactory liquid soap product under a wide range of conditions may be prepared. This product, intended for subsequent solution in water, we would term a "concentrated base for the preparation of liquid soap". It may be prepared in dry form such as powder, flakes or bars, or in form of a paste, gel, or liquid having varying percentages of water, but preferably only sufficient water to facilitate handling. The soap content of such a base will obviously always be higher than that of a liquid soap preparation, and may range upward from thirty per cent of soap. We prefer in general the flake or powder form because of their ready solubility, and because the paste, gel, or liquid form of our prepa-

ration may under some circumstances separate into two phases, and bars may be brittle if containing pyrophosphate above certain limits, varying with the kind of soap, water content, temperature, etc. Any desired proportions of soap and pyrophosphate may be of course used in dry powder form.

These mixtures of soap and pyrophosphate for a liquid soap base may be prepared in various ways. The pyrophosphate, either dry or in solution, may, for example, be mixed into the molten soap in a crutcher; the alkalinity of the pyrophosphate may be reduced either before or after adding to the soap. If the soap is made by saponification in the crutcher, the pyrophosphate may be dissolved in the caustic alkali used for saponification, and the alkalinity reduced if desired after saponification is completed. The soap itself may be first dried and powdered, and then have the powdered pyrophosphate mixed therewith. If mixed in the wet or pasty condition, the product may be used in this form, or dried to any desired extent by usual procedures well known in the soap industry, and converted into the form of bars, flakes, or powder, as desired.

In using this concentrated base for the preparation of liquid soap, the complete elimination of traces of insoluble dirt and iron compounds may be difficult. In such cases the solution in water will not be quite clear even though no lime soaps are precipitated. Under these circumstances, we have found that such dirt or iron compounds readily separate on settling the solution for a few hours or over night, and decanting or drawing off the liquid from the top then yields a clear liquid soap solution. The following examples will further illustrate our invention.

Example 5.—Concentrated base.—The potassium soap prepared from commercial oleic acid or "red oil" is dried to about 5% moisture content, powdered and mixed with one fifth its weight of dry powdered tetrasodium pyrophosphate. When 18 parts of this mixture are dissolved in 82 parts of water of 6 grains of hardness per U. S. gallon, (ratio Ca/Mg=2.9:1), the resulting solution, which contains 15% soap and 3% tetrasodium pyrophosphate, is entirely clear at room temperature, is only slightly viscous, lathers profusely and cleanses efficiently.

Example 6.—Concentrated base.—The potassium soap prepared from coconut oil is dried to about 5% moisture content, powdered and mixed with one fifth its weight of dry powdered tetrasodium pyrophosphate. When 18 parts of this mixture are dissolved in 82 parts of water of 6 grains of hardness per U. S. gallon, (ratio Ca/Mg=2.9:1), the resulting solution, which contains 15% soap and 3% tetrasodium pyrophosphate, is entirely clear at room temperature, is only slightly viscous, lathers profusely and cleanse efficiently.

Example 7.—Concentrated base.—A mixture is prepared containing 40% of the potassium soap of coconut oil, 10% of a mixture of 1 part disodium-dihydrogen pyrophosphate and 9 parts of tetrasodium pyrophosphate, and 50% of water, the product having the form of a soft gel at ordinary temperatures. This clear gel can readily be dissolved in water of 10 grains hardness per U. S. gallon (ratio Ca/Mg=2.9:1) to give, at room temperature, clear liquid soap solutions of 15% soap content, of good lathering and cleansing power, and substantially as mild as pure soap solutions on the skin and on fabrics.

Example 8.—Concentrated base.—A clear gel is prepared containing 50% of the potassium soap of coconut oil and 8% of tetrapotassium pyrophosphate, the remaining 42% being essentially water. From this gel a clear liquid of 20% soap content can be prepared by dilution with the public water supply of the city of Cincinnati, said water having a hardness averaging approximately 5 grains per U. S. gallon.

This concentrated base has a great advantage in shipping to distant points on account of the saving in transportation charges as compared with shipping a corresponding quantity of the complete liquid soap preparation, the transportation charges on the water used for dissolving same being saved. This concentrated base may then be dissolved in water of the hardness for which it was designed, to make a perfectly clear liquid soap preparation of the required mildness at the time and place where it is to be used. If the water has only a low degree of hardness, any excess pyrophosphate, if of reduced alkalinity, as described, will be harmless and unobjectionable.

