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SOLVENT DYEING OF LIVING HUMAN HAIR

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ABSTRACT OF THE DISCLOSURE

A process for dyeing human hair which comprises contacting the hair with a dyeing composition comprising an aqueous solution, suspension or dispersion of a dye, an organic solvent for the dye, and a dissolved aromatic compound which is solid at the dyeing temperature and acts to increase the rate of uptake of the dye by the hair.

This invention relates to dyeing.

It is well known that the dyeing of a wide variety of materials by treatment with an aqueous solution, dispersion or suspension of a dye can be improved by including an organic solvent for the dye in the aqueous dyeing composition.

Thus, it is known from British patent specification 856,381 to include in the aqueous solution, dispersion or suspension of a dye with which keratinous fibers, such as silk and wool, or regenerated protein fibers are to be contacted to effect the dyeing thereof, an organic compound which is a solvent for the dye, and which is a liquid under the conditions of dyeing an insoluble or only slightly soluble in water, the solubility of the dye in the organic compound being greater than the solubility of the dye in water. Organic compounds (solvents) which may be used in the process include: aliphatic alcohols, for example n-butyl alcohol and amyl alcohol; aromatic hydroxy compounds, for example benzyl alcohol; esters, for example amyl lactate; aldehydes; ketones; and aromatic hydrocarbons.

British patent specification 872,506 describes a dyeing process similar to that described in the above specification although in specification 872,506 the treatment is applied to leather, skins and/or animal fibers attached thereto. The solvents that can be used are similar to those that can be used in the process of specification 856,381.

British patent specifications 826,479 and 918,597 also describe a dyeing procedure similar to that described in patent specification 856,381, although in specifications 826,479 and 918,597 the process is applied to the dyeing of human hair. The solvents used in the hair dyeing process of these patents include aliphatic and aralkyl alcohols, for example amyl alcohol and benzyl alcohol, and esters, for example amyl lactate.

British patent specification 840,904 describes a dyeing process similar to that described in British patent specification 826,479 although in this case the organic solvent must be one of a number of specified alcohols and it must be miscible with water in the proportion in which it is present. Alcohols for use in the process described in specification 840,904 include butyl alcohol; aralkanols, for example benzyl alcohol; and cycloaliphatic alcohols, for example cyclohexanol.

British patent specification 979,405 discloses the use as solvents of certain urea derivatives which are liquid at the dyeing temperature.

Benzyl alcohol as well as other slightly water miscible and water immiscible solvents referred to in the above specifications increase the rate of dyeing of the fiber or other material treated. This effect is particularly useful in the dying of living human hair because it enables a good uptake of dye to be obtained even at the relatively low temperatures that have to be employed for such dyeing.

British patent specification 669,192 which concerns the dyeing of furs and skins also discloses a dyeing procedure in which an organic solvent for the dye is included in the dyeing composition. In the procedure described in specification 669,192 the solvent employed is a partially or completely water miscible aliphatic low molecular alcohol, ketone or ester or mixture thereof. The dyeing composition described contains 10% or more of the solvent. The dyeing can be carried out at relatively low temperatures, for example between 20 and 80° C. Examples of the solvents employed are ethyl alcohol, glycol, acetone and ethyl acetate.

British patent specification 819,184 which relates to the dyeing of keratinous fibers, particularly hair, also describes the use of an organic solvent which is completely miscible with the water in the proportion in which it is present. In this instance the solvent employed is one having the general formula:

$$R—(O—CH_2—CH_2)_n—OH$$

where R represents a monovalent aliphatic or araliphatic hydrocarbon group containing not more than 8 carbon atoms and n is from 1 to 4. Examples of these solvents are 2-butoxyethanol and 2-[(beta-ethoxy)-ethoxy]-ethanol. The use of these solvents increases the rate of uptake of the dye on the hair and enables keratinous fibers, e.g. live hair, to be dyed at ambient temperatures.

We have now discovered that the increase in the rate of dye uptake that results from the use of solvents as mentioned in the above specifications can be further improved by including dissolved in the dyeing composition a wide range of aromatic compounds which are solid at the dyeing temperature; such a compound will hereinafter be referred to as a "solid aromatic compound."

