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3,697,215

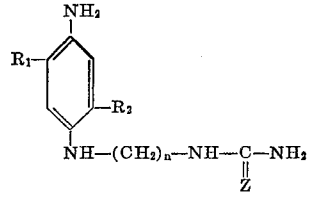
DYEING HAIR WITH N-(UREIDOALKYL)- AND N-(THIOUREIDOALKYL) - PARA - PHENYLENE DIAMINES

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Int. Cl. A61k 7/12
U.S. Cl. 8—10.2 9 Claims

ABSTRACT OF THE DISCLOSURE

Dye compositions containing the oxidation dye:



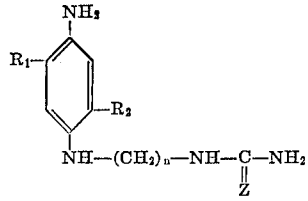
and the method of using it to dye live human hair.

SUMMARY OF THE INVENTION

Certain known methods of dyeing keratinic fibers, and in particular human hair, utilize dyeing compositions comprising oxidation dyes, and in particular aromatic ortho or para-diamines which are generally referred to as "oxidation bases." The shades obtained with these bases may be varied by using color modifiers or "couplers" and, in particular, aromatic meta-diamines or meta-aminophenols.

It is the object of the present invention to provide a new class of bases which may be utilized in dyeing keratinic fibers.

It is a further object of the present invention to provide as a new article of manufacture a composition for dyeing keratinic fibers, and in particular human hair, which is characterized by the fact that it comprises, possibly in association with one or more couplers, at least one base corresponding to the following general formula:



(I)

in which R_1 and R_2 may be the same or different and represent hydrogen, halogen, alkoxy having 1–3 carbon atoms and alkyl having 1–3 carbon atoms, and preferably methyl or methoxy, Z represents oxygen or sulfur, and n is a whole number between 2 and 4 inclusive.

The compounds according to Formula I may of course be used in the form of their acid addition salts.

Among the couplers which may be advantageously used with the bases of Formula I are: meta-aminophenol, 3 - N - carbamylmethylaminophenol, resorcinol, meta-phenylene diamine, 2,4-diamino-anisole sulfate, 3-hydroxy-phenylurea.

When couplers are used in association with the bases of Formula I, the ratio of base to coupler may vary within broad limits, but an excess of coupler is preferably used. The preferred base to coupler ratio is from 1:1 to 1:4.

In the dyeing compositions of the invention the concentration of the Formula I base is between 0.1% and 10% by weight.

The dyeing compositions of the invention may also contain other dyes useful under the same conditions, such as direct dyes (e.g. azo or anthraquinone dyes). They may also contain bases other than those defined above, in association with couplers.

The dyeing composition of the invention may also contain wetting agents, dispersing agents, penetrating agents, and any other ingredients conventionally used in the dyeing of human hair. They may take the form of an aqueous solution, a cream or a gel, or may contain a liquified gas permitting them to be vaporized and packaged in aerosol containers.

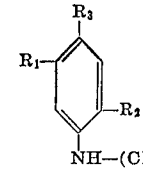
The dyeing compositions of the invention are utilized in a conventional manner at an alkaline pH, preferably between 8 and 10. This pH may be obtained by adding a base such as for example ammonia. The product is applied to the hair in the presence of an oxidizing solution, which is preferably hydrogen peroxide.

One of the essential advantages of the dyeing compositions of the invention is that it gives tints which are highly resistant to discoloration by light, inclement weather, and washing.

It is a further object of the present invention to provide a process for dyeing hair which is characterized by the fact that, after adding hydrogen peroxide to a dyeing composition as above defined, and rendering said composition alkaline by adding a base such as for example ammonia, it is applied to the hair, which is then rinsed, shampooed and dried.

A further object of the present invention is to provide as a new article of manufacture the compounds of Formula I.

