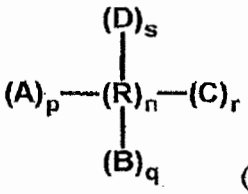
LIQ 100 CIP PCT

1. A method for treating hair, wherein the hair comprises two or more free thiol groups, comprising:

(a) applying to the hair a formulation comprising a binding agent of Formula I



(I)

wherein

A, B, C, and D are reactive moieties capable of reacting with the free thiol groups each containing one or more charges, wherein each of the A, B, C, and D reactive moieties independently contain a moiety selected from the group consisting of a vinyl sulfone, an acrylate group, a methacrylate group, a styrene group, an acryl amide group, a methacryl amide group, a maleate group, a fumarate group, and an itaconate group;

R is a linker that contains two or more charges, wherein the charges are opposite to the charges on the reactive moieties, wherein n = 1-10, and wherein R is not a polymer, and

the sum of the charges is zero, and

wherein the reactive moieties are ionically bound to the linker;

wherein each occurrence of p, q, r, and s is independently an integer from 0 to 25, and wherein the sum of p + q + r + s is equal to or greater than 2, in an effective amount to covalently bind the free thiol groups.

2. The method of claim 1, wherein the reactive moieties and the thiol groups react to form carbon-sulfur (C-S) covalent bonds.

3. The method of any of claims 1-2, wherein A, B, C, and D are the same.

4. The method of any of claims 1-2, wherein at least one of A, B, C, and D is different than the other reactive moieties.

5. The method of any of claims 1-4, wherein the linker is a polyfunctional molecule, and wherein the linker is optionally independently substituted with one or more substituents including hydrogen, halogen, cyano, alkoxy, alkyl, alkenyl, cycloalkyl, cycloalkenyl, aryl,

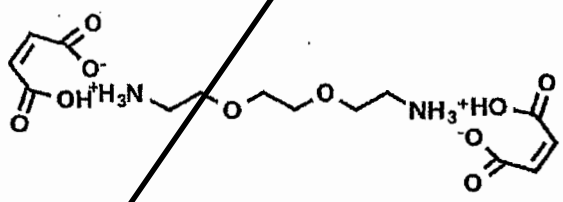
AMENDED SHEET

Received at the EPO on Sep 28, 2015 17:06:16. Page 11 of 24

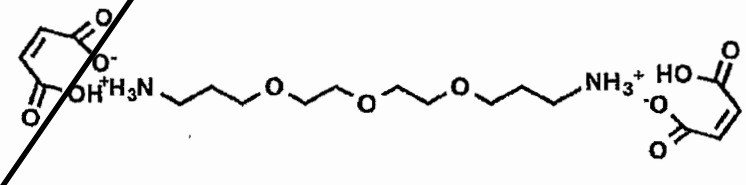
LIQ 100 CIP PCT

heterocycloalkyl, heteroaryl, amine, hydroxy, formyl, acyl, carboxylic acid (-COOH), $-C(O)R^1$, $-C(O)OR^1$, carboxylate ($-COO^-$), primary amide (*e.g.*, $-CONH_2$), secondary amide (*e.g.*, $-CONHR_{11}$), $-C(O)NR^1R^2$, $-NR^1R^2$, $-NR^1S(O)_2R^2$, $-NR^1C(O)R^2$, $-S(O)_2R^2$, $-SR^1$, and $-S(O)_2NR^1R^2$, sulfinyl group (*e.g.*, $-SOR^1$), and sulfonyl group (*e.g.*, $-SOOR^1$);
wherein R^1 and R^2 may each independently be hydrogen, alkyl, alkenyl, alkynyl, cycloalkyl, aryl, heterocycloalkyl and heteroaryl; wherein each of R^1 and R^2 is optionally independently substituted with one or more substituents selected from the group consisting of halogen, hydroxyl, cyano, nitro, amino, alkylamino, dialkylamino, alkyl optionally substituted with one or more halogen or alkoxy or aryloxy, aryl optionally substituted with one or more halogen or alkoxy or alkyl or trihaloalkyl, heterocycloalkyl optionally substituted with aryl or heteroaryl or =O or alkyl optionally substituted with hydroxyl, cycloalkyl optionally substituted with hydroxyl, heteroaryl optionally substituted with one or morehalogen or alkoxy or alkyl or trihaloalkyl, haloalkyl, hydroxyalkyl, carboxy, alkoxy, aryloxy, alkoxycarbonyl, aminocarbonyl, alkylaminocarbonyl, and dialkylaminocarbonyl.

6. The method of any of claims 1-5, wherein the binding agent is:



or



7. The method of any of claims 1-6, wherein the formulation further comprises one or more cosmetically acceptable excipients,

wherein the one or more excipients are selected from the group consisting of water, surfactants, vitamins, natural extracts, preservatives, chelating agents, perfumes, preservatives, antioxidants, chelating agents, hair

AMENDED SHEET

coloring agents, proteins, amino acids, humectants, fragrances, emollients, penetrants, thickeners, viscosity modifiers, hair fixatives, film formers, emulsifiers, opacifying agents, propellants, liquid vehicles, carriers, salts, pH adjusting agents, neutralizing agents, buffers, hair conditioning agents, anti-static agents, anti-frizz agents, anti-dandruff agents, and combinations thereof.

8. The method of claim 7, wherein the binding agent is present in an amount ranging from about 0.01 wt% to about 50 wt% of the formulation.

9. The method of any of claims 7-8, wherein the binding agent is about 3 wt% of the formulation.

10. The method of any of claims 7-9, wherein the excipient is present in an amount ranging from about 10 wt% to about 90 wt% of the formulation.

11. The method of any of claims 1-10, wherein the formulation is in the form of a gel, cream, lotion, shampoo, or conditioner.

12. The method of any of claims 1-11, wherein step (a) is repeated one or more times.

13. The method of any of claims 1-12, wherein step (a) is repeated about 1 minutes to 20 minutes after the first application of the formulation.

14. The method of any of claims 1-13, further comprising,

(b) rinsing, shampooing, and/or conditioning the hair, wherein step (b) occurs subsequent to step (a).

15. The method of claim 14, wherein step (b) is performed within about 10 seconds and about 30 minutes after step (a).

16. The method of any of claims 1-15, further comprising the step of:

applying a first formulation comprising a reducing agent capable of reducing the disulfide bonds in the hair to produce free thiol groups,

wherein the step is performed prior to applying the formulation comprising the binding agent.

17. The method of claim 16, wherein the reducing agent is selected from the group consisting of thioglycolic acid and its derivative salts and esters, thiolactic acid and its derivative salts and esters, cysteine and its derivatives, cysteamine and its derivatives, inorganic sulfites, sodium metabisulfite, other inorganic bisulfites, dithiothreitol, dithioerythritol, organic phosphines, and

LIQ 100 CIP PCT

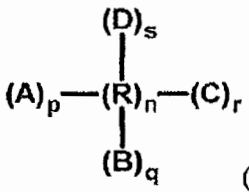
Japanese relaxers.

