

REACTIVE PRINTING DYE AND ITS AQUEOUS COMPOSITION

APPLICATION

BACKGROUND OF THE INVENTION

1. Field of the Invention

5 The present invention relates to reactive dye composition and, more particularly, to a reactive printing dye composition and/ or an aqueous reactive printing dye composition, which is suitable for printing of cellulose fibers.

2. Description of Related Art

10 US Patent No. 6,780,229 disclosed a dye composition in which an organic buffer is used for keeping the pH value in a range of from 4 to 8. A dye composition, including at least one reactive dye and 1,2-propylene glycol or N-methyl-2-pyrrolidone, was disclosed in US Patent No. 6,015,454. The dye composition disclosed by US Patent No. 6,015,454
15 exhibits improved color strength and fixation, but poor storage stability. In addition, US publication No. 2003/0172840 disclosed a dye composition, which includes a reactive dye, sulfolane and a buffer system and has improved storage stability. Unfortunately, its chlorine bleaching fastness, build up (strength) and solubility are not satisfying.

20 Thereby, for those skilled in the art, it is an important objective to provide a reactive printing dye composition having excellent properties, such as high pH value stability, low degradation in dyeing strength, high build up (strength) and high dye concentration.

SUMMARY OF THE INVENTION

The object of the present invention is to provide a reactive printing dye composition and/or an aqueous reactive printing dye composition, which is capable of being used in printing or digital spray printing of cellulose fibers or other fiber blend fabrics, and is advantageous in high pH value stability, enhanced storage stability, and reduced degradation in dyeing strength.

The present invention provides a reactive printing dye composition, which includes:

10 (a) at least one reactive dye in an amount of 45 to 99.85 parts by weight;

(b) an organic buffer in an amount of 0.05 to 10 parts by weight; and

(c) a mirabilite (sodium sulfate) or a dispersant in an amount of 0.1 to 50 parts by weight.

Further, the present invention provides an aqueous reactive printing dye composition, which includes:

(a) at least one reactive dye in an amount of 1 to 50 parts by weight;

(b) an organic buffer in an amount of 0.05 to 10 parts by weight;

20 and

(c) water in an amount of 40 to 98.95 parts by weight.

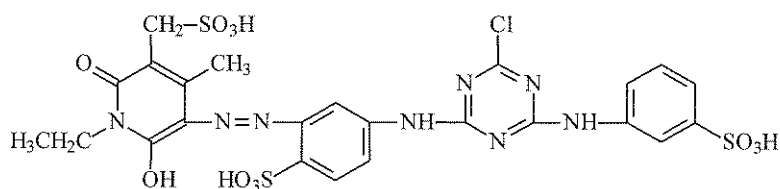
In the reactive printing dye composition and/or the aqueous reactive printing dye composition according to the present invention, the possibility of hydrolysis in reactive groups of the reactive dye can be reduced so as to

resolve the problem of dyeing strength degradation, such that the advantages, such as excellent color strength, good storage stability, inhibited precipitation and improved printing stability, can be provided.

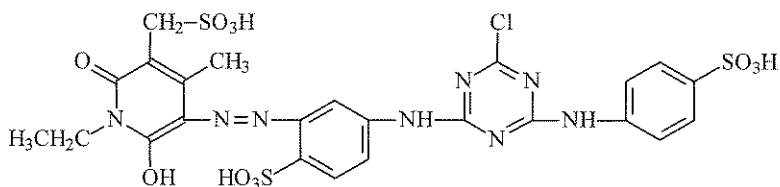
The printed cloth prepared by the reactive printing dye composition and/or the aqueous reactive printing dye composition according to the present invention exhibits excellent properties.

For convenience in printing, the reactive printing dye composition of the present invention may be prepared in an aqueous form.

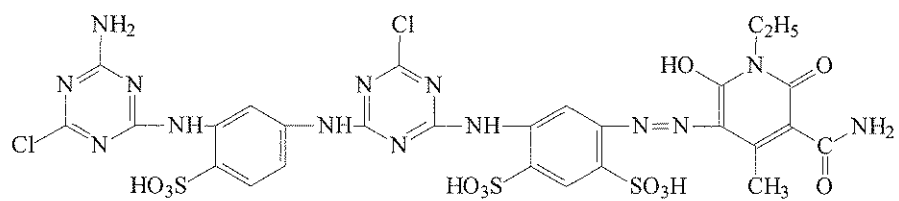
In the reactive printing dye composition and/or the aqueous reactive printing dye composition according to the present invention, the above-mentioned component (a), the reactive dye, may be water-soluble and has a monochlorotriazinyl derivative moiety. Its exemplary cases are shown as following Formulas (I-1) to (I-16),



