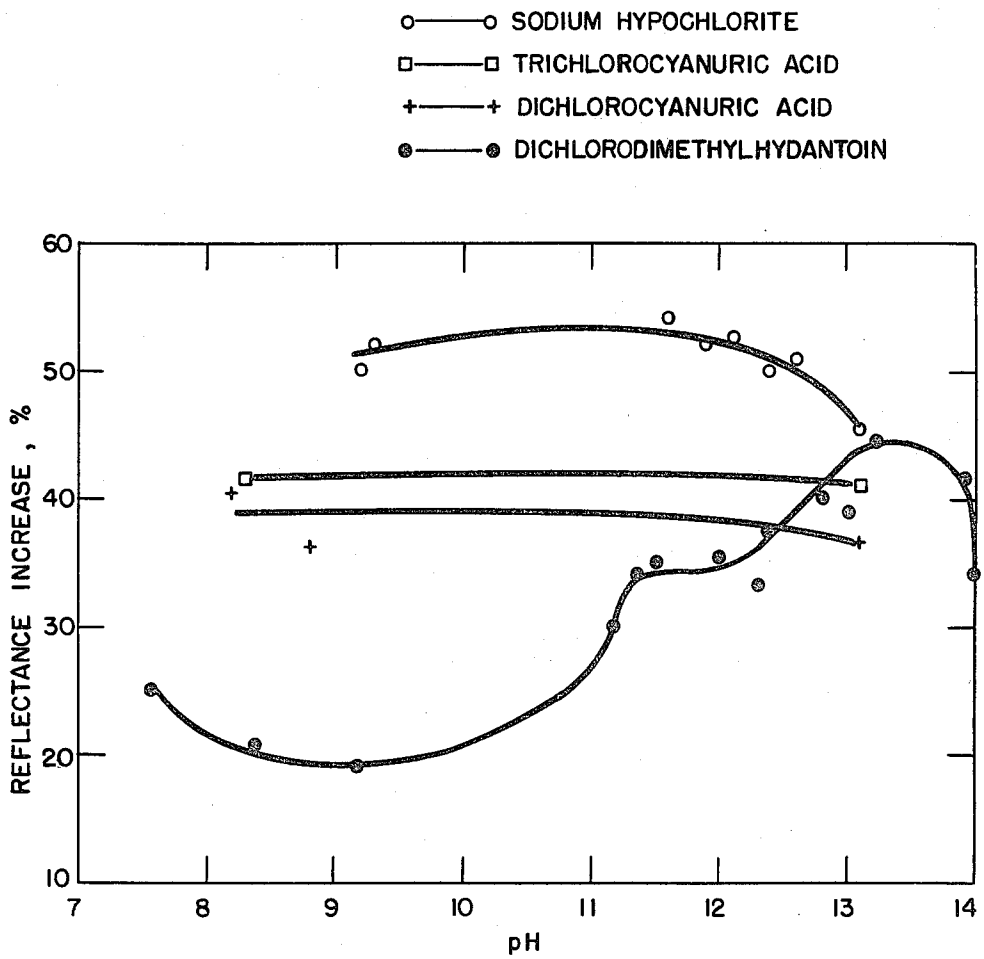
May 31, 1960 R. A. BLOMFIELD 2,938,764

HIGHLY ALKALINE DICHLORODIMETHYLHYDANTOIN
BLEACHING SOLUTIONS AND METHODS
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EFFECT OF pH OF BLEACH COMPOSITION
ON BLEACHING EFFECTIVENESS



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HIGHLY ALKALINE DICHLORODIMETHYL-HYDANTOIN BLEACHING SOLUTIONS AND METHODS

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This invention relates to an improved bleach composition and to an improved method for bleaching textiles. In a more specific aspect, this invention relates to an improved bleach composition employing 1,3-dichloro-5,5-dimethylhydantoin as the source of available chlorine.