The N-(ω-ureidoalkyl) para-phenylene diamines, that is to say those compounds of Formula I in which Z represents oxygen, may be prepared by reacting an alkaline isocyanate and preferably potassium isocyanate with a salt, and preferably with a monohalogenohydrate or a monoacetate, of a compound having the formula:



(II)

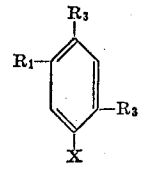
in which R_1, R_2 and n have the significance hereinbefore indicated, R_3 represents an NO_2 or NH_2 group and, when R_3 represents an NO_2 group, the latter is transformed into an NH_2 group by catalytic hydrogenation, using hydrazine hydrate in the presence of Raney's nickel, or by one of the conventional methods of reducing a nitro group, for example by using sodium hydrosulfite in an alkaline medium or by catalytic hydrogenation, such as hydrogenation in an acetic medium in the presence of palladium on charcoal.

The method of preparation which utilizes as a starting material a compound according to Formula II in which R_3 represents an NO_2 group, and in which said compound is reacted with an isocyanate, and the NO_2 group is then reduced by catalytic hydrogenation with hydrazine hydrate in the presence of Raney's nickel, constitutes a novel process.

The compounds according to Formula II which are used as the starting material may be prepared by condensing an alkylene diamine having the formula

$$H_2N—(CH_2)_n—NH_2$$

which may be in hydrate form, on a compound having the formula:



(III)

in which X represents a halogen ,and preferably chlorine or bromine, and R_1, R_2 and R_3 have the significance above indicated.

The N-(ω-thioureidoalkyl) para-phenylene diamines of Formula I in which Z representh a sulphur atom may be prepared by reacting in a first step carbon disulfide and sodium hydroxide with the above compound of Formula II in which R_3 represents an NO_2 group. This yields the corresponding dithiocarbamate, which is transformed in a second step by means of ethyl chloroformate into isothiocyanate, whic his then transformed into para-[N-(ω-thioureidoalkyl)] aminotrobenzene by reaction with ammonia. The nitro group of this compound is then reduced in a conventional manner. Several examples of the preparation and use of the compounds according to the invention will now be described purely by way of illustration.

EXAMPLE 1

Preparation of N-(β-ureidoethyl) para-phenylene diamine from para-[N-(β-aminoethyl)] aminonitrobenzene

(1) Preparation of para-[N-(β-ureidoethyl)] aminonitrobenzene: 37 g. (0.02 mole) of para-[N-(β-aminoethyl)] aminonitrobenzene is dissolved in 200 cm.³ of water at 30° C., to which 15 cm.³ (0.26 mole) of acetic acid has been added. 17 g. (0.21 mole) of potassium isocyanate is then rapidly added. The desired product precipitates immediately in a form which is very difficult to dry. 150 cm.³ of acetic acid is added to the reaction mixture and it is heated until the urein is completely dissolved. After slow cooling, drying yields 33 g. of para-[N-(β-ureidoethyl)] aminonitrobenzene in a well crystallized form, which is practically pure and melts at 187° C.

(2) Preparation of N-(β-ureidoethyl) para-phenylene diamine: 94 g. (0.42 mole) of para-[N-(β-ureidoethyl)] aminonitrobenzene is added little by little, while stirring, to 950 cm.³ of a 3 N solution of NaOH containing 285 g. of technical hydrosulfite, which has first been heated to 60° C. When the addition has been completed the reaction mixture is kept at 70° C. until decoloration is complete. The mixture is then filtered, cooled and dried after salting out. The result is 46 g. of N-(β-ureidoethyl) para-phenylene diamine which, after recrystallization in isopropyl alcohol, melts at 126°.

Analysis	Calculated for $C_9H_{14}N_4O$	Found
C, percent	55.67	55.59
H, percent	7.22	7.39
N, percent	28.86	28.86

EXAMPLE 2

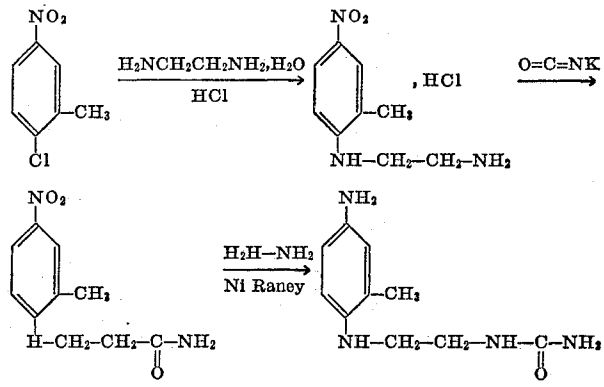
Preparation of N-(β-ureidoethyl)para-phenylene diamine from N-(β-aminoethyl)para-phenylene diamine monohydrobromide

2.43 g. (0.03 mole) of potassium isocyanate is added to 4.6 g. (0.02 mole) of N-(β-aminoethyl) para-phenylene diamine monohydrobromide in 20 cm.³ of water. This mixture is heated for 5 minutes at 60° C. under a nitrogen atmosphere. It is then cooled and salted out, using a concentrated solution of sodium hydroxide. Drying then yields the crude product in a very impure form. After recrystallization in normal butyl alcohol 0.96 g. of N-(β-ureidoethyl) para-phenylene diamine is obtained. This melts at 126°.