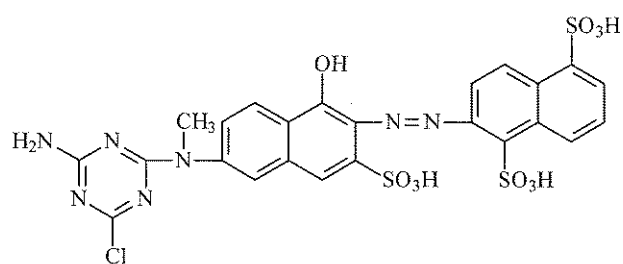
(I-1),



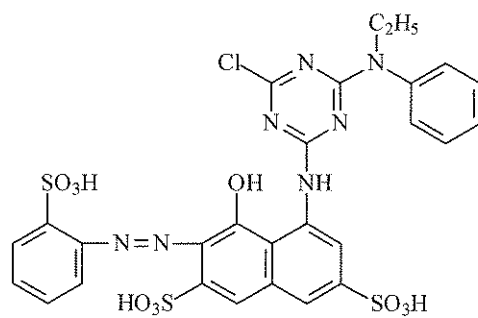
(I-2),



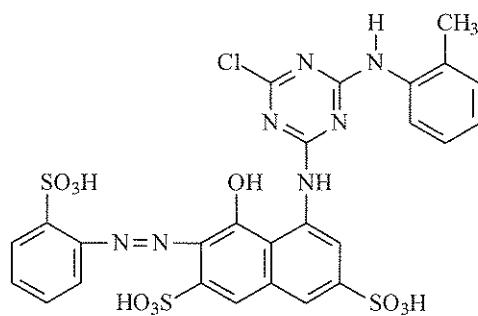
(I-3),



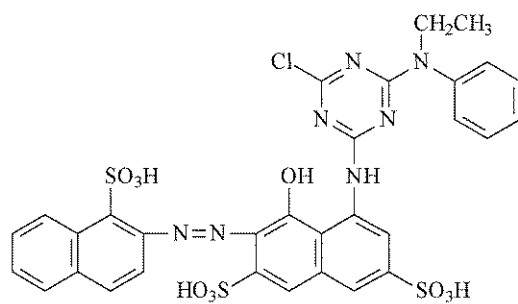
(I-4),



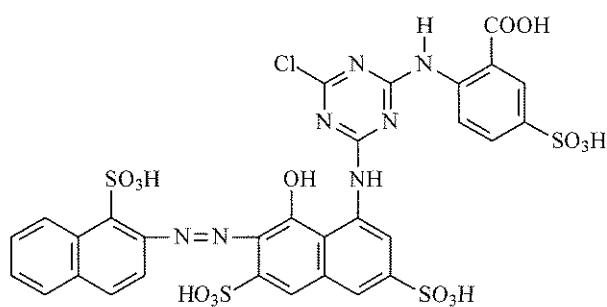
(I-5),



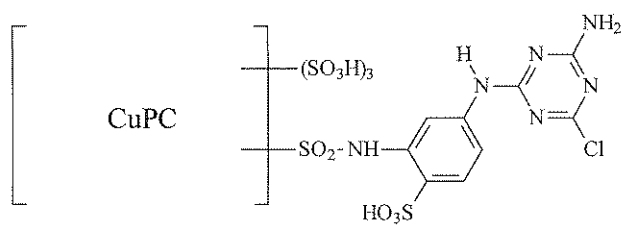
(I-6),



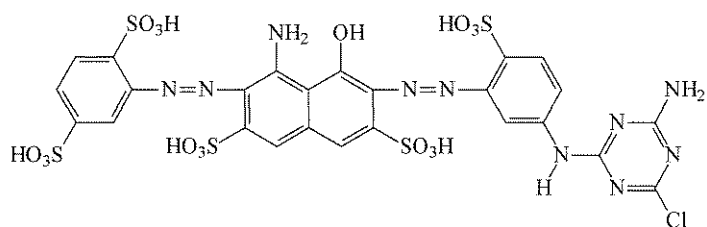
(I-7),



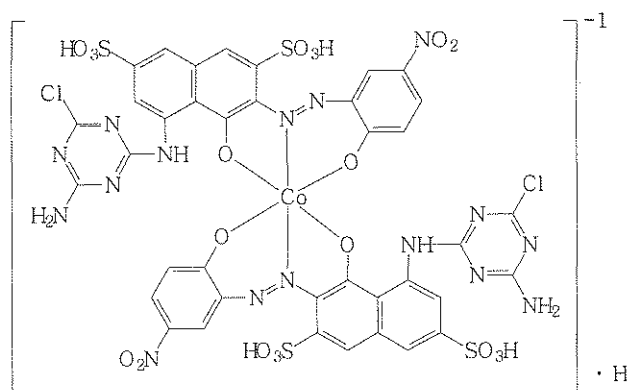
(I-8),



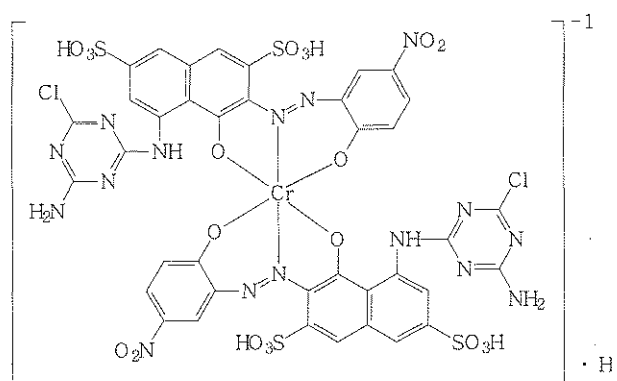
(I-9),



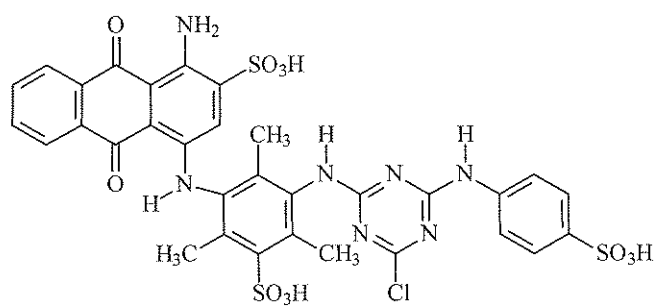
(I-10),



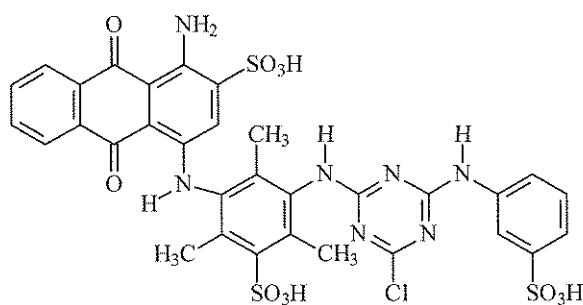
(I-11),



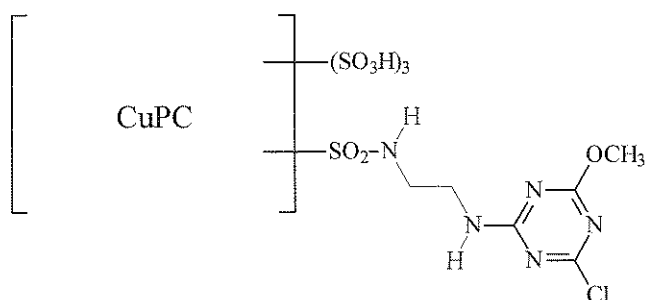
(I-12),



(I-13),



(I-14),



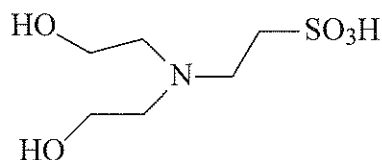
(I-15).

Such reactive dyes may be selected from the Color Index, for example, C.I. Reactive Red 3:1, C.I. Reactive Red 31, C.I. Reactive Red 33, C.I. Reactive Red 24, C.I. Reactive Red 45, C.I. Reactive Red 218, C.I. Reactive Violet 5, C.I. Reactive Yellow 2, C.I. Reactive Yellow 18, C.I. Reactive Yellow 33, C.I. Reactive Yellow 85, C.I. Reactive Yellow 95, C.I. Reactive Blue 15, C.I. Reactive Blue 5, C.I. Reactive Blue 49, C.I. Reactive Blue 71, C.I. Reactive Blue 176, C.I. Reactive Orange 5, C.I. Reactive Orange 12, C.I. Reactive Orange 13, C.I. Reactive Orange 99, C.I. Reactive Green 19, C.I. Reactive Brown 17, C.I. Reactive Black 8 or C.I. Reactive Black 5.

The reactive dyes in the reactive printing dye composition and/or

the aqueous reactive printing dye composition according to the present invention may be used individually or mixed with the above-mentioned reactive dyes or the salts of an alkali metal or ammonium thereof. If the composition is aqueous, the amount of the added salts should be low. In other words, based on the weight of the reactive dye, preferably, the salt content is less than 0.5 wt%. The salts produced during processes and diluents additionally added can be removed by, for example, membrane separation, ultra-filtration, reverse osmosis, or dialysis.

In the reactive printing dye composition and/or the aqueous reactive printing dye composition according to the present invention, the example of the component (b), the organic buffer, is N,N-bis(2-Hydroxyethyl)-2-aminoethanesulfonic acid (BES), and its structure is shown as the formula (II-1),



(II-1).