Bleaching operations conducted in commercial as well as in home laundries which have been based on chlorine-containing bleach compounds have generally involved the use of various hypochlorites, such as sodium hypochlorite or calcium hypochlorite. Such hypochlorites are effective low-cost bleaching agents, but they have certain disadvantages. The most generally recognized disadvantage of hypochlorite bleaches is the tendency for such bleaches to react with cotton or linen fabric in addition to reacting with the stain which is desired to be removed. The reaction of the bleach with the fabric results in reduction in fabric strength, particularly after the fabric has been subjected to repeated wash cycles employing a hypochlorite bleach. This disadvantage is heightened by the fact that, while the stain removal activity of a bleach is increased with increased temperature, the reaction of hypochlorite bleaches with fabric is also increased at higher temperatures.

It is generally known, also, that the activity of hypochlorite bleaches is increased in acidic solutions, but such an increase in activity is one of which advantage cannot be taken in most laundry operations since the wash liquor is generally alkaline in nature. Furthermore, acid solutions present problems in a washing process, such as the formation of greasy fatty acids in the presence of laundry soap and corrosion of metal parts. A bleaching compound which overcomes many of the disadvantages associated with hypochlorite bleaches is 1,3-dichloro-5,5-dimethylhydantoin, hereinafter referred to simply as dichlorodimethylhydantoin. Aqueous solutions of dichlorodimethylhydantoin have the outstanding advantage as bleach compositions of greatly reducing the loss of fabric strength associated with hypochlorite bleaches, while at the same time providing effective, but gentle, bleaching action. In the application of Maurice G. Kramer, Serial No. 482,698, filed January 19, 1955, a bleach composition based on the combination of dichlorodimethylhydantoin and sodium tripolyphosphate is disclosed and claimed which provides effective bleaching action but with remarkably low reduction in fabric strength of the bleached fabric. It is there disclosed that the mixture can contain from 8 to 75 weight percent dichlorodimethylhydantoin, based on the weight of the mixture, and that a particularly effective combination of these ingredients is one containing 75 weight percent sodium tripolyphosphate and 25 weight percent dichlorodimethylhydantoin.

A need exists, however, for increasing the activity of dichlorodimethylhydantoin, and thereby increasing its effectiveness as a bleach, so that fuller advantage can be taken of this improved bleaching compound in all types of bleach operations, and particularly in bleach operations on heavily and stubbornly stained fabrics. The removal of such stubborn stains, if accomplished at all, under conventional bleach practices employing a hypochlorite bleach requires repeated application of the hypochlorite bleach, or time-consuming soaks in high concentrations of hypochlorites at low temperatures, both of which operations necessarily result in serious loss of fabric tensile strength. An increase in effectiveness of the dichlorodimethylhydantoin bleaching compound would have the equally important benefit, when bleaching "normally" stained fabrics in a laundry, of reducing the number of items requiring rewash and rebleach in order to produce bright and stain-free fabrics.

It is an object of this invention, therefore, to provide an improved bleach composition and an improved bleaching method.

It is a further object of this invention to provide an improved bleach composition based on dichlorodimethylhydantoin.

A still further object of this invention is to provide a bleach composition and method of bleaching employing dichlorodimethylhydantoin wherein the bleaching effectiveness of dichlorodimethylhydantoin is increased.

The bleach composition and the method of bleaching of this invetnion are based on the discovery that the bleaching effectiveness of dichlorodimethylhydantoin is remarkably increased in aqueous solutions having a significantly higher pH than is customarily used in bleaching operations. The effectiveness of sodium hypochlorite and other bleaches based on chlorine-containing compounds, on the other hand, is not increased, and in some cases, is reduced in such highly basic solutions.

Bleaching operations are normally carried out in aqueous solutions having a pH of about 9.0 to 10.5. Increased basicity tends to stabilize, rather than activate, conventional hypochlorite bleaches, however. I have found that the effectiveness of dichlorodimethylhydantoin as a bleach is significantly increased in aqueous solutions having a pH in the range of 12 to 14, measured at 25° C. The improved bleach composition of this invention is, therefore, a composition containing dichlorodimethylhydantoin, water and an alkalizing agent wherein the alkalizing agent is present in an amount sufficient that the hydrogen ion concentration of the aqueous composition corresponds to a pH of 12 to 14. The effectiveness of bleaching agents is evaluated on the basis of change in light reflectance of unbleached muslin panels. On this basis, the composition of the invention and the method of the invention afford a reflectance increase of as high as 40%, whereas an aqueous solution of dichlorodimethylhydantoin at a pH of about 10.5 affords a reflectance increase of about 25%. Furthermore, the reflectance increase of fabrics bleached with sodium hypochlorite is actually lower at the high pH range of this invention than at the conventional pH of 10 to 10.5. An article by R. G. Ditzel et al., entitled "ACL–85, New active ingredient for Bleaching and Sanitizing Agents," Soap and Chemical Specialties, pp. 125–139, February 1956, reveals in Figure I on page 127 that the reflectance increase of unbleached muslin bleached with trichloroisocyanuric acid also decreases with increasing pH.