18. The method of any of claims 1-17, wherein the thiols remain bound for at least one week.

19. The method of any of claims 1-18, wherein the molecular weight of the binding agent is less than about 500 Daltons.

20. A formulation consisting of a binding agent, an aqueous solvent, and one or more preservatives, stabilizers, or combinations thereof,

wherein the binding agent is represented by Formula I:



(I)

wherein

A, B, C, and D are reactive moieties capable of reacting with the free thiol groups each containing one or more charges, wherein each of the A, B, C, and D reactive moieties independently contain a moiety selected from the group consisting of a vinyl sulfone, an acrylate group, a methacrylate group, a styrene group, an acryl amide group, a methacryl amide group, a maleate group, a fumarate group, and an itaconate group;

R is a linker that contains two or more charges, wherein the charges are opposite to the charges on the reactive moieties, wherein n = 1-10, and wherein R is not a polymer, and

the sum of the charges is zero, and

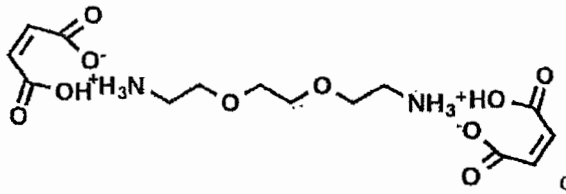
wherein the reactive moieties are ionically bound to the linker;

wherein each occurrence of p, q, r, and s is independently an integer from 0 to 25, and wherein the sum of p + q + r + s is equal to or greater than 2.

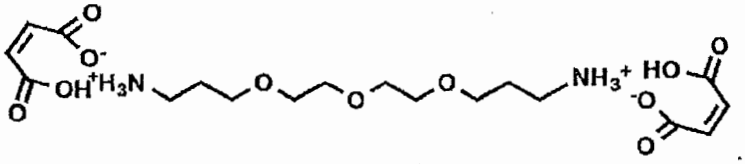
21. The formulation of claim 20, wherein the binding agent is:

AMENDED SHEET

LIQ 100 CIP PCT



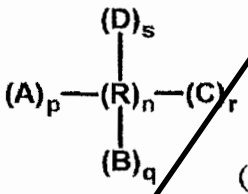
or



22. A method for coloring hair comprising:

(a) applying a first formulation comprising a hair coloring agent and a reducing agent capable of reducing the disulfide bonds in the hair to produce free thiol groups,

(b) applying to the hair a second formulation comprising a binding agent of Formula I



(I)

wherein

A, B, C, and D are reactive moieties capable of reacting with the free thiol groups each containing one or more charges, wherein each of the A, B, C, and D reactive moieties independently contain a moiety selected from the group consisting of a vinyl sulfone, an acrylate group, a methacrylate group, a styrene group, an acryl amide group, a methacryl amide group, a maleate group, a fumarate group, and an itaconate group;

R is a linker that contains two or more charges, wherein the charges are opposite to the charges on the reactive moieties, wherein n = 1-10, and wherein R is not a polymer, and

the sum of the charges is zero, and

wherein the reactive moieties are ionically bound to the linker;

wherein each occurrence of p, q, r, and s is independently an integer from 0 to 25, and wherein the sum of p + q + r + s is equal to or greater than 2,

AMENDED SHEET

Received at the EPO on Sep 28, 2015 17:06:16. Page 15 of 24

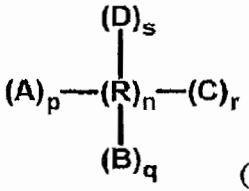
LIQ 100 CIP PCT

in an effective amount to covalently bind the free thiol groups.

23. A method for highlighting hair comprising:

(a) applying a first formulation comprising bleach to lighten hair and produce free thiol groups,

(b) applying to the hair a second formulation comprising a binding agent of Formula I



(I)

wherein

A, B, C, and D are reactive moieties capable of reacting with the free thiol groups each containing one or more charges, wherein each of the A, B, C, and D reactive moieties independently contain a moiety selected from the group consisting of a vinyl sulfone, an acrylate group, a methacrylate group, a styrene group, an acryl amide group, a methacryl amide group, a maleate group, a fumarate group, and an itaconate group;

R is a linker that contains two or more charges, wherein the charges are opposite to the charges on the reactive moieties, wherein n = 1-10, and wherein R is not a polymer, and

the sum of the charges is zero, and

wherein the reactive moieties are ionically bound to the linker;

wherein each occurrence of p, q, r, and s is independently an integer from 0 to 25, and wherein the sum of p + q + r + s is equal to or greater than 2,

in an effective amount to covalently bind the free thiol groups.

24. The method of claim 22 or 23, wherein steps (a) and (b) are performed simultaneously.

25. The method of claim 22 or 23, wherein steps (a) and (b) are performed sequentially, with step (a) performed prior to step (b).

26. The method of claim 24, wherein prior to step (a), the first formulation and the second formulation are mixed together.

27. The method of any of claims 22-26, wherein the reactive moieties

AMENDED SHEET

LIQ 100 CIP PCT

and the thiol groups react to form carbon-sulfur (C-S) covalent bonds.

28. The method of any of claims 22-27, wherein A, B, C, and D are the same.

29. The method of any of claims 22-27, wherein at least one of A, B, C, and D is different than the other reactive moieties.

30. The method of any of claims 22-29, wherein the linker is a polyfunctional molecule,

wherein the linker is optionally independently substituted with one or more substituents including hydrogen, halogen, cyano, alkoxy, alkyl, alkenyl, cycloalkyl, cycloalkenyl, aryl, heterocycloalkyl, heteroaryl, amine, hydroxy, formyl, acyl, carboxylic acid (-COOH), - $C(O)R^1$, $-C(O)OR^1$, carboxylate ($-COO^-$), primary amide (*e.g.*, $-CONH_2$), secondary amide (*e.g.*, $-CONHR_{11}$), $-C(O)NR^1R^2$, $-NR^1R^2$, $-NR^1S(O)_2R^2$, $-NR^1C(O)R^2$, $-S(O)_2R^2$, - SR^1, and $-S(O)_2NR^1R^2$, sulfinyl group (*e.g.*, $-SOR^1$), and sulfonyl group (*e.g.*, $-SOOR^1$);

wherein R^1 and R^2 may each independently be hydrogen, alkyl, alkenyl, alkynyl, cycloalkyl, aryl, heterocycloalkyl and heteroaryl; wherein each of R^1 and R^2 is optionally independently substituted with one or more substituents selected from the group consisting of halogen, hydroxyl, cyano, nitro, amino, alkylamino, dialkylamino, alkyl optionally substituted with one or more halogen or alkoxy or aryloxy, aryl optionally substituted with one or more halogen or alkoxy or alkyl or trihaloalkyl, heterocycloalkyl optionally substituted with aryl or heteroaryl or =O or alkyl optionally substituted with hydroxyl, cycloalkyl optionally substituted with hydroxyl, heteroaryl optionally substituted with one or more halogen or alkoxy or alkyl or trihaloalkyl, haloalkyl, hydroxyalkyl, carboxy, alkoxy, aryloxy, alkoxycarbonyl, aminocarbonyl, alkylaminocarbonyl, and dialkylaminocarbonyl.