In the reactive printing dye composition and/or the aqueous reactive printing dye composition according to the present invention, the dispersant may be Demol RN, Demol SS, Levenol V, or Levenol TD, but is not limited thereto.

In the reactive printing dye composition according to the present invention, based on the total weight of the dye composition, the amount of the reactive dye may range from 45 wt% to 99.85 wt%, the amount of the

organic buffer may range from 0.05 wt% to 10 wt%, and the amount of the mirabilite or the dispersant may range from 0.1 wt% to 50 wt%. Preferably, the amount of the reactive dye ranges from 45 wt% to 99.8 wt%, the amount of the organic buffer ranges from 0.1 wt% to 5 wt%, and the amount of the mirabilite or the dispersant ranges from 0.1 wt% to 50 wt%. More preferably, the amount of the reactive dye ranges from 47 wt% to 99.7 wt%, the amount of the organic buffer ranges from 0.2 wt% to 3 wt%, and the amount of the mirabilite or the dispersant ranges from 0.1 wt% to 50 wt%. Most preferably, the amount of the reactive dye ranges from 47 wt% to 90 wt%, the amount of the organic buffer ranges from 0.2 wt% to 3 wt%, and the amount of the mirabilite or the dispersant ranges from 9.8 wt% to 50 wt%. However, the amounts of the components are not limited thereto.

In the aqueous reactive printing dye composition according to the present invention, based on the total weight of the aqueous dye composition, the amount of the reactive dye may range from 1 wt% to 50 wt%, the amount of the organic buffer may range from 0.05 wt% to 10 wt%, and the amount of water may range from 40 wt% to 98.95 wt%. Preferably, the amount of the reactive dye ranges from 3 wt% to 45 wt%, the amount of the organic buffer ranges from 0.1 wt% to 8 wt%, and the amount of water ranges from 47 wt% to 96.9 wt%. More preferably, the amount of the reactive dye ranges from 3 wt% to 45 wt%, the amount of the organic buffer ranges from 0.2 wt% to 8 wt%, and the amount of water ranges from 47 wt% to 96.8 wt%. Most preferably, the amount of the reactive dye ranges from 5 wt% to 40 wt%, the amount of the organic buffer ranges from 0.2

wt% to 8 wt%, and the amount of water ranges from 52 wt% to 94.8 wt%. However, the amounts of the components are not limited thereto.

In the reactive printing dye composition and/or the aqueous reactive printing dye composition according to the present invention, all of the
5 above-shown compounds are expressed as free acid. Practically, the compounds used in the reactive printing dye composition and/or the aqueous reactive printing dye composition according to the present invention may be metal salts or ammonium salts, and preferably are alkaline metal salts or ammonium salts. The dye composition of the present
10 invention can be prepared by mixing the above components in water according to general procedures.

The reactive printing dye composition and/or the aqueous reactive printing dye composition according to the present invention can be applied to printing on material containing cellulose fibers such as cotton, hemp,
15 cellulose, synthetic fibers, and materials containing hydroxyl fibers.

In the reactive printing dye composition and/or the aqueous reactive printing dye composition according to the present invention, the possibility of hydrolysis in reactive groups of the reactive dye can be reduced so as to resolve the problem of dyeing strength degradation, such that the
20 advantages, such as excellent color strength, good storage stability, inhibited precipitation and improved printing stability, can be provided.

The printed cloth prepared by the reactive printing dye composition and/or the aqueous reactive printing dye composition according to the present invention exhibits excellent properties, such as strong fiber-dye

bond stability, clear features (high resolution), high miscibility and good color strength, and good fastness to light and wet, for example, washing, water, brine, re-dyeing, moisture, chlorinating, rubbing, hot pressing and pleating.

5 BRIEF DESCRIPTION OF THE DRAWINGS

None

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The following examples are used to illustrate the present invention, and many other possible modifications and variations can be made without
10 departing from the spirit of the present invention according to various concepts and applications. The following examples are exemplified for a more concrete description, and the scope of the present invention should not be limited thereto. Without specific explanations, the unit of the parts and percentages used in the examples is calculated by weight, and the
15 temperature is represented by Celsius degrees (°C). The relation between the parts by weight and the parts by volume is just like the relation between kilogram and liter.

Example 1

50 parts of Compound (I-1), 50 parts of Compound (I-2) and 300
20 parts of water are mixed thoroughly, followed by adjusting the pH value to a range of from 5.5 to 8.5. Through reverse osmosis, the salts are controlled to be less than 0.5 wt%. Subsequently, 2 parts of Compound (II-1) are added thereto, followed by stirring and adjusting the pH value to a range of from 6.0 to 8.5. Finally, the solution is spray dried so as to obtain the

reactive printing dye composition of the present embodiment.

Example 2

100 parts of Compound (I-3) and 300 parts of water are mixed thoroughly, followed by adjusting the pH value to a range of from 5.5 to 8.5.

5 After purification, 5 parts of Compound (II-1) and 30 parts of mirabilite are added thereto, followed by stirring and adjusting the pH value to a range of from 6.0 to 8.5. Finally, the solution is spray dried so as to obtain the reactive printing dye composition of the present embodiment.

Example 3

10 100 parts of Compound (I-4) and 300 parts of water are mixed thoroughly, followed by adjusting the pH value to a range of from 5.5 to 8.5. Through reverse osmosis, the salts are controlled to be less than 0.5 wt%. Subsequently, 2 parts of Compound (II-1) and 20 parts of Demol RN are added thereto, followed by stirring and adjusting the pH value to a range of
15 from 6.0 to 8.5. Finally, the solution is spray dried so as to obtain the reactive printing dye composition of the present embodiment.

Example 4

The reactive printing dye composition of the present embodiment is prepared according to the method described in Example 2, except that
20 Compound (I-3) is replaced by Compound (I-5).

Example 5

The reactive printing dye composition of the present embodiment is prepared according to the method described in Example 2, except that Compound (I-3) is replaced by Compound (I-6).

Example 6

The reactive printing dye composition of the present embodiment is prepared according to the method described in Example 2, except that Compound (I-3) is replaced by Compound (I-7).

5 **Example 7**

The reactive printing dye composition of the present embodiment is prepared according to the method described in Example 2, except that Compound (I-3) is replaced by Compound (I-8).

Example 8

10 The reactive printing dye composition of the present embodiment is prepared according to the method described in Example 2, except that Compound (I-3) is replaced by Compound (I-8).

Example 9

15 The reactive printing dye composition of the present embodiment is prepared according to the method described in Example 2, except that Compound (I-3) is replaced by Compound (I-10).

Example 10

20 20 parts of Compound (I-13), 80 parts of Compound (I-14) and 300 parts of water are mixed thoroughly, followed by adjusting the pH value to a range of from 5.5 to 8.5. After purification, 2 parts of Compound (II-1), 10 parts of Demol RN and 30 parts of mirabilite are added thereto, followed by stirring and adjusting the pH value to a range of from 6.0 to 8.5. Finally, the solution is spray dried so as to obtain the reactive printing dye composition of the present embodiment.