As was stated hereinabove, the improved bleach composition of this invention is an aqueous solution of dichlorodimethylhydantoin containing a sufficient amount of an alkalizing agent so that the hydrogen ion concentration of the solution corresponds to a pH in the range from 12 to 14. The alkalizing agent can be any alkaline-reacting substance, such as the alkalizing agents already present in the wash liquor from previous operations of the wash cycle as well as any alkalizing agent that can be added to an aqueous solution of dichlorodimethylhydantoin in sufficient quantity so that the desired pH is

obtained. It will be apparent that many different alkalizing agents are available for this purpose. It will be further apparent that the specific amount of alkalizing agent in the composition can only be defined for a specific bleach operation since consideration must be given to the effect of other ingredients, such as soap and detergents which are often present during the bleach operation. The fabric load and the characteristics of soil and stain involved also influence the amount and specific kind of alkalizing agent that is desirable. When given the benefit of this disclosure, however, one is able to readily ascertain the quantity of alkalizing agent which need be added to an aqueous solution of dichlorodimethylhydantoin so that the composition of the invention is obtained.

Any known alkalizing agent which will establish the desired pH can be used. Alkali metal hydroxides, such as sodium and potassium hydroxide, particularly in combination with a buffering agent, such as sodium carbonate, are the most frequently used alkalizing agents. Examples of other alkalizing agents that can be used are the alkali metal silicates, such as sodium metasilicate, either in anhydrous or pentahydrate form, sodium sesquisilicate or sodium orthosilicate. The alkalizing agent can be a mixture of these materials and can include alkali metal fatty acid soaps in combination with other alkalizing agents. The alkaline salts, such as sodium carbonate, which exhibit a buffering action can be employed in combination with the alkalizing agent, and examples of other such buffering salts are trisodium phosphate and tetrasodium pyrophosphate.

The bleaching composition of this invention can be used alone or in combination with any conventional laundry detergent composition. Conventional ingredients for detergent or bleach compositions often include sodium carboxymethylcellulose and/or solvents, such as pine oil or kerosene, in addition to soap, detergents, alkaline builders, and the like, and these are examples of the type of other materials that can be present without harmful effect on the improved bleaching action of the composition of the invention.

A specific example of the type of detergent composition which can be present together with the bleach composition of this invention is the detergent composition disclosed and claimed in U.S. 2,566,501 wherein the detergent composition contains defined amounts of sodium alkylbenzenesulfonate, sodium carboxymethylcellulose and an inorganic alkaline salt, such as sodium carbonate or modified soda.

It will be noted that, when the bleach composition of this invention is used together with a suds operation or closely following a suds operation in a wash cycle, the quantity of the alkalizing agent required to establish the desired pH is at least partly supplied by the alkalizing materials in the detergent composition used in the suds operation. In this situation, the quantity of alkalizing agent which must be added together with the aqueous solution of dichlorodimethylhydantoin is simply that amount necessary to establish the pH of the composition of the invention. This latter step is the essence of one embodiment of the present invention, which is the method of washing and bleaching wherein an aqueous solution of dichlorodimethylhydantoin is added to the wash liquor together with a sufficient amount of an alkalizing agent so that the hydrogen ion concentration of the wash liquor corresponds to a pH in the range of 12 to 14.

It has been pointed out that the bleaching effectiveness of an aqueous solution of dichlorodimethylhydantoin is significantly improved when the pH of the aqueous solution is in the range of 12 to 14. It has been found, specifically, that heavily stained fabrics are most effectively bleached under practical conditions when the bleach composition of this invention contains the amount of alkalizing agent which establishes the pH at from 12.2 to 12.5.