EXAMPLE 3

Preparation of 4-amino-2-methyl-N-(β-ureidoethyl) aniline

This product is prepared in the following manner:



4-nitro-2-methyl-N-(β-aminoethyl) aniline monohydrochloride is obtained by reacting ethylene diamine with 2-chloro-5-nitro-toluene. This monohydrochloride is then reacted with potassium isocyanate to produce 4-nitro-2-methyl-N-(β-ureidoethyl) aniline, which is reduced with hydrazine and Raney's nickel to 4-amino-2-methyl-N-(β-ureidoethyl) aniline.

First step—Praparation of 4-nitro - 2 - methyl-N-(β-aminoethyl) aniline monohydrochloride: 51.45 g. (0.3 mole) of 2-chloro-5-nitro-toluene is added to 200 cm.³ (2.5 moles) ethylene diamine hydrate. The mixture is heated at reflux for 5 hours, and the excess of ethylene diamine is then eliminated under vacuum. The residue is treated with 300 cm.³ of a 5 N solution of hydrochloric acid. Drying yields 60.5 g. of 4-nitro-2-methyl-N-(β-aminoethyl)aniline monohydrochloride, which is washed with acetone.

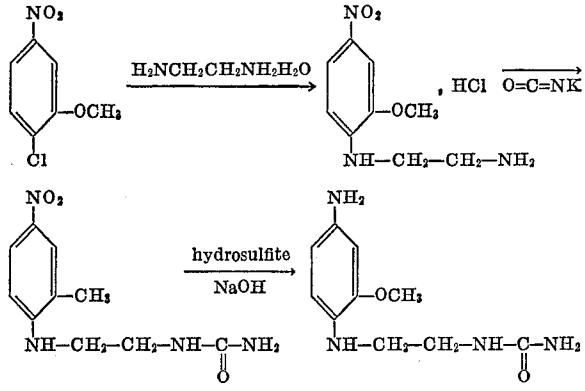
Second step—Preparation of 4-nitro-2-methyl-N-(β-ureidoethyl)aniline: 24.3 g. (0.3 mole) of potassium isocyanate in solution in 75 cm.³ of water is added to 57.9 g. (0.25 mole) of 4-nitro-2-methyl-N-(β-aminoethyl) aniline monohydrochloride in 235 cm.³ of water at 60°. After keeping the reaction mixture for 15 minutes in a boiling water bath, drying yields 48 g. of 4-nitro-2-methyl-N-(β-ureidoethyl)aniline which, after recrystallization in acetic acid, melts at 186° C.

Third step—Preparation of 4-amino-2-methyl-N-(β-ureidoethyl)aniline: 11.9 g. (0.05 mole) of 4-nitro-2-methyl-N-(β-ureidoethyl) aniline and 14 cm.³ (0.28 mole) hydrazine hydrate are introduced into 160 cm.³ of methanol. The mixture is brought to reflux and about 2 g. of Raney's nickel is added. Heating is continued until the solution becomes decolorized. After eliminating the nickel by filtration, the methanol is evaporated under vacuum and 9 g. of a crystallized residue is obtained which, after recrystallization in nitromethane, yields 8.2 g. of 4-amino-2-methyl-N-(β-ureidoethyl)aniline, which melts at 143° C.

Analysis	Calculated for $C_{10}H_{16}N_4O$	Found
C, percent	57.69	57.69–57.77
H, percent	7.69	7.69–7.72
N, percent	26.92	26.92–26.77

EXAMPLE 4

Preparation of 4-amino-2-methoxy-N-(β-ureidoethyl) aniline, utilizing the following reaction



Ethylene diamine is reacted with 2-chloro-5-nitroanisole to form 4-nitro - 2 - methoxy-N-(β-aminoethyl) aniline which is isolated in the form of its monohydrochloride. This monohydrochloride is reacted with potassium isocyanate to form 4-nitro-2-methoxy-N-(β-ureidoethyl) aniline which is reduced by a sodium hydrosulfite solution to 4-amino-2-methoxy-N-(β-ureidoethyl) aniline.

