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HIGHLY ALKALINE STORABLE AND NON-FOAMING BOTTLE CLEANSING AGENTS

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ABSTRACT OF THE DISCLOSURE

Storable, solid bottle cleansing agents consisting essentially of 50–95 weight percent finely grained caustic alkali which has a grain size of less than 3 mm., and of a reaction product of propylene oxide with an aliphatic amine which has at least 3 reactive hydrogens in its molecule. The reaction product must have a cloud point ranging from 10 to 60° C., preferably from 15 to 40° C. These cleansing agents are substantially non-foaming when used and do not deteriorate on storage.

This is a continuation of application Ser. No. 495,349, filed Oct. 12, 1965, now abandoned.

The invention relates to highly alkaline bottle cleansing agents which are storable for long periods of time and which have the property of suppressing foam in the cleansing solution. More particularly, it relates to agents consisting to a large extent of fine-grained caustic alkali of a given particle size, plus an additive consisting of certain reaction products of propylene oxide.

The use of alkaline bottle cleansing agents is known which, beside fairly large quantities of caustic alkali, contain such ingredients as ortho- and polyphosphates, gluconates, silicates and, in some instances, wetting agents. Especially in automatic bottle cleansing devices, foam suppressants also are added. The latter not only are to avert an overflow of the liquid due to foaming, but also to facilitate the removal of labels stripped off the bottles in order to avoid shutdowns.

It also is known that foam suppressants are of different efficacy depending upon the source of the foam. The latter may come into being in many different ways in bottle cleansing processes. Label adhesives preferably are dextrin or casein glues which produce foam. Chain lubricants and printing inks introduce wetting agents of several kinds, particularly alkylbenzene sulfonates or soaps. Residual bottle contents, such as soft drinks, milk, or beer, also give rise to foam formation.

It therefore has met with difficulties to find foam suppressants which are active for all the foams named. In practice, nonionic compounds frequently are used, e.g., addition products of ethylene oxide on fatty alcohols or fatty amines, but these, also, are of limited effectiveness. Most important, these compounds cannot be incorporated in bottle cleansing agents containing powdered caustic alkali because they lose their effectiveness entirely in the presence of finely powdered caustic alkali, and the originally non-foaming bottle cleansers, within a short period of time, convert into strongly foaming materials.

Attempts at substituting coarsely flaked alkali for the powder, in order to slow the decrease in effectiveness, have not met with success at higher alkali contents, alone on account of separation of the ingredients.

It now has been found that these drawbacks are avoided when bottle cleansing agents are employed as hereinafter described which preferably have an alkali content of 50–95 percent. The agents according to the invention are characterized by a content of (a) caustic alkali having a grain or particle size of less than 3 mm. diameter and (b) reaction products of propylene oxide with aliphatic amines having at least 3 reactive hydrogen atoms in their molecules and whose cloud point is between 10 and 60° C., preferably between 15 and 40° C.

The fine-grained caustic alkali content enables ready manufacture of powdered bottle cleansing agents which exhibit no separation, not even upon storage, refilling or transportation. The alkali used may be powdered or finely grained whereby the particles size must not be more than 3 mm. and preferably more than 60 percent should be of a particle size of less than 1.5 mm. Upon the use of coarser grains, separation may occur. The preferred caustic alkalis are sodium and potassium hydroxide.

The reaction products of propylene oxide with aliphatic amines must be of such amines which contain at least 3 hydrogen atoms in their molecules which are capable of reacting with propylene oxide. Hydrogen atoms bound either on a nitrogen atom or on an oxygen atom, if present, have this capability.

Applicable aliphatic amines are polyamines, preferably those having 1 to 5 carbon atoms between the nitrogen atoms, the total number of nitrogen atoms being 2 to 8, such as ethylenediamine, propylenediamine, tetra- and pentamethylenediamine. Particularly valuable are those polyamines which can be produced by the addition of ethyleneimines on ammonia or on amines, respectively, e.g., ethylenediamine, diethylenetriamine, triethylenetetramine and tetraethylenepentamine.

Good results also have been obtained with reaction products of propylene oxide with aliphatic amines containing hydroxyl groups, such as triethanol- and triisopropanolamine.

The reaction products of propylene oxide with the aliphatic amines as described preferably are employed in the solid bottle cleansing agents in concentrations of 0.5 to 3.5 percent.

In order to attain the above-named cloud point ranging from 10 to 60° C., it is necessary that a definite amount of propylene oxide groups is added onto the corresponding aliphatic amines. This amount depends upon the kind of amine employed. In general, the cloud point is lowered with an increasing number of propylene oxide groups.