31. The method of any of claims 22-30, wherein the binding agent is:

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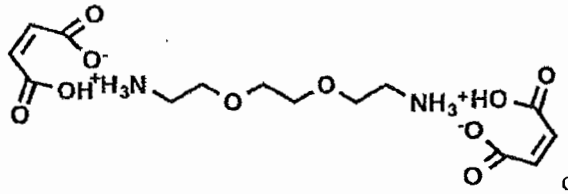
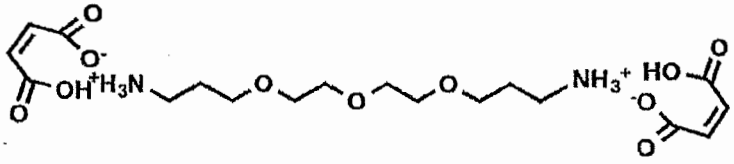


or



32. The method of any of claims 22-31, wherein the second formulation further comprises one or more cosmetically acceptable excipients, and

wherein the one or more excipients are selected from the group consisting of water, surfactants, vitamins, natural extracts, preservatives, chelating agents, perfumes, preservatives, antioxidants, proteins, amino acids, humectants, fragrances, emollients, penetrants, thickeners, viscosity modifiers, hair fixatives, film formers, emulsifiers, opacifying agents, propellants,

liquid vehicles, carriers, salts, pH adjusting agents, neutralizing agents, buffers, hair conditioning agents, anti-static agents, anti-frizz agents, anti-dandruff agents, and combinations thereof.

33. The method of claim 32, wherein the binding agent is present in an amount ranging from about 0.01 wt% to about 50 wt% of the second formulation, preferably from about 0.01 wt% to about 10 wt% of the second formulation.

34. The method of any of claims 31-33, wherein the binding agent is present in an amount ranging from about 2.5 to 3 wt% of the second formulation.

35. The method of any of claims 31-34, wherein the excipient is present in an amount ranging from about 10 wt% to about 99.99 wt% of the second formulation, preferably from about 50 wt% to about 90 wt% of the second formulation.

36. The method of any of claims 22-35, wherein the second formulation is in the form of a gel, cream, lotion, shampoo, or conditioner.

37. The method of any of claims 22-36, wherein step (b) is repeated one

LIQ 100 CIP PCT

or more times.

38. The method of any of claims 22-37, further comprising,

(c) rinsing, shampooing, and/or conditioning the hair, wherein step (c) occurs subsequent to step (b).

39. The method of claim 38, wherein step (c) is performed within about 10 seconds to about 30 minutes, preferably between about 1 minute and about 20 minutes, more preferably about 10 minutes after step (b).

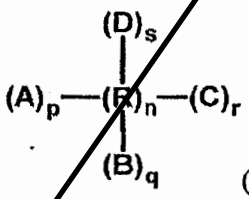
40. The method of any of claims 22-39, wherein the coloring agent is selected from the group consisting of highlighting agents, permanent coloring agents, demi-permanent coloring agents, and semi-permanent coloring agents.

41. A kit comprising:

(a) a first formulation comprising a reducing agent capable of reducing disulfide bonds in hair to produce free thiol groups, and

(b) a second formulation comprising a binding agent in an effective amount to covalently bind free thiol groups in hair,

wherein the binding agent is represented by Formula I:



(I)

wherein

A, B, C, and D are reactive moieties capable of reacting with the free thiol groups each containing one or more charges, wherein each of the A, B, C, and D reactive moieties independently contain a moiety selected from the group consisting of a vinyl sulfone, an acrylate group, a methacrylate group, a styrene group, an acryl amide group, a methacryl amide group, a maleate group, a fumarate group, and an itaconate group;

R is a linker that contains two or more charges, wherein the charges are opposite to the charges on the reactive moieties, wherein n = 1-10, and wherein R is not a polymer, and

the sum of the charges is zero, and

wherein the reactive moieties are ionically bound to the linker;

Received at the EPO on Sep 28, 2015 17:06:16. Page 19 of 24

LIQ 100 CIP PCT

wherein each occurrence of p, q, r, and s is independently an integer from 0 to 25, and wherein the sum of p + q + r + s is equal to or greater than 2.

42. The kit of claim 41, further comprising a shampoo, a conditioner, instructions for use, a developer, mixing container, an odor eliminator, gloves, or a combination thereof.

43. The kit of any of claims 41-42, wherein the first formulation is a bleaching, straightening, waving, curling, or coloring formulation.

44. The kit of any of claims 41-43, wherein A, B, C, and D are the same.

45. The kit of any of claims 41-44, wherein at least one of A, B, C, and D is different than the other reactive moieties.

46. The kit of any of claims 41-45, wherein the linker is a polyfunctional molecule,

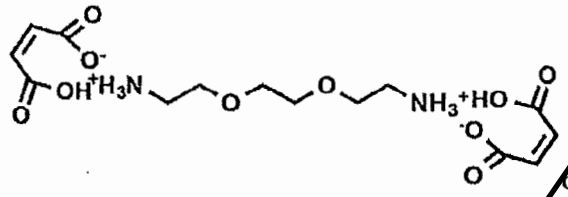
wherein the linker is optionally independently substituted with one or more substituents selected from the group consisting of hydrogen, halogen, cyano, alkoxy, alkyl, alkenyl, cycloalkyl, cycloalkenyl, aryl, heterocycloalkyl, heteroaryl, amine, hydroxy, formyl, acyl, carboxylic acid (-COOH), $-C(O)R^1$, $-C(O)OR^1$, carboxylate ($-COO^-$), primary amide (*e.g.*, $-CONH_2$), secondary amide (*e.g.*, $-CONHR_{11}$), $-C(O)NR^1R^2$, $-NR^1R^2$, $-NR^1S(O)_2R^2$, $-NR^1C(O)R^2$, $-S(O)_2R^2$, $-SR^1$, and $-S(O)_2NR^1R^2$, sulfinyl group (*e.g.*, $-SOR^1$), and sulfonyl group (*e.g.*, $-SOOR^1$);

wherein R^1 and R^2 may each independently be hydrogen, alkyl, alkenyl, alkynyl, cycloalkyl, aryl, heterocycloalkyl and heteroaryl; wherein each of R^1 and R^2 is optionally independently substituted with one or more substituents selected from the group consisting of halogen, hydroxyl, cyano, nitro, amino, alkylamino, dialkylamino, alkyl optionally substituted with one or more halogen or alkoxy or aryloxy, aryl optionally substituted with one or more halogen or alkoxy or alkyl or trihaloalkyl, heterocycloalkyl optionally substituted with aryl or heteroaryl or =O or alkyl optionally substituted with hydroxyl, cycloalkyl optionally substituted with hydroxyl, heteroaryl optionally substituted with one or more halogen or alkoxy or alkyl or trihaloalkyl, haloalkyl, hydroxyalkyl, carboxy, alkoxy, aryloxy,

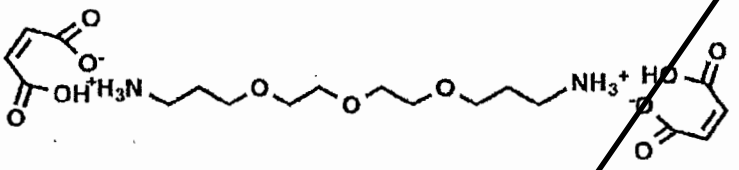
alkoxycarbonyl, aminocarbonyl, alkylaminocarbonyl, and dialkylaminocarbonyl.

47. The kit of any of claims 41-46, wherein the reactive moieties and the thiol groups react to form carbon-sulfur (C-S) covalent bonds.

48. The kit of any of one of claims 41-47, wherein the binding agent is:



or



49. The kit of any of claims 41-48, wherein the second formulation further comprises one or more cosmetically acceptable excipients selected from the group consisting of water, surfactants, vitamins, natural extracts, preservatives, chelating agents, perfumes, preservatives, antioxidants, chelating agents, hair coloring agents, proteins, amino acids, humectants, fragrances, emollients, penetrants, thickeners, viscosity modifiers, hair fixatives, film formers, emulsifiers, opacifying agents, propellants, liquid vehicles, carriers, salts, pH adjusting agents, neutralizing agents, buffers, hair conditioning agents, anti-static agents, anti-frizz agents, anti-dandruff agents, and combinations thereof.