The amount of dichlorodimethylhydantoin employed in the composition of the invention is generally that amount which, when dissolved in water, provides from 12.5 to 3600 parts of available chlorine per million parts of water. Expressed on a weight percent basis, the amount of dichlorodimethylhydantoin is from 0.0018 to 0.54 weight percent based on the weight of dichlorodimethylhydantoin and water. This is the broad range of amount of dichlorodimethylhydantoin which provides bleaching action and has utility for the wide variety of bleaching problems that are met. Generally speaking, however, the amount of dichlorodimethylhydantoin employed in the composition of the invention is that amount which, when dissolved in water, provides from 50 to 1200 parts of available chlorine per million parts of water. This range of amount corresponds to a weight percent of 0.0075 to 0.18 based on the weight of dichlorodimethylhydantoin and water.

The following examples are supplied in order to illustrate the invention, and should not be used to unduly restrict the invention as disclosed herein.

EXAMPLE I

The bleaching effectiveness of a composition according to the invention was tested in a series of laboratory beaker tests conducted so as to determine the effect of pH under controlled conditions.

For comparative purposes, tests were made under the same conditions with sodium hypochlorite, dichlorocyanuric acid and trichloroisocyanuric acid.

The bleach compositions tested were prepared by dissolving a sufficient quantity of the active agent in 1 liter of water so that the concentration of the active agent was sufficient to provide 200 parts per million of available chlorine. Varying amounts of alkalizing agents were then added so as to obtain the pH values indicated in Table 1 below.

The bleach composition based on dichlorodimethylhydantoin was prepared by dissolving in water a mixture of dichlorodimethylhydantoin and sodium tripolyphosphate containing 25 weight percent dichlorodimethylhydantoin, based on the weight of the mixture, the amount of the mixture in solution being that amount which provided 200 parts per million of available chlorine. This amount of dichlorodimethylhydantoin constituted 0.03 weight percent based on the weight of water and dichlorodimethylhydantoin.

The bleaching tests were carried out on six 4" x 4" swatches of unbleached muslin which were prepared for the tests by washing them 5 minutes in a tergotometer at 75 cycles per minute at 160° F. in a 0.25 weight percent solution of a detergent composition consisting essentially of sodium alkylbenzenesulfonate, sodium carboxymethylcellulose and an inorganic alkaline salt as set forth in U.S. Patent 2,566,501, cited above, said detergent composition having been prepared in 1 liter of demineralized water. The swatches were then rinsed under a demineralized water tap.

After rinsing the washed swatches, the bleaching operation was carried out in the tergotometer in the 1 liter bleach solutions, prepared as described above, for 15 minutes at 75 cycles per minute at 160° F.

After bleaching, the swatches were removed from the bleach liquor, rinsed under the demineralized water tap and pressed dry.

The bleaching effectiveness obtained in each test was measured by standard light reflectance techniques. The light reflectance of the bleached swatches was compared to the light reflectance of the swatches before bleaching using a blue filter in a Hunter multi-purpose reflectometer manufactured by Henry A. Gardner Laboratory, Inc., Washington, D.C.

The results of these tests are summarized below in Table 1.

Table 1

Test No.	Alkalizing Agent, grams per liter	Effect of pH of Bleach Composition on Bleaching Effectiveness							
		Dichlorodimethylhydantoin		Sodium Hypochlorite		Dichlorocyanuric Acid		Trichloroisocyanuric Acid	
		pH	Reflectance Increase, Percent	pH	Reflectance Increase, Percent	pH	Reflectance Increase, Percent	pH	Reflectance Increase, Percent
1	Sodium Triopolyphosphate, 5	7.6	25.3						
2	Disodium phosphate, 5	8.4	21.0	9.3	52.0	8.2	40.7	8.3	41.8
3	Sodium bicarbonate, 5	9.2	19.0	9.2	50.2	8.8	36.3	8.8	39.6
4	Sodium carbonate, 5	11.2	30.2	11.6	54.2				
5	Sodium carbonate, 4.85 / Sodium hydroxide, 0.15	11.4	34.3	11.9	52.3				
6	Sodium carbonate, 4.75 / Sodium hydroxide, 0.25	11.5	35.0	12.1	52.5				
7	Sodium carbonate, 4.5 / Sodium hydroxide, 0.5	12.0	35.6	12.4	50.5				
8	Sodium hydroxide, 1	12.3	33.2						
9	Sodium carbonate, 4 / Sodium hydroxide, 1	12.4	37.8	12.6	51.0				
10	Sodium hydroxide, 3	12.8	40.0						
11	Sodium hydroxide, 5	13.0	39.0	13.1	46.5	13.1	36.8	13.1	41.3
12	Sodium hydroxide, 10	13.2	44.4						
13	Sodium hydroxide, 30	13.9	41.5						
14	Sodium hydroxide, 50	14.0	34.3						