The cloud point is determined in each instance by slow heating of a 1 percent aqueous solution and determination of the first clearly discernible cloudiness. The cloud points given refer to pure solutions. The addition of foreign matter varies the cloud points. The bottle cleansing agents according to the invention may contain, aside from the principal ingredients, i.e., caustic alkali and propyleneamine reaction products, the customarily used additives, such as orthophosphates, polymeric phosphates, soda, potash, gluconates, and, if desired, wetting agents. The agents are employed in the customary bath concentrations of 0.1 to 2 percent, and preferably of 0.5 to 1 percent. The most favorable application temperature is 60 to 80° C.

The bottle cleansing agents according to the invention can be stored for long periods of time. They do not change their foam-depressing properties and are effective against all kinds of foams occurring in bottle washing processes.

The invention now will be further explained by the following examples.

However, it should be understood that these are given merely by way of illustration, and not of limitation, and that numerous changes may be made in the detail without

departing from the spirit and the scope of the invention as hereinafter claimed.

All percentages in this specification are percent by weight unless otherwise specified.

Example 1

The storability of the reaction products of propylene oxide with aliphatic amines having at least three reactive hydrogen atoms in their molecules, in the presence of solid finely grained caustic alkali, was determined in the following manner:

98% finely powdered NaOH were intimately mixed with 2% of the substance to be tested in a high-speed mixer and then stored at room temperature. Within a time of 12 weeks, the cloud point of the mixtures was determined in 1% aqueous solution every 3 weeks. The determination of the cloud point was carried out by slow heating of the solution and noting of the first temperature at which a well-discernible clouding of the solution occurred. (Note.—The cloud point of the mixture is not identical with the cloud point of the pure solution of the propyleneamine reaction product.) These mixtures whose cloud point varied merely slightly were deemed stable in storage. Upon decomposition of the investigated substance, a steadily increasing rise of the cloud point temperature occurred. The results are given in Table 1. For purposes of comparison, a reaction product of ethylenediamine with equal parts of ethylene oxide and propylene oxide was tested, as shown in Table 1.

Like results were obtained with finely powdered KOH in lieu of NaOH.

TABLE 1.—98% NaOH; 2% ADDITIVE

No.	Additive (Reaction Product of—)	Cloud Point (° C.) in Weeks 0	3	6	9	12
1	Ethylenediamine with ethylene and propylene oxide.	31	50	55	>95	>95
2	Triethanolamine with 15 mols propylene oxide.	88	89	91	91	
3	Triethanolamine with 20 mols propylene oxide.	62	71	75	77	79
4	Triethylenetetramine with 30 mols propylene oxide.	43	44	47	49	51

Example 2

The reduction of the foam volume of cleansing solutions by the agents according to the invention was determined in the following manner:

The alkali solutions used were produced by refluxing of 3% NaOH solution in water with different additives for 10 hours. As additives the following were used: 3% of a commercial dextrin glue; 3% of a commercial casein glue; 3% milk; 0.075% tetrapropylenebenzenesulfonate (100%); 0.1% curd soap. 100 ml. each of these solutions were heated to 60 and 80° C., respectively in a measuring cylinder and then strongly shaken therein 20 times. The foam volume thus created was read in ml. immediately after shaking. For the determination of the stability of the foam produced, the foam volume again was read after 30 and 60 seconds. The results are found in Table 2.

Like tests were carried out with the difference that to the solution as described, prior to refluxing, 0.045 volume percent of the following compounds were added:

The reaction product of triethanolamine with 17.5 mols propylene oxide (cloud point 41.5° C.); the reaction product of triethanolamine with 27 mols propylene oxide (cloud point 30.5° C.); the reaction product of triisopropanolamine with 20 mols propylene oxide (cloud point 38° C.); the reaction product of triethylenetetramine with 30 mols propylene oxide (cloud point 31.5° C.). The foam volumes found are listed in Table 2.

Example 3

The bottle cleansing agent was produced in a mixer having the following composition:

	Percent
NaOH (grain size smaller than 2 mm.)	85
Polymeric phosphate	10
Sodium silicate ($Na_2O:SiO_2=3.30$)	4
Reaction product of triethanolamine with 17.5 mols propylene oxide (cloud point 41.5° C.)	1

This material was stored for 6 months. Upon employment after this storage period in an automatic bottle washing machine, the agent exhibited an excellent cleansing action with negligible foaming. Beer bottles, milk bottles and soft drink bottles, partly bearing paper labels, were well cleaned, and the labels came off well and could be removed from the machine without difficulty.