First step—Preparation of 4-nitro-methoxy-N-(β-aminoethyl)aniline monohydrochloride. 31 g. (0.165 mole) of 2-chloro-5-nitro-anisole is added to 130 cm.³ (1.65 mole) ethylene diamine hydrate. The reaction mixture is heated at reflux for five hours, and the excess of ethylene diamine driven off under vacuum. The residue is treated with 200 cm.³ of a 5 N hydrochloric acid solution, and dried, yielding 30 g. of 4-nitro-2-methoxy-N-(β-aminoethyl) aniline, which is washed with acetone.

Second step—Preparation of 4-nitro-2-methoxy-N-(β-ureidoethyl) aniline: 3.9 g. (0.048 mole) of potassium isocyanate in solution in 12 cm.³ of water is added to 9.4 g. (0.038 mole) of 4-nitro-2-methoxy-2 N-(β-aminoethyl) aniline monohydrochloride in 40 cm.³ of water at 50° C. After keeping the reaction mixture at 50° for 15 minutes drying yields 7 g. of 4-nitro-2-methoxy-N-(β-ureidoethyl) aniline which after recrystallization in aqueous acetic acid, melts at 183° C.

Analysis	Calculated for $C_{10}H_{14}N_4O_4$	Found
C, percent	47.24	46.99–47.18
H, percent	5.51	5.72–5.62
N, percent	22.05	21.77–21.64

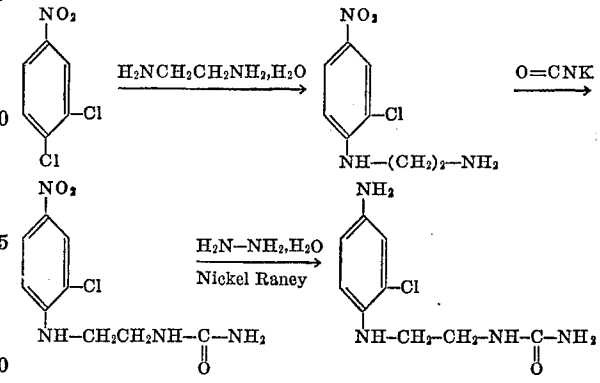
Third step—Preparation of 4-amino-2-methoxy-N-(β-ureidoethyl) aniline: 30 g. (0.118 mole) of 4-nitro-2-methoxy-N-(β-ureidoethyl) aniline is introduced little by little, while stirring and cooling, sufficiently to avoid any increase in temperature into 300 cm.³ of a 3 N solution of sodium hydroxide to which 120 g. of sodium hydrosulfite has been added and which has been brought to 70° C.

After decoloration of the reaction mixture, it is dried, washed first with water and then with alcohol. The yield is 18 g. of 4-amino-2-methoxy-N-(β-ureidoethyl) aniline which, after recrystallization in nitromethane, melts at 164° C.

Analysis	Calculated for $C_{10}H_{16}N_4O_2$	Found
C, percent	53.57	53.48
H, percent	7.14	7.06
N, percent	25.00	25.03

EXAMPLE 5

Preparation of 4-amino-2-chloro-N-(β-ureidoethyl) aniline, utilizing the following sequence of reactions



Ethylene diamine is reacted with 3,4-dichloronitrobenzene to form 4-nitro-2-chloro-N-(β-aminoethyl) aniline, which is reacted in an acetic solution with potassium isocyanate to form 4-nitro-2-chloro-N-(β-ureidoethyl) aniline. This latter compound is reduced with hydrazine in the Raney's nickel, yielding 4-amino-2-chloro-N-(β-ureidoethyl) aniline.

First step—Preparation of 4-nitro-2-chloro-N-(β-aminoethyl) aniline: 192 g. (1 mole) of 3,4-dichloro-nitrobenzene is added to 810 cm.³ (10 moles) ethylene diamine hydrate. The reaction mixture is heated at reflux for four hours and then poured into 2.5 liters of ice water. Drying yields 205 g. of 4-nitro-2-chloro-N-(β-aminoethyl) aniline which, after recrystallization in absolute ethanol, melts at 116° C.