Example 11

The reactive printing dye composition of the present embodiment is prepared according to the method described in Example 2, except that Compound (I-3) is replaced by Compound (I-15).

5 Example 12

The reactive printing dye composition of the present embodiment is prepared according to the method described in Example 2, except that Compound (I-3) is replaced by Compound (I-16).

Example 13

10 According to the method described in Example 10, 2 parts of Compound (II-1) and 0.2 part of Procexl are added thereto, followed by stirring and adjusting the pH value to a range of from 6.0 to 8.5. Finally, water is added thereto until the solution reaches 100 parts so as to obtain the aqueous reactive printing dye composition.

15 Example 14

3.2 parts of Compound (I-13), 12.8 parts of Compound (I-14) and 60 parts of water are mixed thoroughly, followed by adjusting the pH value to a range of from 5.5 to 8.5. Through reverse osmosis, the salts are controlled to be less than 0.5 wt%. Subsequently, 2 parts of Compound
20 (II-1), 1 part of Urea and 0.2 part of Procexl are added thereto, followed by stirring and adjusting the pH value to a range of from 6.0 to 8.5. Finally, water is added thereto until the solution reaches 100 parts so as to obtain the aqueous reactive printing dye composition.

Comparative Example 1

100 parts of Compound (I-1) and 100 parts of water are mixed thoroughly, followed by adjusting the pH value to a range of from 5.5 to 8.5. Through reverse osmosis, the salts are controlled to be less than 0.5 wt%.

5 Subsequently, 2 parts of disodium phosphate and 20 parts of Demol RN are added thereto, followed by stirring and adjusting the pH value to a range of from 6.0 to 8.5. Finally, the solution is spray dried so as to obtain a dye composition.

Comparative Example 2

10 50 parts of Compound (I-13), 50 parts of Compound (I-14) and 300 parts of water are mixed thoroughly, followed by adjusting the pH value to a range of from 5.5 to 8.5. After purification, 2 parts of disodium phosphate, 10 parts of Demol RN and 30 parts of mirabilite are added thereto, followed by stirring and adjusting the pH value to a range of from 6.0 to 8.5. Finally,
15 the solution is spray dried so as to obtain a dye composition.

Comparative Example 3

100 parts of Compound (I-4) and 300 parts of water are mixed thoroughly, followed by adjusting the pH value to a range of from 5.5 to 8.5. Through reverse osmosis, the salts are controlled to be less than 0.5 wt%.

20 Subsequently, 20 parts of Demol RN are added thereto, followed by stirring and adjusting the pH value to a range of from 6.0 to 8.5. Finally, the solution is spray dried so as to obtain a dye composition.

Comparative Example 4

100 parts of Compound (I-4) and 300 parts of water are mixed

thoroughly, followed by adjusting the pH value to a range of from 5.5 to 8.5. Through reverse osmosis, the salts are controlled to be less than 0.5 wt%. Subsequently, 2 parts of disodium phosphate and 20 parts of Demol RN are added thereto, followed by stirring and adjusting the pH value to a range of
5 from 6.0 to 8.5. Finally, the solution is spray dried so as to obtain a dye composition.

Comparative Example 5

100 parts of Compound (I-4) and 300 parts of water are mixed thoroughly, followed by adjusting the pH value to a range of from 5.5 to 8.5.
10 Through reverse osmosis, the salts are controlled to be less than 0.5 wt%. Subsequently, 2 parts of N,N-diethylaniline sulfonic acid (DEAS) and 20 parts of Demol RN are added thereto, followed by stirring and adjusting the pH value to a range of from 6.0 to 8.5. Finally, the solution is spray dried so as to obtain a dye composition.

Comparative Example 6

100 parts of Compound (I-4) and 300 parts of water are mixed thoroughly, followed by adjusting the pH value to a range of from 5.5 to 8.5. Through reverse osmosis, the salts are controlled to be less than 0.5 wt%. Subsequently, 2 parts of N-morpholinolpropanesulfonic acid (MOPS) are
20 added thereto, followed by stirring and adjusting the pH value to a range of from 6.0 to 8.5. Finally, the solution is spray dried so as to obtain a dye composition.

Comparative Example 7

50 parts of Compound (I-1), 50 parts of Compound (I-2) and 300

parts of water are mixed thoroughly, followed by adjusting the pH value to a range of from 5.5 to 8.5. Through reverse osmosis, the salts are controlled to be less than 0.5 wt%, and then the pH value is adjusted to a range of from 6.0 to 8.5. Finally, the solution is spray dried so as to obtain a dye composition.

Comparative Example 8

3.2 parts of Compound (I-13), 2.8 parts of Compound (I-14) and 60 parts of water are mixed thoroughly, followed by adjusting the pH value to a range of from 5.5 to 8.5. Through reverse osmosis, the salts are controlled to be less than 0.5 wt%. Subsequently, 0.2 part of Procexl is added thereto, followed by stirring and adjusting the pH value to a range of from 6.0 to 8.5. Finally, the solution is spray dried so as to obtain a dye composition.

Comparative Example 9

The dye composition of the comparative example is prepared according to the method described in Example 13, except that Compound (II-1) is replaced by N,N-diethylaniline sulfonic acid (DEAS).

Comparative Example 10

The dye composition of the comparative example is prepared according to the method described in Example 13, except that Compound (II-1) is replaced by N-(2-hydroxy ethyl)-piperazine ethane sulfonic acid (HEPES).

Comparative Examples 11 to 13

The dye compositions of these comparative examples are prepared according to the method described in Example 14, except that no

Compound (II-1) is added thereto in Comparative Example 11, Compound (II-1) is replaced by DEAS in Comparative Example 12, and Compound (II-1) is replaced by HEPES in Comparative Example 13.

5 Test Results

A. Dye Composition

For the dye compositions according to the above-mentioned Examples and Comparative Examples, after adding 2% of the dye composition according to the present invention and 2% of disodium phosphate (commercially provided), the changes between pH values before and after spray drying at high temperature and then storage are recorded in Table 1. Additionally, the results in the case of adding 0.5% of the dye composition according to the present invention and 0.5% of disodium phosphate (commercially provided) are shown in Table 2.

《Table 1》 Change between pH values before and after spray drying and then storage

Item	pH value before spray drying	pH value after 60°C *1W	△ pH	pH value after 70°C *1W	△ pH
Example 9	6.8	6.76	-0.04	6.3	-0.5
Comparative Example 1	7.6	7.27	-0.34	6.6	-1.0
Example 10	7.0	6.3	-0.7	5.63	-1.37
Comparative	7.6	6.87	-0.73	6.09	-1.51

Example 2					
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《Table 2》 Change between pH values before and after spray drying and then storage

Item	pH value before spray drying	pH value after spray drying	Δ pH
Example 3	7.0	6.6	-0.4
Comparative Example 3	7.0	5.2	-1.8
Comparative Example 4	7.3	6.7	-0.6
Comparative Example 5	7.0	6.6	-0.4

(1) Δ pH means the difference between pH values before and after test.

5 (2) | Δ pH | is the smaller the better.