50. The kit of any of claims 41-49, wherein the binding agent is present in an amount ranging from about 0.01 wt% to about 50 wt% of the second formulation.

51. The kit of any of claims 41-50, wherein the excipient is present in an amount ranging from about 10 wt% to about 90 wt% of the second formulation.

52. The kit of any of claims 41-51, wherein the first and second formulations are pre-mixed.

53. The kit of any of claims 41-52, wherein the second formulation is pre-mixed with a shampoo or conditioner.

LIQ 100 CIP PCT

54. The kit of any of claims 41-53, wherein the second formulation is in the form of a liquid, lotion, milk, mousse, spray, gel, cream, shampoo, or conditioner.

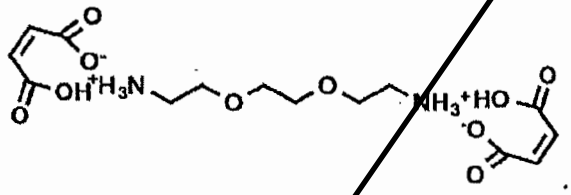
55. The kit of any of claims 41-54, wherein the second formulation is provided as two or more separate ingredients.

56. The kit of any of claims 41-55, wherein the binding agent is provided as a dry powder in a sealed package and the pharmaceutically acceptable excipient provided in a vial or other container.

57. The kit of any of claims 41-56, wherein:

(1) the first formulation is a bleaching formulation; and

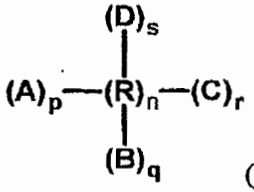
(2) the binding agent of the second formulation is



58. The kit of claim 57, wherein the bleaching formulation further comprises a developer.

59. The kit of any of claims 57-58, further comprising a shampoo, a conditioner, instructions for use, a developer, mixing container, an odor eliminator, or a combination thereof.

60. A shampoo or conditioner comprising an effective amount of a binding agent, wherein the binding agent is represented by Formula I:



(I)

wherein

A, B, C, and D are reactive moieties capable of reacting with the free thiol groups each containing one or more charges, wherein each of the A, B, C, and D reactive moieties independently contain a moiety selected from the group consisting of a vinyl sulfone, an acrylate group, a methacrylate group,

AMENDED SHEET

LIQ 100 CIP PCT

a styrene group, an acryl amide group, a methacryl amide group, a maleate group, a fumarate group, and an itaconate group;

R is a linker that contains two or more charges, wherein the charges are opposite to the charges on the reactive moieties, wherein n = 1-10, and wherein R is not a polymer, and

the sum of the charges is zero, and

wherein the reactive moieties are ionically bound to the linker; wherein each occurrence of p, q, r, and s is independently an integer from 0 to 25, and wherein the sum of p + q + r + s is equal to or greater than 2.

61. The shampoo or conditioner of claim 60, wherein the reactive moieties and the thiol groups react to form carbon-sulfur (C-S) covalent bonds.

62. The shampoo or conditioner of any of claims 60-61, wherein A, B, C, and D are the same.

63. The shampoo or conditioner of any of claims 60-61, wherein at least one of A, B, C, and D is different than the other reactive moieties.

64. The shampoo or conditioner of any of claims 60-63, wherein the linker is a polyfunctional molecule,

wherein the linker is optionally independently substituted with one or more substituents selected from the group consisting of hydrogen, halogen, cyano, alkoxy, alkyl, alkenyl, cycloalkyl, cycloalkenyl, aryl, heterocycloalkyl, heteroaryl, amine, hydroxy, formyl, acyl, carboxylic acid (-COOH), $-C(O)R^1$, $-C(O)OR^1$, carboxylate (-COO-), primary amide (e.g., $-CONH_2$), secondary amide (e.g., $-CONHR^1$), $-C(O)NR^1R^2$, $-NR^1R^2$, $-NR^1S(O)_2R^2$, $-NR^1C(O)R^2$, $-S(O)_2R^2$, $-SR^1$, and $-S(O)_2NR^1R^2$, sulfinyl group (e.g., $-SOR^{11}$), and sulfonyl group (e.g., $-SOOR^1$);

wherein R^1 and R^2 may each independently be hydrogen, alkyl, alkenyl, alkynyl, cycloalkyl, aryl, heterocycloalkyl and heteroaryl;

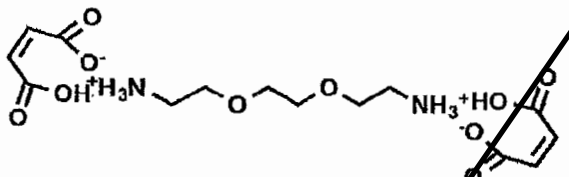
wherein each of R^1 and R^2 is optionally independently substituted with one or more substituents selected from the group consisting of halogen, hydroxyl, cyano, nitro, amino, alkylamino, dialkylamino, alkyl optionally substituted with one or more halogen or alkoxy or aryloxy, aryl optionally substituted with one or more halogen or alkoxy or alkyl or trihaloalkyl,

AMENDED SHEET

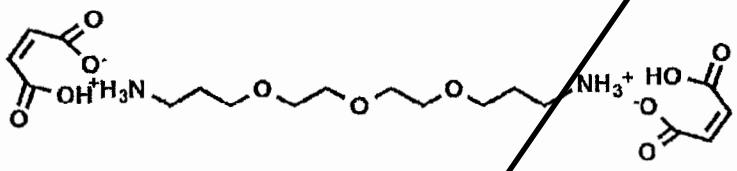
LIQ 100 CIP PCT

heterocycloalkyl optionally substituted with aryl or heteroaryl or =O or alkyl optionally substituted with hydroxyl, cycloalkyl optionally substituted with hydroxyl, heteroaryl optionally substituted with one or more halogen or alkoxy or alkyl or trihaloalkyl, haloalkyl, hydroxyalkyl, carboxy, alkoxy, aryloxy, alkoxycarbonyl, aminocarbonyl, alkylaminocarbonyl, and dialkylaminocarbonyl.

65. The shampoo or conditioner of any of claims 60-64, wherein the binding agent is:



or



66. The shampoo or conditioner of any of claims 60-65, further comprising one or more cosmetically acceptable excipients, wherein the one or more excipients are selected from the group consisting of water, surfactants, vitamins, natural extracts, preservatives, chelating agents, perfumes, preservatives, antioxidants, chelating agents, hair coloring agents, proteins, amino acids, humectants, fragrances, emollients, penetrants, thickeners, viscosity modifiers, hair fixatives, film formers, emulsifiers, opacifying agents, propellants, liquid vehicles, carriers, salts, pH adjusting agents, neutralizing agents, buffers, hair conditioning agents, anti-static agents, anti-frizz agents, anti-dandruff agents, and combinations thereof.

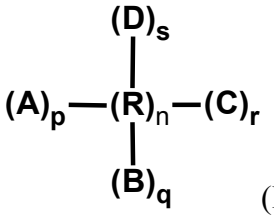
67. The shampoo or conditioner of claim 66, wherein the binding agent is present in an amount ranging from about 0.01 wt% to about 50 wt% of the formulation.