Having thus described our invention, what we claim and desire to secure by Letters Patent is:—

1. A liquid soap preparation, clear at ordinary temperatures, comprising hard water containing in solution three to thirty per cent of a water-soluble soap and a sufficient quantity of a water-soluble substance to prevent precipitation of the hardness constituents of the water by the soap at ordinary temperatures, said substance consisting essentially of a water-soluble pyrophosphate having the average formula $M_xH_{4-x}P_2O_7$, in which M represents an alkali metal and x has any value between 4 and 3.54.

2. A liquid soap preparation, clear at ordinary temperatures, comprising hard water containing in solution 3 to 30 per cent of a water-soluble soap, and a sufficient quantity of a water-soluble substance to prevent precipitation of the hardness constituents of the water by the soap at ordinary temperatures, said substance consisting essentially of a water-soluble pyrophosphate having the average formula $M_xH_{4-x}P_2O_7$, in which M stands for sodium or potassium and x has any value between 4.0 and 3.54.

3. A liquid soap preparation, clear at ordinary temperatures, comprising hard water containing in solution 3 to 30 per cent of a water-soluble soap, and a sufficient quantity of a water-soluble substance to prevent precipitation of the hardness constituents of the water by the soap at ordinary temperatures, said substance consisting essentially of a mixture of tetra-alkali-metal pyrophosphate and di-alkali-metal-dihydrogen pyrophosphate in such proportions as to have the average formula $M_xH_{4-x}P_2O_7$, in which M stands for sodium or potassium and x has any value between 4.0 and 3.54.

4. A liquid soap preparation, clear at ordinary temperatures, comprising hard water containing in solution 3 to 30 per cent of a water-soluble soap, and a sufficient quantity of a water-soluble substance to prevent precipitation of the hardness constituents of the water by the soap at ordinary temperatures, said substance consisting essentially of tetra-alkali-metal pyrophosphate with a sufficient quantity of an acid capable of reacting with said pyrophosphate to yield a pyrophosphate having the average formula

$$M_xH_{4-x}P_2O_7,$$

in which M stands for sodium or potassium and x has any value between 4.0 and 3.54.

5. A liquid soap preparation, clear at ordinary temperatures, comprising hard water containing in solution 3 to 30 per cent of a water-soluble soap, and a sufficient quantity of a water-soluble substance to prevent precipitation of the hardness constituents of the water by the soap at ordinary temperatures, said substance consisting essentially of tetra-alkali-metal pyrophosphate with a sufficient quantity of an acid capable of reacting with said pyrophosphate selected from the group consisting of hydrochloric, nitric, nitrous, sulfuric, sulfurous, pyrophosphoric, orthophosphoric, carbonic, acetic, citric, tartaric, lactic and higher fatty acids to yield a pyrophosphate having the average formula $M_xH_{4-x}P_2O_7$, in which M stands for sodium or potassium and x has any value between 4.0 and 3.54.

6. A liquid soap preparation, clear at ordinary temperatures, comprising hard water containing in solution 3 to 30 per cent of a water-soluble soap, and a sufficient quantity of a water-soluble substance to prevent precipitation of the hardness constituents of the water by the soap at ordinary temperatures, said substance consisting essentially of tetra-alkali-metal pyrophosphate with a sufficient quantity of an acid salt of an alkali metal to yield a pyrophosphate having the average formula $M_xH_{4-x}P_2O_7$, in which M stands for sodium or potassium and x has any value between 4.0 and 3.54.

7. A liquid soap preparation, clear at ordinary temperatures, comprising hard water containing in solution 3 to 30 per cent of a water-soluble soap, and a sufficient quantity of a water-soluble substance to prevent precipitation of the hardness constituents of the water by the soap at ordinary temperatures, said substance consisting essentially of tetra-alkali-metal pyrophosphate with a sufficient quantity of an acid salt selected from the group consisting of alkali-metal-hydrogen sulfates, alkali-metal-hydrogen phosphates and alkali-metal hydrogen carbonates to yield a pyrophosphate having the average formula $M_xH_{4-x}P_2O_7$, in which M stands for sodium or potassium and x has any value between 4.0 and 3.54.