B. Screen Printing:

50-100 parts of urea, 10-20 parts of reduction inhibitor agent, 10-30 parts of sodium bicarbonate, 60 parts of sodium alginate or 400-600 parts of thickening agents (containing 4-12 % of sodium alginate), and warm water, in a sum of 1000 parts, are mixed to obtain an assisting paste. 3 parts of C.I. Reactive Orange 13 spread in 97 parts of the assisting paste and then rapidly stirred. A twill halftone of 45 degrees and 100 meshes goes over a mercerized cotton twill, on which the color paste is then brushed through a printer. The fabric is then dried in an oven at 100°C for 5 min. The dried

5 fabric is then steamed with 102-105°C saturated steam in a steamer at normal pressure for 5-15 mins. Finally, the dyed fabric is washed with cold water, boiling water for 10 mins, boiling non-ionic detergent for 10 mins, and cold water once to twice, and then dried. Alternatively, dry heat fixation also can be used for dyeing.

[Color Test]

Each parameter and relative strength of the above-mentioned dried fabric are measured through ICS GAIN Spectrophotometer, CIE (Commission International del'Eclairage) L*a*b* and CMC 2.00:1 Color Test Systems with D65 standard light source. The results according to the dye compositions of the present invention and Comparative Examples are shown in Table 3, and the dyed fabric provided by using the dye stored in a cold storage is used as a standard.

《Table 3》 Changes between properties before and after spray drying

Item	Solubility	Printing strength after high temperature storage (70°C*72hrs)	Change in relative strength △ Str
Example 3	⊙	99.6%	-0.4%
Comparative Example 3	○ -△	90.8%	-9.2%
Comparative Example 4	○ -△	94.6%	-5.4%
Comparative Example 5	○ -⊙	96.2%	-3.8%
Comparative	○	99.4%	-0.6%

Item	Solubility	Printing strength after high temperature storage (70°C*72hrs)	Change in relative strength Δ Str
Example 3	⊙	99.6%	-0.4%
Example 6			

⊙ : excellent solubility (it can be dissolved after adding water and then slightly stirring)

○ : good solubility (it can be dissolved after adding water and then stirring)

5 Δ : acceptable solubility (its velocity is higher and long time for stirring is required to dissolve it)

Δ Str: difference between strengths before and after the test (the value after minus is the smaller the better since it represents less degradation in strength)

10

C. Storage Stability Test

The dye compositions according to Examples and Comparative Examples are placed in a weather meter. The temperature is set at 60°C to observe the changes in each property after storage at high temperature for 1 week. The results are shown in Table 4. Additionally, the temperature is cycled between from -10 °C and 50°C for 2 months to observe the changes in each property of the dye compositions according to Examples and Comparative Examples.

20 《Table 4》 Storage stability at high temperature (60°C*1W)

Item	Example 13	Comparative Example 8	Comparative Example 9	Comparative Example 10
pH value before test	7.0	7.0	7.0	7.0
pH value after 60 °C *1 W	6.6	2.5	6.2	5.6
Δ pH	-0.4	-4.5	-0.8	-1.4
Increased amount of anion (ppm)	+69	+5035	+160	+192
Precipitation	No	Yes	No	No
Relative strength (%)	99.9%	22.7%	99.8%	93.2%
Δ Str	-0.1%	-77.3%	-0.2%	-6.8%

(1) Δ pH: the difference between pH values before and after the test (| Δ pH| is the smaller the better);

(2) increased amount of anion: the value is the smaller the better (it represents less hydrolysis of reactive groups);

5 (3) Δ Str: the value after minus is the smaller the better (it represents less degradation in strength).

《Table 5》 Storage stability at high and low temperature (from -10°C to 50 °C*2M)

Item	Example 14	Comparative Example 11	Comparative Example 12	Comparative Example 13
pH value before test	7.0	7.0	7.0	7.0
pH value after -10°C-50°C*2 months	7.0	6.7	6.6	7.3

Δ pH	0	-0.3	-0.4	+0.3
Increased amount of anion (ppm)	+29	+74	+35	+181
Precipitation	No	No	No	Small particles
Relative strength (%)	100.6%	99.6%	98.8%	95.0%
Δ Str	+0.6%	-0.4%	-1.2%	-5.0%

Although the present invention has been explained in relation to its preferred embodiment, it is to be understood that many other possible modifications and variations can be made without departing from the scope of the invention as hereinafter claimed.

WHAT IS CLAIMED IS:

1. A reactive printing dye composition, comprising:

(a) at least one reactive dye in an amount of 45 to 99.85 parts by weight;

5 (b) an organic buffer in an amount of 0.05 to 10 parts by weight; and

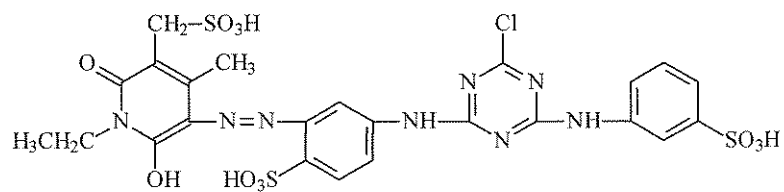
(c) a mirabilite (sodium sulfate) or a dispersant in an amount of 0.1 to 50 parts by weight.

2. The reactive printing dye composition as claimed in claim 1,
10 wherein the amount of the component (a) ranges from 45 wt% to 99.8 wt%, the amount of the component (b) ranges from 0.1 wt% to 5 wt%, and the amount of the component (c) ranges from 0.1 wt% to 50 wt%.

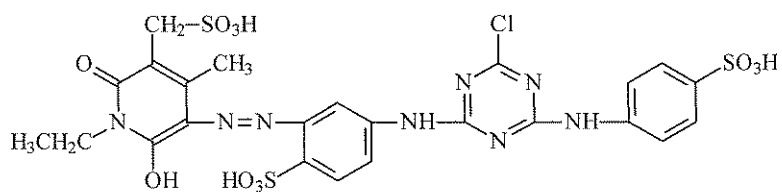
3. The reactive printing dye composition as claimed in claim 2,
15 wherein the amount of the component (a) ranges from 47 wt% to 99.7 wt%, the amount of the component (b) ranges from 0.2 wt% to 3 wt%, and the amount of the component (c) ranges from 0.1 wt% to 50 wt%.

4. The reactive printing dye composition as claimed in claim 3,
wherein the amount of the component (a) ranges from 47 wt% to 90 wt%, the amount of the component (b) ranges from 0.2 wt% to 3 wt%, and the
20 amount of the component (c) ranges from 9.8 wt% to 50 wt%.