68. The shampoo or conditioner of any of claims 66-67, wherein the binding agent is present in an amount ranging from about 2.5 to 3 wt% of the formulation.

CLAIMS

1. A method for treating hair, in which the hair comprises two or more free thiol groups, comprising:

(a) applying to the hair a formulation comprising a binding agent of Formula I



(I)

in which

A, B, C, and D are reactive moieties capable of reacting with the free thiol groups each containing one or more charges, in which each of the A, B, C, and D reactive moieties independently contain a moiety selected from the group consisting of a vinyl sulfone, an acrylate group, a methacrylate group, a styrene group, an acryl amide group, a methacryl amide group, a maleate group, a fumarate group, and an itaconate group;

R is a linker that contains two or more charges, in which the charges are opposite to the charges on the reactive moieties, in which n = 1-10, and in which R is not a polymer, and

the sum of the charges is zero, and

in which the reactive moieties are ionically bound to the linker;

in which each occurrence of p, q, r, and s is independently an integer from 0 to 25, and in which the sum of p + q + r + s is equal to or greater than 2, in an effective amount to covalently bind the free thiol groups.

2. A method according to Claim 1, in which the reactive moieties and the thiol groups react to form carbon-sulfur (C-S) covalent bonds.

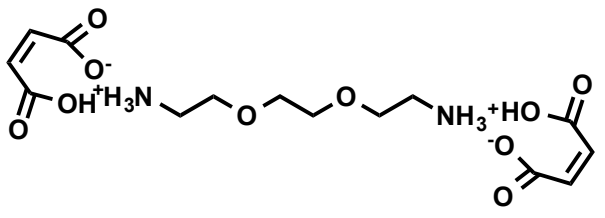
3. A method according to Claim 1 or 2, in which A, B, C, and D are the same.

4. A method according to Claim 1 or 2, in which at least one of A, B, C, and D is different than the other reactive moieties.

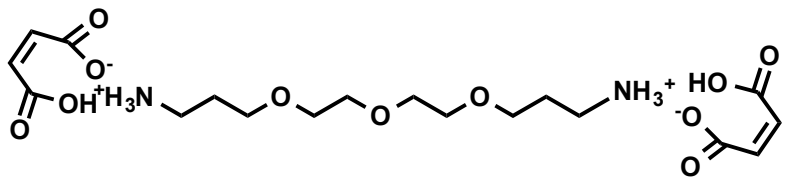
5. A method according to any preceding claim, in which the linker is a polyfunctional molecule, and in which the linker is optionally independently substituted with one or more substituents including hydrogen, halogen, cyano, alkoxy, alkyl, alkenyl, cycloalkyl, cycloalkenyl, aryl, heterocycloalkyl, heteroaryl, amine, hydroxy, formyl, acyl, carboxylic acid (-COOH), $-C(O)R^1$, $-C(O)OR^1$, carboxylate ($-COO^-$), primary amide (*e.g.*, $-CONH_2$), secondary amide (*e.g.*, $-CONHR_{11}$), $-C(O)NR^1R^2$, $-NR^1R^2$, $-NR^1S(O)_2R^2$, $-NR^1C(O)R^2$, $-S(O)_2R^2$, $-SR^1$, and $-S(O)_2NR^1R^2$, sulfinyl group (*e.g.*, $-SOR^1$), and sulfonyl group (*e.g.*, $-SOOR^1$);

in which R^1 and R^2 may each independently be hydrogen, alkyl, alkenyl, alkynyl, cycloalkyl, aryl, heterocycloalkyl and heteroaryl; in which each of R^1 and R^2 is optionally independently substituted with one or more substituents selected from the group consisting of halogen, hydroxyl, cyano, nitro, amino, alkylamino, dialkylamino, alkyl optionally substituted with one or more halogen or alkoxy or aryloxy, aryl optionally substituted with one or more halogen or alkoxy or alkyl or trihaloalkyl, heterocycloalkyl optionally substituted with aryl or heteroaryl or =O or alkyl optionally substituted with hydroxyl, cycloalkyl optionally substituted with hydroxyl, heteroaryl optionally substituted with one or morehalogen or alkoxy or alkyl or trihaloalkyl, haloalkyl, hydroxyalkyl, carboxy, alkoxy, aryloxy, alkoxycarbonyl, aminocarbonyl, alkylaminocarbonyl, and dialkylaminocarbonyl.

6. A method according to any preceding claim, in which the binding agent is:



or



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7. A method according to any preceding claim, in which the formulation further comprises one or more cosmetically acceptable excipients,

in which the one or more excipients are selected from the group consisting of water, surfactants, vitamins, natural extracts, preservatives, chelating agents, perfumes, preservatives, antioxidants, chelating agents, hair coloring agents, proteins, amino acids, humectants, fragrances, emollients, penetrants, thickeners, viscosity modifiers, hair fixatives, film formers, emulsifiers, opacifying agents, propellants, liquid vehicles, carriers, salts, pH adjusting agents, neutralizing agents, buffers, hair conditioning agents, anti-static agents, anti-frizz agents, anti-dandruff agents, and combinations thereof.

8. A method according to Claim 7, in which the binding agent is present in an amount ranging from about 0.01 wt% to about 50 wt% of the formulation.

9. A method according to Claim 7 or 8, in which the binding agent is about 3 wt% of the formulation.

10. A method according to Claim 7, 8 or 9, in which the excipient is present in an amount ranging from about 10 wt% to about 90 wt% of the formulation.

11. A method according to any preceding claim, in which the formulation is in the form of a gel, cream, lotion, shampoo, or conditioner.

12. A method according to any preceding claim, in which step (a) is repeated one or more times.

13. A method according to any preceding claim, in which step (a) is repeated about 1 minutes to 20 minutes after the first application of the formulation.

14. A method according to any preceding claim, further comprising,

(b) rinsing, shampooing, and/or conditioning the hair, in which step (b) occurs subsequent to step (a).

15. A method according to Claim 14, in which step (b) is performed within about 10 seconds and about 30 minutes after step (a).

16. A method according to any preceding claim, further comprising the step of:

applying a first formulation comprising a reducing agent capable of reducing the disulfide bonds in the hair to produce free thiol groups,

in which the step is performed prior to applying the formulation comprising the binding agent.

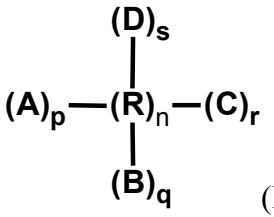
17. A method according to Claim 16, in which the reducing agent is selected from the group consisting of thioglycolic acid and its derivative salts and esters, thiolactic acid and its derivative salts and esters, cysteine and its derivatives, cysteamine and its derivatives, inorganic sulfites, sodium metabisulfite, other inorganic bisulfites, dithiothreitol, dithioerythritol, organic phosphines, and Japanese relaxers.

18. A method according to any preceding claim, in which the thiols remain bound for at least one week.

19. A method according to any preceding claim, in which the molecular weight of the binding agent is less than about 500 Daltons.