Second step—Preparation of 4-nitro-2-chloro-N-(β-ureidoethyl) aniline: 100 g. (0.46 mole) of 4-nitro-2-chloro-N-(β-aminoethyl) aniline is dissolved in a liter of water to which 29 cm.³ of acetic acid has been added. 41.3 g. (0.51 mole) of potassium isocyanate is added to this reaction mixture, which is then left at the ambient temperature for two hours. Drying yields 110 g. of 4-nitro-2-chloro-N-(β-ureidoethyl) aniline which, after washing with dilute acetic acid and with water, followed by recrystallization in nitromethane, melts at 188° C.

Analysis	Calculated for $C_9H_{11}O_3N_4Cl$	Found
C, percent	41.77	42.09–42.16
H, percent	4.25	4.32–4.33
N, percent	21.66	21.64
C, percent	13.73	13.33–13.39

Third step—Preparation of 4-amino-2-chloro-N-(β-ureidoethyl) aniline: 51.7 g. (0.2 mole) of urein and 50 cm.³ (1 mole) of hydrazine hydrate is introduced into 600 cm.³ of methanol. The mixture is brought to reflux and about 8 g. of Raney's nickel is added little by little. Reflux is continued until the solution is decolorized. After eliminating the nickel by filtration and concentrating half the mother liquor under vacuum, cooling and drying yields 32 g. of 4 - amino - 2 - chloro - N - (β-ureidoethyl) aniline which, after recrystallization in methylisobutylketone, melts at 160° C.

Analysis	Calculated for $C_9H_{13}ON_4Cl$	Found
C, percent	47.26	47.94–47.72
H, percent	5.69	5.79–5.75
N, percent	24.51	24.21–24.32
Cl, percent	15.53	15.15

EXAMPLE 6

The following solution is prepared:

	G.
N-(β-ureidoethyl)para-phenylene diamine	1
Meta-aminophenol	3
20% lauryl ammonium sulfate, that is to say, aqueous ammonium lauryl sulfate solution, the concentration of which is 20% as referred to lauryl alcohol	200
Ethylene diamine tetra-acetic acid	3
20% ammonia	100
40% sodium bisulfite aqueous solution	10
Water, q.s.p.	1000

When this solution is mixed with an equal weight of 6% hydrogen peroxide and applied for 30 minutes to 100% white hair, an eggplant shade is produced.

EXAMPLE 7

The following solution is prepared:

	G.
3-N-carbamylmethylaminophenol	2.5
N-(β-ureidoethyl)para-phenylene diamine	1.5
20% lauryl ammonium sulfate	200
Ethylene diamine tetra-acetic acid	3
20% ammonia	100
40% sodium bisulfite	10
Water, q.s.p.	1000

When this solution is mixed with an equal weight of 6% hydrogen peroxide and applied for 30 minutes to 100% white hair, a violet gray results.

EXAMPLE 8

The following solution is prepared:

	G.
N-(β-ureidoethyl)para-phenylene diamine	1
Resorcinol	3
20% lauryl ammonium sulfate	200
Ethylene diamine tetra-acetic acid	3
20% ammonia	100
40% sodium bisulfite	10
Water, q.s.p.	1000

This solution, when mixed with an equal weight of 6% hydrogen peroxide and applied for 30 minutes to 100% white hair, produces a bright golden chestnut.

EXAMPLE 9

The following solution is prepared:

	G.
N-(β-ureidoethyl) para-phenylene diamine	1
Para-toluylene diamine	1
2,4-diamino anisole sulfate	5
4-γ - aminopropylamino - 1 - methylamino-anthraquinone	1
20% lauryl ammonium sulfate	200
Ethylene diamine tetra-acetic acid	3
20% ammonia	100
40% sodium bisulfite	10
Water, q.s.p.	1000

This solution, when mixed with an equal weight of 6% hydrogen peroxide and applied for 30 minutes to 100% white hair, produces a bluish black.