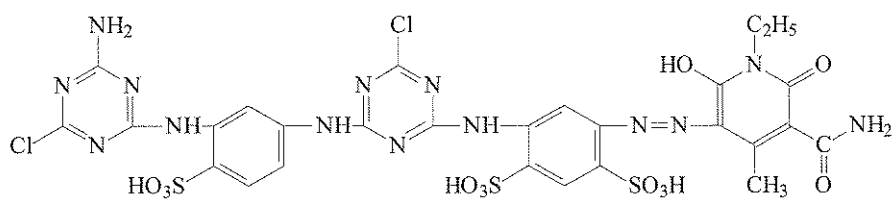
5. The reactive printing dye composition as claimed in any one of the preceding claims, wherein the component (a) is a reactive dye as shown in any one of the following formulas (I-1) to (I-15), its combination or its salt,



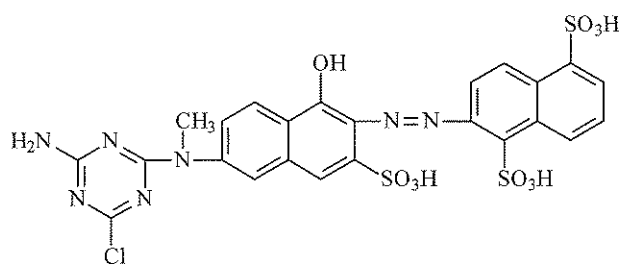
(I-1),



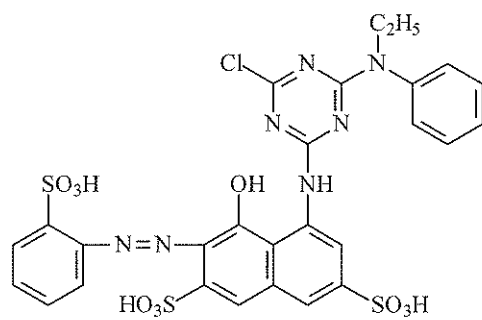
(I-2),



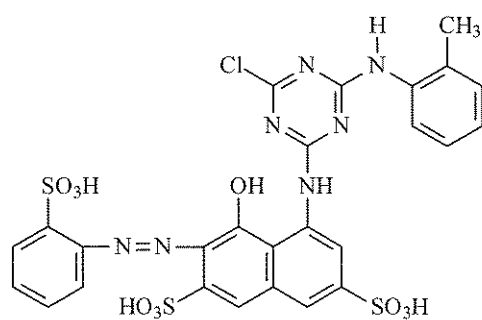
(I-3),



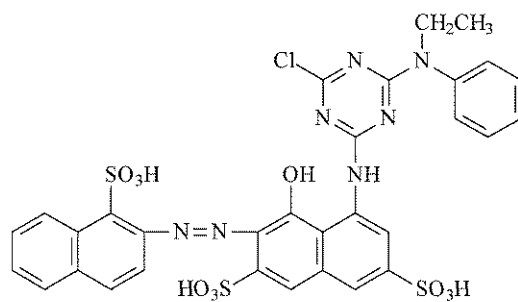
(I-4),



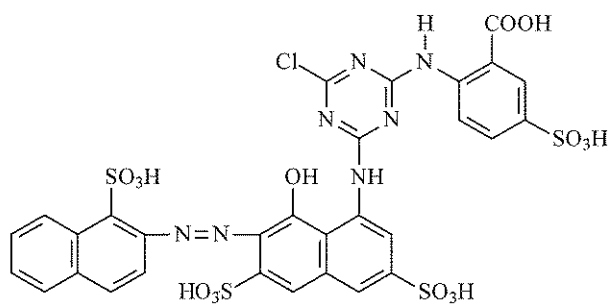
(I-5),



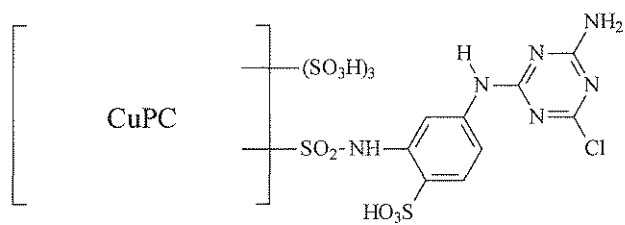
(I-6),



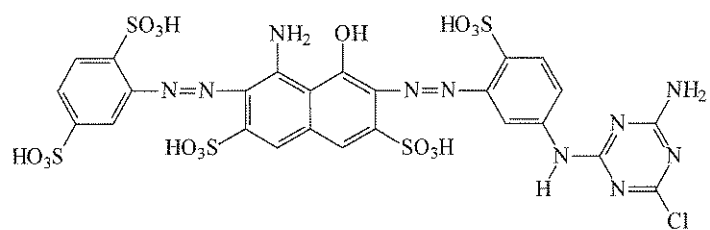
(I-7),



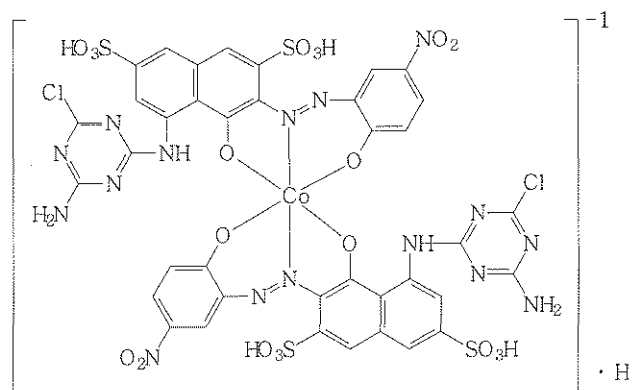
(I-8),



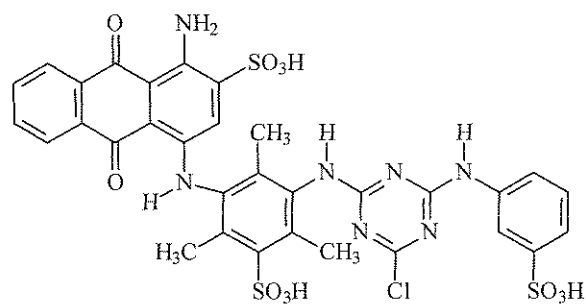
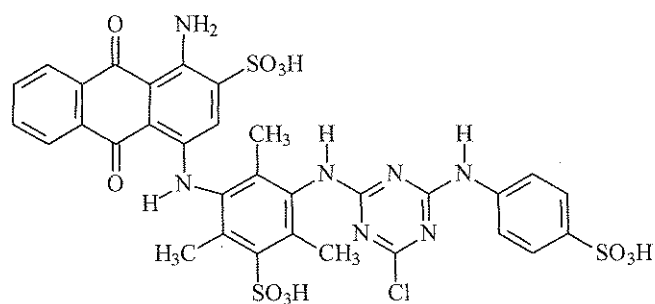
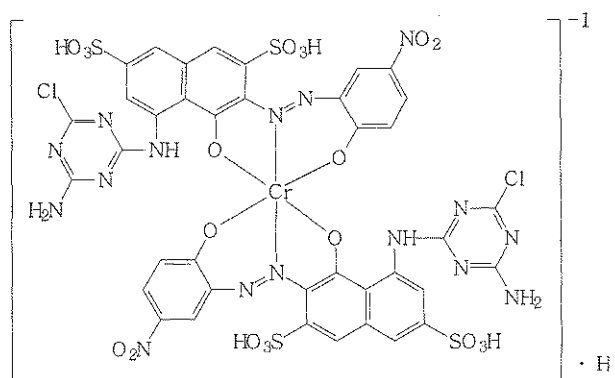
(I-9),

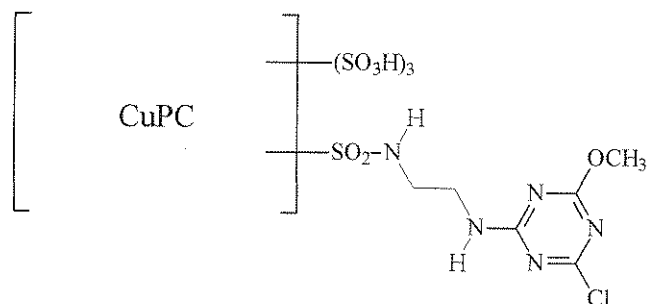


(I-10),



(I-11),

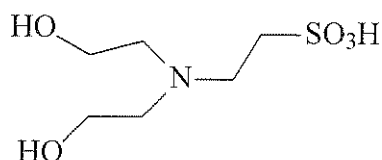




(I-15).