20. A formulation consisting of a binding agent, an aqueous solvent, and one or more preservatives, stabilizers, or combinations thereof,

in which the binding agent is represented by Formula I:



(I)

in which

A, B, C, and D are reactive moieties capable of reacting with the free thiol groups each containing one or more charges, in which each of the A, B, C, and D reactive moieties independently contain a moiety selected from the group consisting of a vinyl sulfone, an acrylate group, a methacrylate group, a styrene group, an acryl amide group, a methacryl amide group, a maleate group, a fumarate group, and an itaconate group;

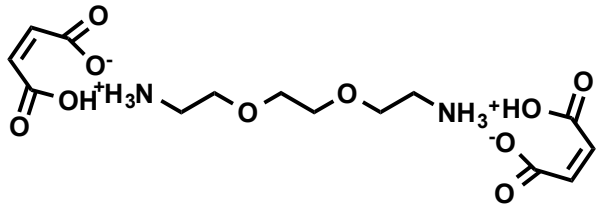
R is a linker that contains two or more charges, in which the charges are opposite to the charges on the reactive moieties, in which n = 1-10, and in which R is not a polymer, and

the sum of the charges is zero, and

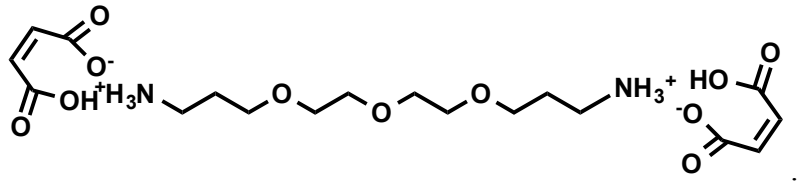
in which the reactive moieties are ionically bound to the linker;

in which each occurrence of p, q, r, and s is independently an integer from 0 to 25, and in which the sum of p + q + r + s is equal to or greater than 2.

21. A formulation according to Claim 20, in which the binding agent is:



or



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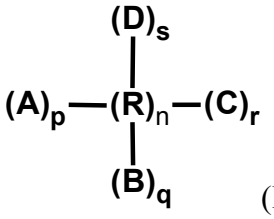
22. A method for coloring hair comprising:

(a) applying a first formulation comprising a hair coloring agent and a reducing agent capable of reducing the disulfide bonds in the hair to produce free thiol groups,

(b) applying to the hair a second formulation comprising a binding agent of Formula I



(I)

in which

A, B, C, and D are reactive moieties capable of reacting with the free thiol groups each containing one or more charges, in which each of the A, B, C, and D reactive moieties independently contain a moiety selected from the group consisting of a vinyl sulfone, an acrylate group, a methacrylate group, a styrene group, an acryl amide group, a methacryl amide group, a maleate group, a fumarate group, and an itaconate group;

R is a linker that contains two or more charges, in which the charges are opposite to the charges on the reactive moieties, in which n = 1-10, and in which R is not a polymer, and

the sum of the charges is zero, and

in which the reactive moieties are ionically bound to the linker;

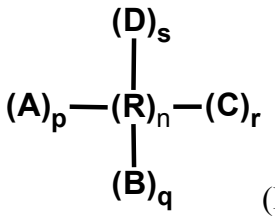
in which each occurrence of p, q, r, and s is independently an integer from 0 to 25, and in which the sum of p + q + r + s is equal to or greater than 2,

in an effective amount to covalently bind the free thiol groups.

23. A method for highlighting hair comprising:

(a) applying a first formulation comprising bleach to lighten hair and produce free thiol groups,

(b) applying to the hair a second formulation comprising a binding agent of Formula I



(I)

in which

A, B, C, and D are reactive moieties capable of reacting with the free thiol groups each containing one or more charges, in which each of the A, B, C, and D reactive moieties independently contain a moiety selected from the group consisting of a vinyl sulfone, an acrylate group, a methacrylate group, a styrene group, an acryl amide group, a methacryl amide group, a maleate group, a fumarate group, and an itaconate group;

R is a linker that contains two or more charges, in which the charges are opposite to the charges on the reactive moieties, in which n = 1-10, and in which R is not a polymer, and

the sum of the charges is zero, and

in which the reactive moieties are ionically bound to the linker;

in which each occurrence of p, q, r, and s is independently an integer from 0 to 25, and in which the sum of p + q + r + s is equal to or greater than 2,

in an effective amount to covalently bind the free thiol groups.

24. The method of claim 22 or 23, in which steps (a) and (b) are performed simultaneously.

25. A method according to Claim 22 or 23, in which steps (a) and (b) are performed sequentially, with step (a) performed prior to step (b).

26. A method according to Claim 24, in which prior to step (a), the first formulation and the second formulation are mixed together.

27. A method according to any of Claims 22 to 26, in which the reactive moieties and the thiol groups react to form carbon-sulfur (C-S) covalent bonds.

28. A method according to any of Claims 22 to 27, in which A, B, C, and D are the same.

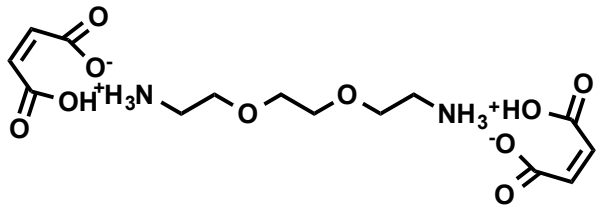
29. A method according to any of Claims 22 to 27, in which at least one of A, B, C, and D is different than the other reactive moieties.

30. A method according to any of Claims 22 to 29, in which the linker is a polyfunctional molecule,

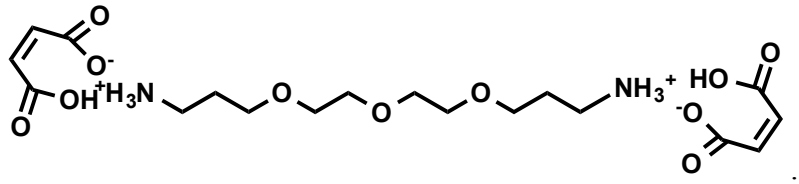
in which the linker is optionally independently substituted with one or more substituents including hydrogen, halogen, cyano, alkoxy, alkyl, alkenyl, cycloalkyl, cycloalkenyl, aryl, heterocycloalkyl, heteroaryl, amine, hydroxy, formyl, acyl, carboxylic acid (-COOH), - $C(O)R^1$, $-C(O)OR^1$, carboxylate ($-COO^-$), primary amide (*e.g.*, $-CONH_2$), secondary amide (*e.g.*, $-CONHR_{11}$), $-C(O)NR^1R^2$, $-NR^1R^2$, $-NR^1S(O)_2R^2$, $-NR^1C(O)R^2$, $-S(O)_2R^2$, $-SR^1$, and $-S(O)_2NR^1R^2$, sulfinyl group (*e.g.*, $-SOR^1$), and sulfonyl group (*e.g.*, $-SOOR^1$);

in which R^1 and R^2 may each independently be hydrogen, alkyl, alkenyl, alkynyl, cycloalkyl, aryl, heterocycloalkyl and heteroaryl; in which each of R^1 and R^2 is optionally independently substituted with one or more substituents selected from the group consisting of halogen, hydroxyl, cyano, nitro, amino, alkylamino, dialkylamino, alkyl optionally substituted with one or more halogen or alkoxy or aryloxy, aryl optionally substituted with one or more halogen or alkoxy or alkyl or trihaloalkyl, heterocycloalkyl optionally substituted with aryl or heteroaryl or =O or alkyl optionally substituted with hydroxyl, cycloalkyl optionally substituted with hydroxyl, heteroaryl optionally substituted with one or more halogen or alkoxy or alkyl or trihaloalkyl, haloalkyl, hydroxyalkyl, carboxy, alkoxy, aryloxy, alkoxycarbonyl, aminocarbonyl, alkylaminocarbonyl, and dialkylaminocarbonyl.