The results of these tests, which are tabulated in Table 1 above, are graphically illustrated in the accompanying drawing. The drawing aids in appreciating the unusual increase in bleaching effectiveness that one obtains with the composition of the invention where the bleach composition comprises water, dichlorodimethylhydantoin and a sufficient amount of an alkalizing agent so that the hydrogen ion concentration of the composition corresponds to a pH in the range from 12 to 14. A particularly desirable range of pH for the composition of the invention is 12.5 to 13.5. This latter range afforded the optimum bleaching action in the tests carried out in this example. No such increase in bleaching effectiveness at high pH is obtained with sodium hypochlorite, dichlorocyanuric acid or trichloroisocyanuric acid, and in fact, the bleaching effectiveness of these compounds is slightly decreased at the high pH.

EXAMPLE II

The results of the tests carried out in the laboratory, described in Example I, were confirmed in practical washing and bleaching operations using an 18 pound fabric load in a Prosperity washing machine. The fabric load for each test was 18 pounds of heavily soiled and stained fabrics from a commercial laundry. In addition to the heavily soiled and stained fabrics from the commercial laundry, unbleached muslin swatches, prepared as described in Example I, were included in the fabric load so that reflectance increase measurements could be made, also as described in Example I.

The general wash formula which was followed in these tests is set forth below in Table 2.

Table 2

GENERAL WASH FORMULA

Operation		Water, Soft		Time, Minutes
No.	Title	Level, inches	Temperature,[1] ° F.	
1	Flush	10	160	2
2	do	10	160	2
3	Break	5	[2] 200	15
4	Flush	10	160	2
5	do	10	160	2
6	Bleach-Break	5	200	10
7	Flush	10	160	2
8	do	10	160	2
9	Suds	5	160	6
10	Rinse	10	160	3
11	do	10	160	3
12	do	10	140–90	3
13	do	10	140–90	3
14	Sour	5	140–90	8

[1] Approximate. [2] Steam added.

The total volume of water employed for each of operations 1, 2, 4, 5, 7, 8, and 10–13, including water required for saturation of the fabric, was 23.8 gallons, and the total volume of water employed for each of operations 3, 6, 9 and 14, including water required for saturation of the fabric, was 16.2 gallons.

Four washes were carried out according to the general wash formula set forth in Table 2. The bleach composition employed in operation No. 6 in washes No. 2, 3 and 4 was in accordance with the present invention as indicated in Table 3 below, while the bleach composition used in operation No. 6 in wash No. 1 was not in accordance with the present invention since there was not a sufficient amount of alkalizing agent present so that the bleach composition had a pH in the range of 12 to 14.

The composition used for break operation No. 3 in the general wash formula in each of the four washes reported below in Table 3 was a proprietary composition based on a mixture of sodium hydroxide and sodium carbonate which also contained minor amounts of tetrasodium pyrophosphate, sodium carboxymethylcellulose, deodorized kerosene and pine oil. The amount of this composition used in operation No. 3 in each of the tests was 9.5 ounces.

The composition used for bleach-break operation No. 6 in washes Nos. 2, 3 and 4 reported below in Table 3 was a mixture of the break composition given above for operation No. 3 and a bleach composition consisting of a mixture of sodium tripolyphosphate and dichlorodimethylhydantoin containing 25 weight percent dichlorodimethylhydantoin based on the weight of the last-mentioned mixture. The composition used for operation No. 6 in wash No. 1 reported below in Table 3 was a mixture of dichlorodimethylhydantoin and sodium tripolyphosphate containing 25 weight percent of dichlorodimethylhydantoin based on the weight of the mixture.