6. The reactive printing dye composition as claimed in any one of the preceding claims, wherein the reactive dye of the component (a) is selected from the group consisting of C.I. Reactive Red 3:1, C.I. Reactive Red 31, C.I. Reactive Red 33, C.I. Reactive Red 24, C.I. Reactive Red 45, C.I. Reactive Red 218, C.I. Reactive Violet 5, C.I. Reactive Yellow 2, C.I. Reactive Yellow 18, C.I. Reactive Yellow 33, C.I. Reactive Yellow 85, C.I. Reactive Yellow 95, C.I. Reactive Blue 15, C.I. Reactive Blue 5, C.I. Reactive Blue 49, C.I. Reactive Blue 71, C.I. Reactive Blue 176, C.I. Reactive Orange 5, C.I. Reactive Orange 12, C.I. Reactive Orange 13, C.I. Reactive Orange 99, C.I. Reactive Green 19, C.I. Reactive Brown 17, C.I. Reactive Black 8, C.I. Reactive Black 5 and a mixture thereof.

7. The reactive printing dye composition as claimed in any one of the preceding claims, wherein the component (b) is an organic buffer as shown in the following formula (II-1) or its salt,



(II-1).

8. An aqueous reactive printing dye composition, comprising:
(a) at least one reactive dye in an amount of 1 to 50 parts by weight;
(b) an organic buffer in an amount of 0.05 to 10 parts by weight;

and

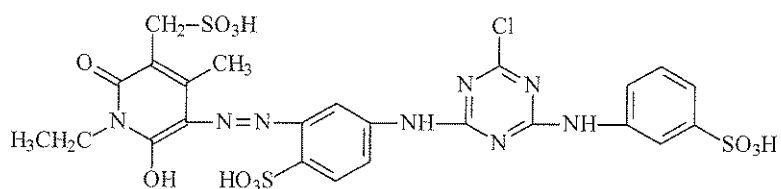
- 5 (c) water in an amount of 40 to 98.95 parts by weight.

9. The aqueous reactive printing dye composition as claimed in claim 8, wherein the amount of the component (a) ranges from 3 wt% to 45 wt%, the amount of the component (b) ranges from 0.1 wt% to 8 wt%, and the amount of the component (c) ranges from 47 wt% to 96.9 wt%.

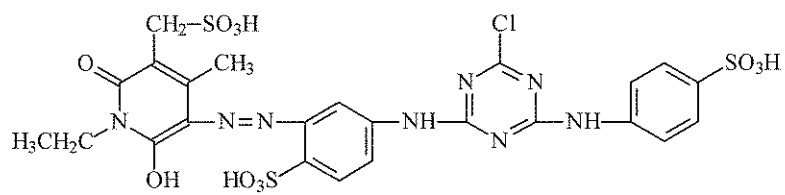
- 10 10. The aqueous reactive printing dye composition as claimed in claim 9, wherein the amount of the component (a) ranges from 3 wt% to 45 wt%, the amount of the component (b) ranges from 0.2 wt% to 8 wt%, and the amount of the component (c) ranges from 47 wt% to 96.8 wt%.

11. The aqueous reactive printing dye composition as claimed in
15 claim 10, wherein the amount of the component (a) ranges from 5 wt% to 40 wt%, the amount of the component (b) ranges from 0.2 wt% to 8 wt%, and the amount of the component (c) ranges from 52 wt% to 94.8 wt%.

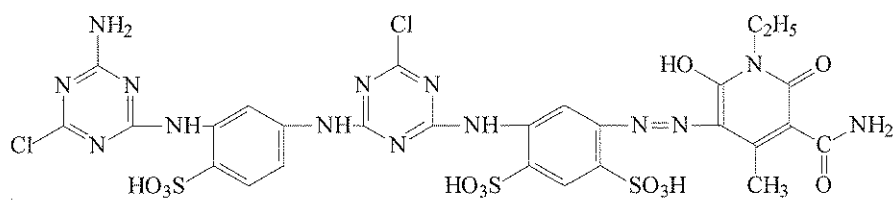
12. The aqueous reactive printing dye composition as claimed in
any one of claims 8 to 11, wherein the component (a) is a reactive dye as
20 shown in any one of the following formulas (I-1) to (I-15), its combination or its salt,