EXAMPLE 10

The following solution is prepared:

	G.
N-(β-ureidoethyl) para-phenylene diamine	1
3-hydroxy-phenylurea	2
20% lauryl ammonium sulfate	200
Ethylene diamine tetra-acetic acid	3
20% ammonia	100
40% sodium bisulfite	10
Water, q.s.p.	1000

This solution, when mixed with an equal weight of 6% hydrogen peroxide and applied for 30 minutes to 100% white hair produces a grayish blue.

EXAMPLE 11

The following solution is prepared:

	G.
4-amino-2-methyl-N-(β-ureidoethyl) aniline	1
Meta-aminophenol	3.5
20% aqueous solution of lauryl ammonium sulfate	200
Ethylene diamine tetra-acetic acid	3
20% ammonia	100
40% sodium bisulfite	10
Water, q.s.p.	1000

When this solution is mixed with an equal weight of 6% hydrogen peroxide, and applied to 100% wite hair for 30 minutes, a deep gray shade results.

EXAMPLE 12

The following solution is prepared:

	G.
4-amino-2-methyl-N-(β-ureidoethyl) aniline	1
2,4-diamino anisole sulfate	4
20% aqueous solution of lauryl ammonium sulfate	200
Ethylene diamine tetra-acetic acid	3
20% ammonia	100
40% sodium bisulfite	10
Water, q.s.p.	1000

This solution, when mixed with an equal weight of 6% hydrogen peroxide and applied for 30 minutes to 100% white hair, produces a greenish gray shade.

EXAMPLE 13

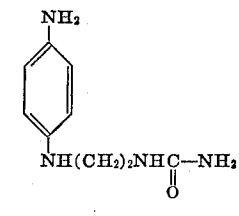
The following solution is prepared:

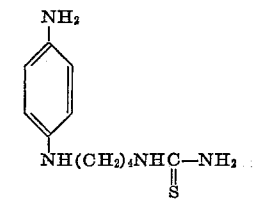
	G.
4-amino-2-methyl-N-(β-ureidoethyl) aniline	1
Meta-aminophenol	3.5
20% aqueous solution of lauryl ammonium sulfate	200
Ethylene diamine tetra-acetic acid	3
20% ammonia	100
40% sodium bisulfite	10
Water, q.s.p.	1000

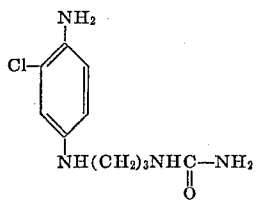
This solution, when mixed with an equal weight of 6% hydrogen peroxide and applied for 30 minutes to 100% white hair produces a rose blonde shade.

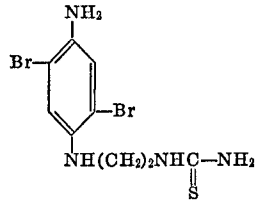
The dye compounds of this invention may be placed in any suitable carrier such as water, alcohol, etc., and they may be in any suitable form such as solution, gel, cream, aerosol, etc. Suitable carriers such as gelling agents, aerosol compositions, etc. are set forth in many text books, such as Cosmetic Materials, vol. I and II by Harry.

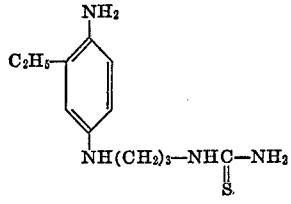
Illustrative oxidation dyes of this invention are:

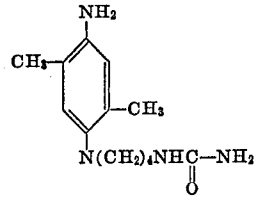


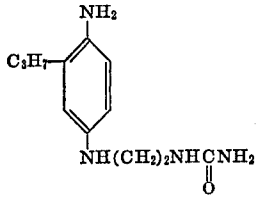


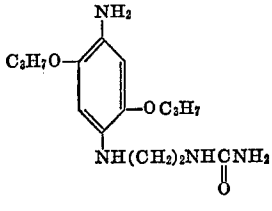


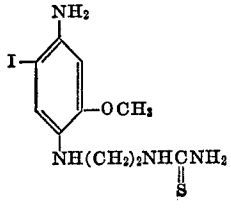






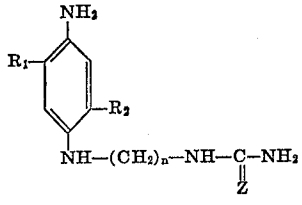






What is claimed is:

1. Composition for dyeing human hair comprising an aqueous alkaline solution of a coloring amount of an oxidation base compound selected from the group consisting of (a) a compound having the formula:



wherein R_1 and R_2 each independently are selected from the group consisting of hydrogen, halogen, alkyl having 1–3 carbon atoms and alkoxy having 1–3 carbon atoms, Z is selected from the group consisting of oxygen and sulfur, *n* is a whole number between 2 and 4, inclusive, and (b) an acid addition salt thereof selected from the group consisting of hydrochloride and hydrobromide.