8. A liquid soap preparation, clear at ordinary temperatures, mild on the skin and fabrics, comprising hard water containing in solution 5 to 25 per cent of the potassium soap of coconut oil, and a sufficient quantity of a water-soluble substance to prevent precipitation of the hardness constituents of the water by the soap at ordinary temperatures, said substance consisting essentially of a mixture of 9 parts of tetra-alkali-metal pyrophosphate and 1 part of di-alkali-metal-dihydrogen pyrophosphate, said alkali metal being selected from the group consisting of sodium and potassium, whereby the alkalinity of the complete preparation is not increased substantially above that due to the soap alone.

9. A liquid soap preparation, clear at ordinary temperatures, mild on the skin and fabrics, which comprises hard water containing in solution from 5 to 25 per cent of the potassium soap of red oil together with a sufficient quantity of a substance consisting essentially of a water-soluble pyrophosphate of reduced alkalinity to prevent precipitation of the hardness constituents of the water by the soap at ordinary temperatures, said pyrophosphate consisting of a mixture of 9 parts of terta-alkali-metal pyrophosphate and 1 part of di-alkali-metal-dihydrogen pyrophosphate, said alkali metal being selected from the group consisting of sodium and potassium, whereby the alkalinity of the complete preparation is not increased substantially above that due to the soap alone.

10. A concentrated base adapted for use in preparing from hard water a liquid soap clear at ordinary temperature, comprising at least thirty per cent of a water-soluble soap and a sufficient quantity of a water-soluble substance to prevent the precipitation of lime soap when said base is dissolved in said hard water to form a solution containing between three and thirty per cent soap, said substance consisting essentially of a water-soluble pyrophosphate having the average formula $M_xH_{4-x}P_2O_7$, in which M represents sodium or potassium, and x has any value between 4.0 and 3.54.

11. A concentrated base adapted for use in preparing from hard water a liquid soap, clear at ordinary temperature and having an alkalinity not substantially greater than that due to the soap, comprising at least thirty per cent of the potassium soap of coconut oil and a sufficient quantity of a water-soluble substance to prevent the precipitation of lime soap when said base is dissolved in said hard water to form a solution containing between three and thirty per cent soap, said substance consisting essentially of a mixture of 9 parts of tetra-alkali-metal pyrophosphate with 1 part of di-alkali-metal-dihydrogen pyrophosphate, said alkali-metal being selected from the group consisting of sodium and potassium.

12. A concentrated base adapted for use in preparing from hard water a liquid soap, clear at ordinary temperature and having an alkalinity not substantially greater than that due to the soap, comprising at least thirty per cent of the potassium soap of red oil and a sufficient quantity of a water-soluble substance to prevent the precipitation of lime soap when said base is dissolved in said hard water to form a solution containing between three and thirty per cent soap, said substance consisting essentially of a mixture of 9 parts of tetra-alkali-metal pyrophosphate with 1 part of di-alkali-metal-dihydrogen pyrophosphate, said alkali-metal being selected from the group consisting of sodium and potassium.

13. A concentrated base adapted for use in preparing from hard water a liquid soap, clear at ordinary temperature, comprising at least thirty per cent of a water-soluble soap and a sufficient quantity of a water-soluble substance to prevent the precipitation of lime soap when said base is dissolved in said water to form a solution containing three to thirty per cent soap, said substance consisting essentially of a water-soluble pyrophosphate having the average formula $M_xH_{4-x}P_2O_7$, in which M represents an alkali metal and x has any value between 4 and 3.54.

14. A concentrated base adapted for use in preparing from hard water a liquid soap, clear at ordinary temperature, comprising at least thirty per cent of a water-soluble soap derived from cottonseed oil and a sufficient quantity of a water-soluble substance to prevent the precipitation of lime soap when said base is dissolved in said water to form a solution containing three to thirty per cent soap, said substance consisting essentially of a water-soluble pyrophosphate having the average formula $M_xH_{4-x}P_2O_7$, in which M represents an alkali metal and x has any value between 4 and 3.54.

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