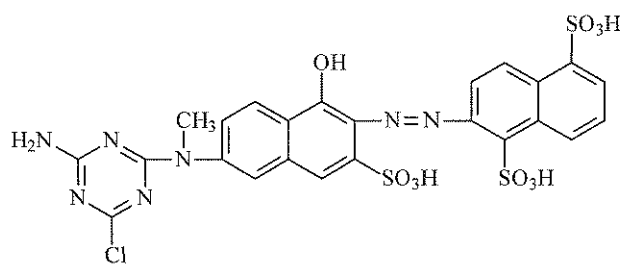
(I-1),



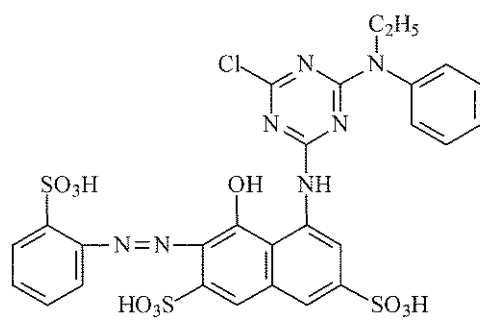
(I-2),



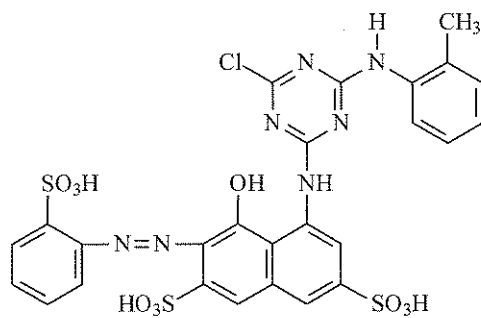
(I-3),



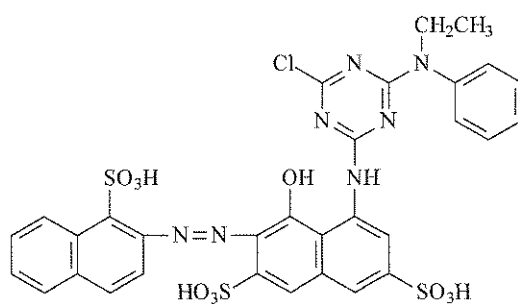
(I-4),



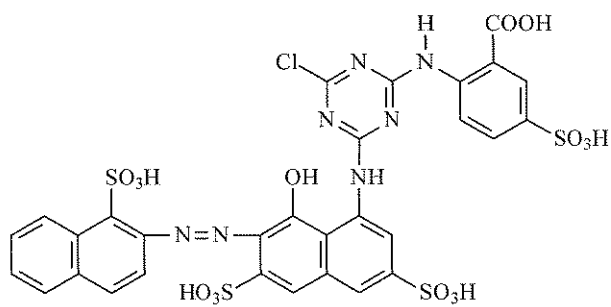
(I-5),



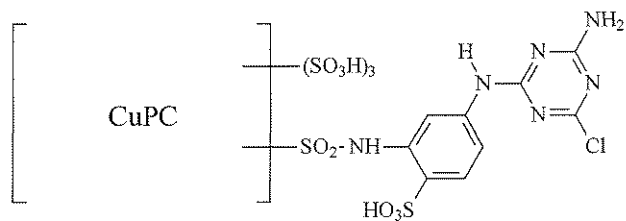
(I-6),



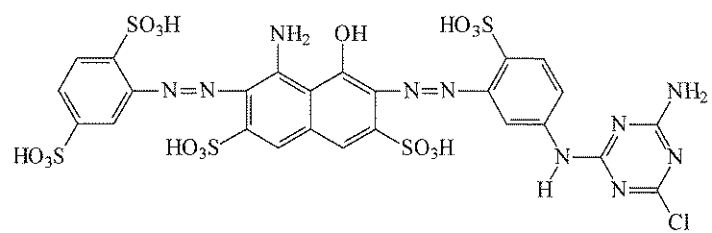
(I-7),



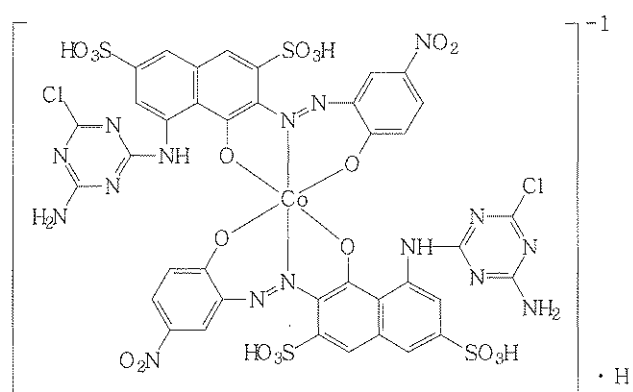
(I-8),



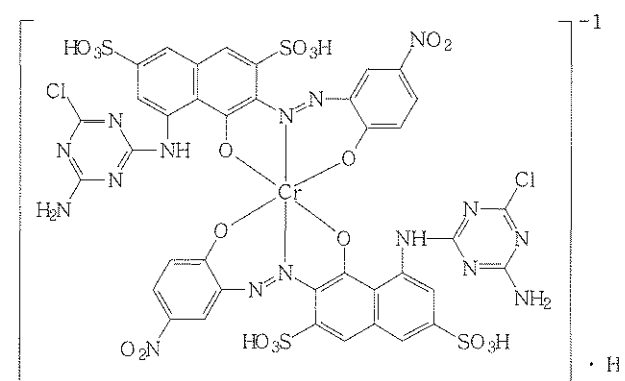
(I-9),



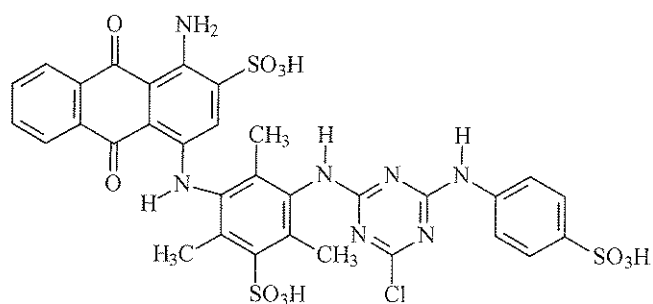
(I-10),



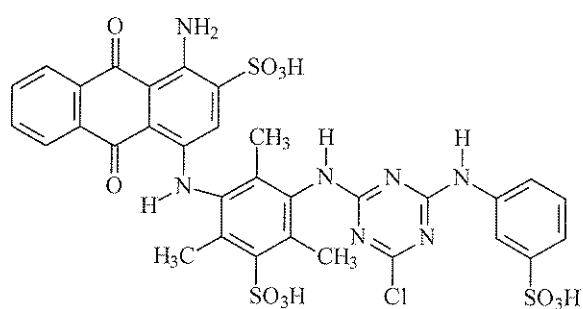
(I-11),



(I-12),

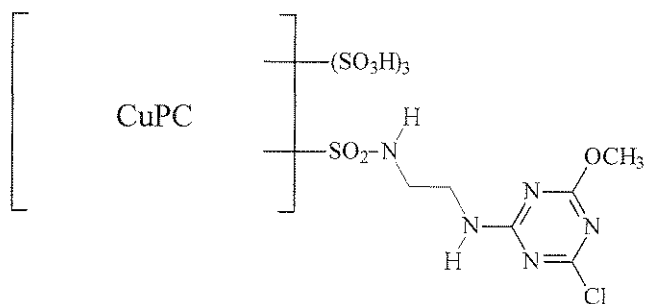


(I-13),



5

(I-14), and

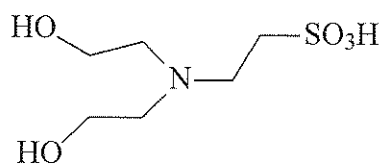


(I-15).

13. The aqueous reactive printing dye composition as claimed in
 10 any one of claims 8 to 12, wherein the reactive dye of the component (a) is
 selected from the group consisting of C.I. Reactive Red 3:1, C.I. Reactive
 Red 31, C.I. Reactive Red 33, C.I. Reactive Red 24, C.I. Reactive Red 45,
 C.I. Reactive Red 218, C.I. Reactive Violet 5, C.I. Reactive Yellow 2, C.I.
 Reactive

Yellow 18, C.I. Reactive Yellow 33, C.I. Reactive Yellow 85, C.I. Reactive Yellow 95, C.I. Reactive Blue 15, C.I. Reactive Blue 5, C.I. Reactive Blue 49, C.I. Reactive Blue 71, C.I. Reactive Blue 176, C.I. Reactive Orange 5, C.I. Reactive Orange 12, C.I. Reactive Orange 13, C.I. Reactive Orange 99, 5 C.I. Reactive Green 19, C.I. Reactive Brown 17, C.I. Reactive Black 8, C.I. Reactive Black 5 and a mixture thereof.

14. The aqueous reactive printing dye composition as claimed in any one of claims 8 to 13, wherein the component (b) is an organic buffer as shown in the following formula (II-1) or its salt,



(II-1).