31. A method according to any of Claims 22 to 30, in which the binding agent is:



or



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32. A method according to any of Claims 22 to 31, in which the second formulation further comprises one or more cosmetically acceptable excipients, and

in which the one or more excipients are selected from the group consisting of water, surfactants, vitamins, natural extracts, preservatives, chelating agents, perfumes, preservatives, antioxidants, proteins, amino acids, humectants, fragrances, emollients, penetrants, thickeners, viscosity modifiers, hair fixatives, film formers, emulsifiers, opacifying agents, propellants,

liquid vehicles, carriers, salts, pH adjusting agents, neutralizing agents, buffers, hair conditioning agents, anti-static agents, anti-frizz agents, anti-dandruff agents, and combinations thereof.

33. A method according to Claim 32, in which the binding agent is present in an amount ranging from about 0.01 wt% to about 50 wt% of the second formulation, preferably from about 0.01 wt% to about 10 wt% of the second formulation.

34. A method according to Claim 31, 32 or 33, in which the binding agent is present in an amount ranging from about 2.5 to 3 wt% of the second formulation.

35. A method according to any of Claims 31 to 34, in which the excipient is present in an amount ranging from about 10 wt% to about 99.99 wt% of the second formulation, preferably from about 50 wt% to about 90 wt% of the second formulation.

36. A method according to any of Claims 22 to 35, in which the second formulation is in the form of a gel, cream, lotion, shampoo, or conditioner.

37. A method according to any of Claims 22 to 36, in which step (b) is repeated one or more times.

38. A method according to any of Claims 22 to 37, further comprising,

(c) rinsing, shampooing, and/or conditioning the hair, in which step (c) occurs subsequent to step (b).

39. A method according to Claim 38, in which step (c) is performed within about 10 seconds to about 30 minutes, preferably between about 1 minute and about 20 minutes, more preferably about 10 minutes after step (b).

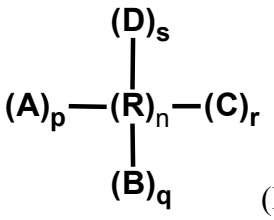
40. A method according to any of Claims 22 to 39, in which the coloring agent is selected from the group consisting of highlighting agents, permanent coloring agents, demi-permanent coloring agents, and semi-permanent coloring agents.

41. A kit comprising:

(a) a first formulation comprising a reducing agent capable of reducing disulfide bonds in hair to produce free thiol groups, and

(b) a second formulation comprising a binding agent in an effective amount to covalently bind free thiol groups in hair,

in which the binding agent is represented by Formula I:



(I)

in which

A, B, C, and D are reactive moieties capable of reacting with the free thiol groups each containing one or more charges, in which each of the A, B, C, and D reactive moieties independently contain a moiety selected from the group consisting of a vinyl sulfone, an acrylate group, a methacrylate group, a styrene group, an acryl amide group, a methacryl amide group, a maleate group, a fumarate group, and an itaconate group;

R is a linker that contains two or more charges, in which the charges are opposite to the charges on the reactive moieties, in which n = 1-10, and in which R is not a polymer, and

the sum of the charges is zero, and

in which the reactive moieties are ionically bound to the linker;

in which each occurrence of p, q, r, and s is independently an integer from 0 to 25, and in which the sum of p + q + r + s is equal to or greater than 2.

42. A kit according to Claim 41, further comprising a shampoo, a conditioner, instructions for use, a developer, mixing container, an odor eliminator, gloves, or a combination thereof.

43. A kit according to Claim 41 or 42, in which the first formulation is a bleaching, straightening, waving, curling, or coloring formulation.

44. A kit according to Claim 41, 42 or 43, in which A, B, C, and D are the same.

45. A kit according to Claim 41, 42 or 43, in which at least one of A, B, C, and D is different than the other reactive moieties.

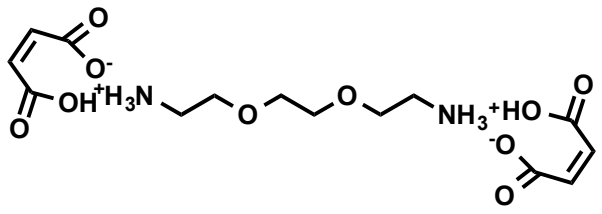
46. A kit according to any of Claims 41 to 45, in which the linker is a polyfunctional molecule,

in which the linker is optionally independently substituted with one or more substituents selected from the group consisting of hydrogen, halogen, cyano, alkoxy, alkyl, alkenyl, cycloalkyl, cycloalkenyl, aryl, heterocycloalkyl, heteroaryl, amine, hydroxy, formyl, acyl, carboxylic acid (-COOH), $-C(O)R^1$, $-C(O)OR^1$, carboxylate ($-COO^-$), primary amide (*e.g.*, $-CONH_2$), secondary amide (*e.g.*, $-CONHR_{11}$), $-C(O)NR^1R^2$, $-NR^1R^2$, $-NR^1S(O)_2R^2$, $-NR^1C(O)R^2$, $-S(O)_2R^2$, $-SR^1$, and $-S(O)_2NR^1R^2$, sulfinyl group (*e.g.*, $-SOR^1$), and sulfonyl group (*e.g.*, $-SOOR^1$);

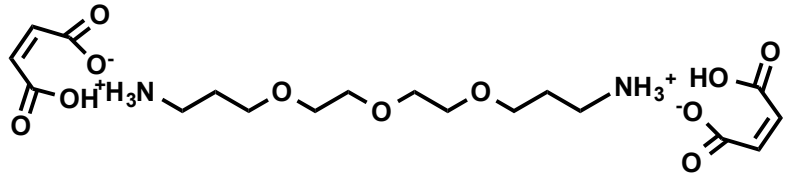
in which R^1 and R^2 may each independently be hydrogen, alkyl, alkenyl, alkynyl, cycloalkyl, aryl, heterocycloalkyl and heteroaryl; in which each of R^1 and R^2 is optionally independently substituted with one or more substituents selected from the group consisting of halogen, hydroxyl, cyano, nitro, amino, alkylamino, dialkylamino, alkyl optionally substituted with one or more halogen or alkoxy or aryloxy, aryl optionally substituted with one or more halogen or alkoxy or alkyl or trihaloalkyl, heterocycloalkyl optionally substituted with aryl or heteroaryl or =O or alkyl optionally substituted with hydroxyl, cycloalkyl optionally substituted with hydroxyl, heteroaryl optionally substituted with one or more halogen or alkoxy or alkyl or trihaloalkyl, haloalkyl, hydroxyalkyl, carboxy, alkoxy, aryloxy, alkoxycarbonyl, aminocarbonyl, alkylaminocarbonyl, and dialkylaminocarbonyl.

47. A kit according to any of Claims 41 to 46, in which the reactive moieties and the thiol groups react to form carbon-sulfur (C-S) covalent bonds.

48. A kit according to any of Claims 41 to 47, in which the binding agent is:



or



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49. A kit according to any of Claims 41 to 48, in which the second formulation further comprises one or more cosmetically acceptable excipients selected from the group consisting of water, surfactants, vitamins, natural extracts, preservatives, chelating agents, perfumes, preservatives, antioxidants, chelating agents, hair coloring agents, proteins, amino acids, humectants, fragrances, emollients, penetrants, thickeners, viscosity modifiers, hair fixatives, film formers, emulsifiers, opacifying agents, propellants, liquid vehicles, carriers, salts, pH adjusting agents, neutralizing agents, buffers, hair conditioning agents, anti-static agents, anti-frizz agents, anti-dandruff agents, and combinations thereof.