The composition used for suds operation No. 9 was a mixture of the break composition given above for operation No. 3 and a commercial laundry soap which was an alkali-metal fatty acid soap derived from fatty acids having a titer of 39 to 42° C. and which contained a minimum of 92% real soap. The amount of the break composition was 0.95 ounce and the amount of the soap was 0.24 ounce in each of the tests.

The composition used for sour operation No. 14 was a laundry sour consisting of sodium silicofluoride. The amount of the sodium silicofluoride used in each of the tests was 0.36 ounce.

The results of the four washes are summarized below in Table 3.

Table 3

Wash No.	Bleach-Break Operation No. 6		Reflectance Increase, Unbleached Muslin, Percent	Visual Quality of Washed Fabrics
	DCDMH,[1] Wt. Percent Based on Weight of Water and DCDMH	pH at 25° C.		
1	0.0166	9.2	20.7	Poor.
2	0.0166	12.2	27.6	Good.
3	0.0166	12.5	27.1	Good.
4	0.0332	12.5	32.0	Good+.

[1] Dichlorodimethylhydantoin.

The weight percent of dichlorodimethylhydantoin in washes Nos. 1, 2 and 3 corresponds to 111 parts of available chlorine per million parts of water and the weight percent of dichlorodimethylhydantoin in wash No. 4 corresponds to 222 parts of available chlorine per million parts of water.

The observation that the quality of the washed fabric in wash No. 1 was "poor" indicates that original stains were clearly visible and that 50 to 75% of the items in the wash would require rewash and rebleach.

The observation that the quality of the washed fabrics in washes Nos. 2 and 3 was "good" indicates that the original stains were only occasionally slightly visible and that from 10 to 15% of the items would require rewash and rebleach. The plus sign beside "good" for wash No. 4 indicates that the quality of the washed fabrics was better than that of washes Nos. 2 and 3 and that only about 5 to 10% of the items would require rewash and rebleach.

It should be emphasized that the original fabric load used in the tests reported in this example were heavily soiled and stained. The results shown above in Table 3 are a clear confirmation for the work reported in Example I showing that the bleach composition of the invention, water, dichlorodimethylhydantoin and sufficient alkalizing agent so that the composition has a pH in the range of 12 to 14, is remarkably improved. The data in Table 3 shows, further, that a composition of the invention wherein the amount of alkalizing agent provides a pH of 12.2 to 12.5 is an effective and desirable composition for use in bleaching heavily stained fabrics. It should be particularly noted, in this regard that break-bleach operation No. 6 was carried out at about 200° F. The composition of this invention is highly effective at such high temperatures, and in the method of this invention a temperature of 190 to 200° F. is very desirable for bleaching heavily soiled and stained fabrics. Such high temperatures can be used with the bleach composition and method of this invention without the loss in fabric strength which would occur if a hypochlorite bleach were used at such high temperatures. However, the method of this invention is generally applicable and the improved results are obtained when the method is carried out at temperatures in the range of 140 to 210° F.

It should be apparent that the objectives of this invention have been attained. The principal improvement lies in the increased bleaching effectiveness one obtains with the bleach composition of the invention while at the same time retaining the important advantage associated with dichlorodimethylhydantoin of much smaller reduction in fabric strength than is encountered in the use of hypochlorite bleaches.

I claim:

1. An improved bleach composition, which comprises, 1,3-dichloro-5,5-dimethylhydantoin, an alkalizing agent selected from the group consisting of alkali metal hydroxides, alkali metal silicates and mixtures thereof and water, said composition containing a sufficient amount of said alkalizing agent so that the hydrogen ion concentration of said composition corresponds to a pH in the range of 12 to 14.

2. An improved bleach composition, which comprises, 1,3-dichloro-5,5-dimethylhydantoin, an alkalizing agent selected from the group consisting of alkali metal hydroxides, alkali metal silicates and mixtures thereof and water, said composition containing a sufficient amount of said alkalizing agent so that the hydrogen ion concentration of said composition corresponds to a pH in the range of 12.5 to 13.5.