2. The composition of claim 1 in which the concentration of the base is between 0.1 and 10% by weight.

3. The composition of claim 1 which also contains an effective coupling amount of a coupler selected from the group consisting of metaaminophenol, - 3-N-carbamyl methylaminophenol, resorcinol, metaphenylene diamine, 2, 4-diamino anisole sulfate and 3-hydroxy phenylurea, the molar ratio of base to coupler ranging between 1:1 to 1:4.

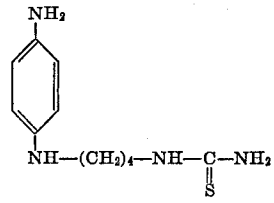
4. The composition of claim 1 wherein the pH is between 8 and 10.

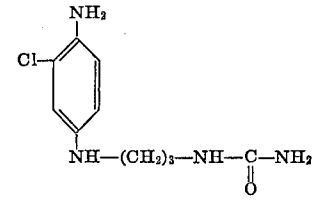
5. The composition of claim 3 in which the ratio of base to coupler is less than 1.

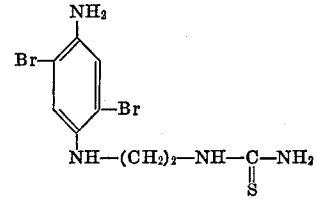
6. A method of dyeing human hair comprising applying to said hair to be dyed a dyeing amount of the composition of claim 1 in the presence of hydrogen peroxide.

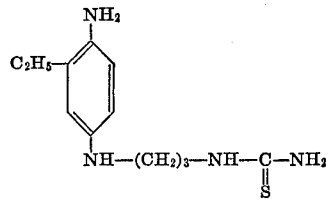
7. The method of claim 6, in which said composition is left in contact with said hair for 5 to 30 minutes, after which the hair is rinsed, shampooed and dried.

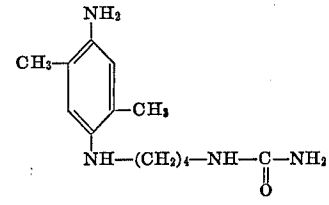
8. A composition for dyeing human hair comprising an aqueous alkaline solution of an oxidation base compound seletced from the group consisting of N-(β-ureidoethyl) para-phenylene diamine, 4-amino-2-methyl-N-(β-ureidoethyl) aniline, 4-amino-2-methoxy-N-(β-ureidoethyl) aniline, 4-amino-2-chloro-N-(β-ureidoethyl) aniline,

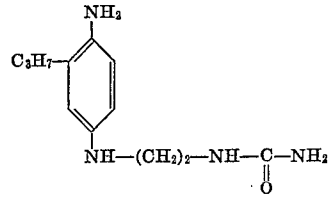


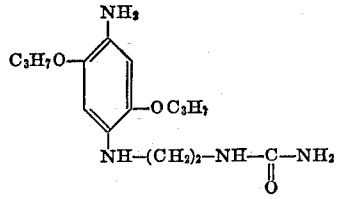




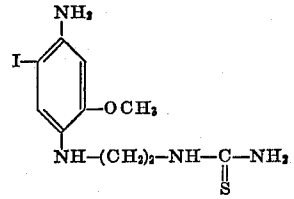








and



said compound being present in amounts between 0.1–10% by weight of said composition.

9. The composition of claim 8 also including a coupler selected from the group consisting of meta-aminophenol, 3-N-carbamethyleneaminophenol, resorcinol, metaphenylene diamine, 2,4-diamino anisole sulfate and 3-hydroxy phenylurea, the molar ratio of base to coupler ranging between 1:1 to 1:4.

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U.S. Cl. X.R.

8—11; 260—552 R, 553 A