50. A kit according to any of Claims 41 to 49, in which the binding agent is present in an amount ranging from about 0.01 wt% to about 50 wt% of the second formulation.

51. A kit according to any of Claims 41 to 50, in which the excipient is present in an amount ranging from about 10 wt% to about 90 wt% of the second formulation.

52. A kit according to any of Claims 41 to 51, in which the first and second formulations are pre-mixed.

53. A kit according to any of Claims 41 to 52, in which the second formulation is pre-mixed with a shampoo or conditioner.

54. A kit according to any of Claims 41 to 53, in which the second formulation is in the form of a liquid, lotion, milk, mousse, spray, gel, cream, shampoo, or conditioner.

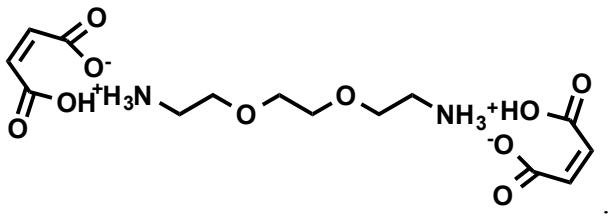
55. A kit according to any of Claims 41 to 54, in which the second formulation is provided as two or more separate ingredients.

56. A kit according to any of Claims 41 to 55, in which the binding agent is provided as a dry powder in a sealed package and the excipient provided in a vial or other container.

57. A kit according to any of Claims 41 to 56, in which:

(1) the first formulation is a bleaching formulation; and

(2) the binding agent of the second formulation is



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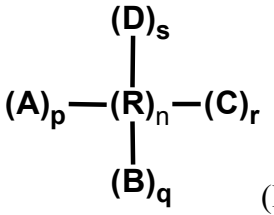
58. A kit according to Claim 57, in which the bleaching formulation further comprises a developer.

59. A kit according to Claim 57 ot 58, further comprising a shampoo, a conditioner, instructions for use, a developer, mixing container, an odor eliminator, or a combination thereof.

60. A shampoo or conditioner comprising an effective amount of a binding agent, in which the binding agent is represented by Formula I:



(I)

in which

A, B, C, and D are reactive moieties capable of reacting with the free thiol groups each containing one or more charges, in which each of the A, B, C, and D reactive moieties independently contain a moiety selected from the group consisting of a vinyl sulfone, an acrylate group, a methacrylate group, a styrene group, an acryl amide group, a methacryl amide group, a maleate group, a fumarate group, and an itaconate group;

R is a linker that contains two or more charges, in which the charges are opposite to the charges on the reactive moieties, in which n = 1-10, and in which R is not a polymer, and

the sum of the charges is zero, and

in which the reactive moieties are ionically bound to the linker;

in which each occurrence of p, q, r, and s is independently an integer from 0 to 25, and in which the sum of p + q + r + s is equal to or greater than 2.

61. A shampoo or conditioner according to Claim 60, in which the reactive moieties and the thiol groups react to form carbon-sulfur (C-S) covalent bonds.

62. A shampoo or conditioner according to Claim 60 or 61, in which A, B, C, and D are the same.

63. A shampoo or conditioner according to Claim 60 or 61, in which at least one of A, B, C, and D is different than the other reactive moieties.

64. A shampoo or conditioner according to any of Claims 60 to 63, in which the linker is a polyfunctional molecule,

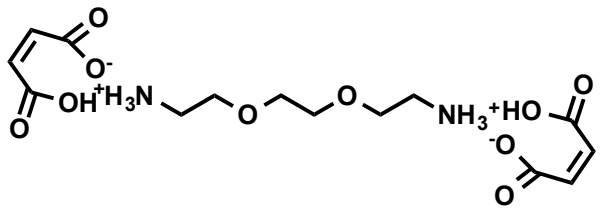
in which the linker is optionally independently substituted with one or more substituents selected from the group consisting of hydrogen, halogen, cyano, alkoxy, alkyl, alkenyl, cycloalkyl, cycloalkenyl, aryl, heterocycloalkyl, heteroaryl, amine, hydroxy, formyl, acyl, carboxylic acid (-COOH), $-C(O)R^1$, $-C(O)OR^1$, carboxylate (-COO-), primary amide (e.g., $-CONH_2$), secondary amide (e.g., $-CONHR^1$), $-C(O)NR^1R^2$, $-NR^1R^2$, $-NR^1S(O)_2R^2$, $-NR^1C(O)R^2$, $-S(O)_2R^2$, $-SR^1$, and $-S(O)_2NR^1R^2$, sulfinyl group (e.g., $-SOR^{11}$), and sulfonyl group (e.g., $-SOOR^1$);

in which R^1 and R^2 may each independently be hydrogen, alkyl, alkenyl, alkynyl, cycloalkyl, aryl, heterocycloalkyl and heteroaryl;

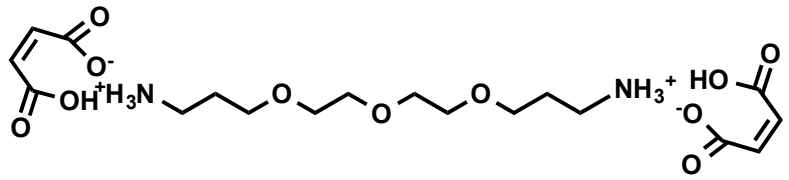
in which each of R^1 and R^2 is optionally independently substituted with one or more substituents selected from the group consisting of halogen, hydroxyl, cyano, nitro, amino, alkylamino, dialkylamino, alkyl optionally substituted with one or more halogen or alkoxy or aryloxy, aryl optionally substituted with one or more halogen or alkoxy or alkyl or trihaloalkyl, heterocycloalkyl optionally substituted with aryl or heteroaryl or

=O or alkyl optionally substituted with hydroxyl, cycloalkyl optionally substituted with hydroxyl, heteroaryl optionally substituted with one or more halogen or alkoxy or alkyl or trihaloalkyl, haloalkyl, hydroxyalkyl, carboxy, alkoxy, aryloxy, alkoxycarbonyl, aminocarbonyl, alkylaminocarbonyl, and dialkylaminocarbonyl.

65. A shampoo or conditioner according to any of Claims 60 to 64, in which the binding agent is:



or



66. A shampoo or conditioner according to any of Claims 60 to 65, further comprising one or more cosmetically acceptable excipients, in which the one or more excipients are selected from the group consisting of water, surfactants, vitamins, natural extracts, preservatives, chelating agents, perfumes, preservatives, antioxidants, chelating agents, hair coloring agents, proteins, amino acids, humectants, fragrances, emollients, penetrants, thickeners, viscosity modifiers, hair fixatives, film formers, emulsifiers, opacifying agents, propellants, liquid vehicles, carriers, salts, pH adjusting agents, neutralizing agents, buffers, hair conditioning agents, anti-static agents, anti-frizz agents, anti-dandruff agents, and combinations thereof.

67. A shampoo or conditioner according to Claim 66, in which the binding agent is present in an amount ranging from about 0.01 wt% to about 50 wt% of the formulation.

68. A shampoo or conditioner according to Claim 66 or 67, in which the binding agent is present in an amount ranging from about 2.5 to 3 wt% of the formulation.