3. An improved bleach composition, which comprises, 1,3-dichloro-5,5-dimethylhydantoin, an alkalizing agent selected from the group consisting of alkali metal hydroxides, alkali metal silicates and mixtures thereof and water, said composition containing from about 0.0018 to 0.54 weight percent of 1,3-dichloro-5,5-dimethylhydantoin based on the weight of 1,3-dichloro-5,5-dimethylhydantoin and water, and said composition containing a sufficient amount of said alkalizing agent so that the hydrogen ion concentration of said composition is in the range of 12 to 14.

4. An improved bleach composition, which comprises, 1,3-dichloro-5,5-dimethylhydantoin, an alkalizing agent selected from the group consisting of alkali metal hydroxides, alkali metal silicates and mixtures thereof and water, said composition containing from about 0.0075 to 0.18 weight percent of 1,3-dichloro-5,5-dimethylhydantoin based on the weight of 1,3-dichloro-5,5-dimethylhydantoin and water, and said composition containing a sufficient amount of said alkalizing agent so that the hydrogen ion concentration of said composition is in the range of 12 to 14.

5. An improved bleach composition, which comprises, water, an alkalizing agent selected from the group consisting of alkali metal hydroxides, alkali metal silicates and mixtures thereof and a mixture of 1,3-dichloro-5,5-dimethylhydantoin and sodium tripolyphosphate, said mixture containing from 8 to 75 weight percent of 1,3-dichloro-5,5-dimethylhydantoin based on the weight of said mixture, said composition containing 0.0018 to 0.54 weight percent of 1,3-dichloro-5,5-dimethylhydantoin based on the weight of 1,3-dichloro-5,5-dimethylhydantoin and water, and said composition containing a sufficient amount of said alkalizing agent so that the hydrogen ion concentration of said composition corresponds to a pH of 12 to 14.

6. A composition according to claim 5 wherein said mixture contains about 25 weight percent 1,3-dichloro-5,5-dimethylhydantoin based on the weight of said mixture.

7. An improved bleach composition, which comprises, water, an alkalizing agent selected from the group consisting of alkali metal hydroxides, alkali metal silicates and mixtures thereof and a mixture of 1,3-dichloro-5,5-dimethylhydantoin and sodium tripolyphosphate, said mixture containing about 25 weight percent 1,3-dichloro-5,5-dimethylhydantoin based on the weight of said mixture, said composition containing 0.0075 to 0.18 weight percent 1,3-dichloro-5,5-dimethylhydantoin based on the weight of 1,3-dichloro-5,5-dimethylhydantoin and water, and said composition containing a sufficient amount of said alkalizing agent so that the hydrogen ion concentration of said composition corresponds to a pH of 12.5 to 13.5.

8. An improved method for bleaching cotton fabrics, which comprises, agitating said fabrics in an alkaline aqueous bleach composition at a temperature in the range of about 140 to 210° F., said aqueous bleach composition comprising water, an alkalizing agent selected from the group consisting of alkali metal hydroxides, alkali metal silicates and mixtures thereof and 1,3-dichloro-5,5-dimethylhydantoin, the amount of said alkalizing agent being sufficient so that the hydrogen ion concentration of said aqueous bleach composition corresponds

to a pH in the range of 12 to 14, and the amount of said 1,3-dichloro-5,5-dimethylhydantoin being from 0.0018 to 0.54 weight percent based on the weight of 1,3-dichloro-5,5-dimethylhydantoin and water in said aqueous bleach composition.

9. A method according to claim 8 wherein said weight percent 1,3-dichloro-5,5-dimethylhydantoin is from 0.0075 to 0.18 and wherein the agitating of said fabrics in said aqueous bleach composition is carried out at a temperature in the range of 190 to 200° F.

10. In a method of washing and bleaching cotton textiles wherein the textiles are subjected in any sequence to washing, rinsing and bleaching operations in an aqueous medium, the improvement which comprises, carrying out said bleaching operation by adding dichlorodimethylhydantoin and an alkalizing agent selected from the group consisting of alkali metal hydroxides, alkali metal silicates and mixtures thereof to said aqueous medium, the amount of said dichlorodimethylhydantoin added being such as to constitute from 0.0018 to 0.54 weight percent based on

the weight of dichlorodimethylhydantoin and water in said aqueous medium, and the amount of said alkalizing agent added being sufficient so that the hydrogen ion concentration of said aqueous medium corresponds to a pH of 12 to 14.

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