Example 4

A cleaning agent was produced by mixing the following components:

	Percent
KOH (grain size less than 1.5 mm.)	60
Polyphosphate	15
Sodium silicate ($Na_2O:SiO_2=3.35$)	10
Filler (Na_2SO_4)	13
Reaction product of triethylenetetramine with 30 mols polypropylene oxide (cloud point 31.5° C.)	2

The cleansing agent was stored for 6 months before using it in an automatic bottle washing machine at a temperature of 80° C. Beer, milk and soft drink bottles, partly bearing paper labels, were washed clean with very little foam development, the labels came off and could readily be removed.

TABLE 2

Temp. (° C.)	Sol. No.[3]	Foam Volume After 20 Shakes (ml.) No Additive (Blank) 0″	30″	60″	Triethanolamine Plus 17.5 PO [1] (CP[2] 41.5° C.) 0″	30″	60″	Triethanolamine Plus 27 PO (CP 30.5° C.) 0″	30″	60″	Triisopropanolamine plus 20 PO (CP 38° C.) 0″	30″	60″	Triethylenetetramine plus 30 PO (CP 31.5° C.) 0″	30″	60″
60	1	100	70	50	10	5	0	15	10	5	5	0	0	10	5	0
	2	250	50	25	20	20	15	20	15	5	15	15	10	10	10	10
	3	400	280	250	15	5	5	45	45	40	0	0	0	20	10	10
	4	250	200	180	210	120	110	15	10	10	25	20	20	15	10	10
	5	250	150	100	160	65	55	100	30	25	145	30	25	80	20	1
80	1	50	45	45	5	0	0	15	10	10	5	0	0			
	2	295	195	100	5	5	5	10	10	5	20	15	10			
	3	400	350	225	10	5	5	30	30	30	0	0	0			
	4	155	125	100	35	35	30	25	25	20	30	25	25			
	5	300	200	150	25	20	15	50	30	20	25	25	20			

[1] PO=mols polypropylene oxide.
[2] CP=cloud point.
[3] Solutions were 3% aqueous NaOH containing the following additives:
Solution 1: 3% dextrin glue.
Solution 2: 3% casein glue.
Solution 3: 3% milk.
Solution 4: 0.075% tetrapropylene benzene sulfonate (100%).
Solution 5: 0.1% curd soap.

Example 5

A bottle washing agent was mixed and stored for 6 months. It had the following composition:

	Percent
NaOH (grain size less than 2 mm.)	70
Polyphosphate	10
Sodium silicate ($Na_2O:SiO_2=3.35$)	10
Filler (Na_2SO_4)	7
Reaction product of triisopropanolamine with 20 mols propylene oxide (cloud point 38° C.)	3

Beer, milk and soft drink bottles, partly bearing labels, were washed at 80° C. in an automatic bottle washer. The bottles came out of the bath fully clean, and very little foam developed. The labels had come off and could well be removed from the bath.

What is claimed is:

1. A solid, substantially non-foaming, storable bottle cleansing agent consisting essentially of 50–95 percent of a caustic alkali having a particle size of less than 3 mm.; 0.5–3.5 percent of a reaction product of propylene oxide with an amine selected from the group consisting of ethylene- and propylenediamine, tetra- and pentadimethylenediamine, diethylenetriamine, triethylenetetramine, tetraethylenepentamine, triethanol- and triisopropanolamine; said reaction product having a cloud point ranging substantially from 10 to 60° C.

2. The agent as defined in claim 1, wherein at least 60 percent of said caustic alkali has a grain size of less than 1.5 mm.

3. A cleansing agent according to claim 1, wherein the balance of said agent is selected from the group consisting of soda, potash, sodium silicate, and sodium sulfate.

4. The agent as defined in claim 3, wherein more than 60 percent of the caustic alkali present has a grain size of less than 1.5 mm.

5. A bottle washing process which comprises subjecting said bottles to a stream of a 0.1 to 2.0 percent aqueous solution at substantially 60–80° C.; said solution containing as active ingredient a highly alkaline agent consisting essentially of substantially 50–95 percent of finely grained caustic alkali having a particle size of less than 3 mm., and substantially 0.5 to 3.5 percent of a reaction product of propylene oxide with an amine selected from the group consisting of ethylenediamine, propylenediamine, tetra- and pentamethylenediamine, diethylenetriamine, triethylenetetramine, tetraethylenepentamine triethanol- and triisopropanolamine; said reaction product having a cloud point of substantially 10 to 60° C.; and rinsing said bottles free of said agent with water.

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