Accordingly, the present invention provides a dyeing composition which comprises an aqueous solution, suspension or dispersion of a dye and an organic solvent for the dye, the composition additionally comprising dissolved therein a solid aromatic compound so as to improve the rate of uptake of the dye on the material to be dyed. "Dye" is used in this paragraph and hereinafter to include direct dyestuffs, i.e. dyestuffs capable of being fixed directly and in the final shade by the product to be dyed, without it being necessary to interpose any chemical transformation, and water insoluble colored organic compounds.

The invention also provides a process which comprises contacting the material to be dyed with a dyeing composition comprising an aqueous solution, suspension or dispersion of a dye and an organic solvent for the dye, which solvent is liquid under the conditions of dyeing, the dyeing composition additionally comprising a solid aromatic compound which acts to increase the rate of uptake of the dye by the material contacted.

The invention may be applied to the dyeing of the various materials mentioned in the prior patent specifications referred to. In the case of fibers, these can either be in the natural state or woven or otherwise made up into fabrics or garments. The invention is particularly applicable to the dyeing of keratinous fibers such as hair.

Experiments carried out have indicated that the solid aromatic compounds effective as increasing the rate of uptake of the dye from dyeing compositions containing solvents are those containing an aromatic ring and at least one of the following groups as substituents of the ring: carboxylic acid, amide and substituted amide, hydroxyl and esters thereof, nitrile, aldehyde, ketone, halogen, amine, alkoxy, ureido, and aliphatic groups, for example saturated or unsaturated groups containing up to 6 carbon atoms, which aliphatic groups are themselves substituted by at least one hydroxyl or carboxyl group.

The solid aromatic compound molecule may contain a phenyl or naphthyl ring.

The classes of compounds from which the solid aromatic compound may be chosen include: carboxylic acids, e.g. benzoic, cinnamic, salicylic, hippuric, and naphthoic acids; mono- and polyhydric phenols; and chloro benzenes.

Examples of compounds containing more than one of the above substituent groups are o-anisaldehyde, o-amino phenol and p-chloro phenol. The substituent groups may be the same as in, for example, p-dichlorobenzene and o-dimethoxy benzene.

Examples of compounds containing a substituted aliphatic group are methoxy phenyl acetic acid, p-nitro benzyl alcohol and cinnamic acid.

The solid aromatic compound may comprise an unsubstituted hydrocarbon group attached to the aromatic ring. Such a group may be a phenyl group or an aliphatic group such as an alkyl or alkenyl group having up to 6 carbon atoms, for example. Other groups may be present, for example nitro, nitroso, sulphonic acid or substituted sulphonic acid groups.

Examples of compounds having other substituents present are o-cresol, thymol, sulphanilic acid, m-nitrobenzaldehyde, p-nitro-benzyl alcohol, sulphanilanilide, p-nitrobenzyl alcohol and 2,4-dichloronitrobenzene.

The optimum amount of the solid aromatic compound to be used will to some extent be dependent on the other components of the dyeing composition such as the dye and solvent. In most cases an amount of at least 0.5% by weight of the dyeing composition will be necessary to produce a significant increase in the dyeing effect. For the dyeing of hair usually amounts in the range 1 to 5% give the best results. Amounts of the solid aromatic compound in excess of its solubility in the dyeing composition are not objectionable but do not give any significant advantage and usually such an excess will not be used.

As the dyeing of living hair is usually carried out below 45° C. the solid aromatic compound used in this instance can have a melting point as low as 45° C., or even lower depending on the actual dyeing temperature used. Higher temperatures may be used in other dyeing treatments, for instance in wool dyeing, but then the range of solid aromatic compounds that can be used is smaller. Thus for wool dyeing one employs solid aromatic compounds having a melting point above about 80° C. or in any event above the actual dyeing temperature used.

As is known from the abovementioned specifications, a wide variety of dyes can be used in solvent-containing dye systems and those mentioned can be employed in performing this invention.

Among the dyes that can be used are reactive dyes which contain chromophoric groups linked to a reactive group such as mono- or di-chlorotriazine, di- or tri-chloropyrimidine or vinyl sulphone. Reactive dyes free from a sulphonic or non-chelated carboxylic acid group such as described in British patent specification 953,230 can also be used.

As examples of dyes which may be employed in carrying out this invention are mentioned the following—

Monoazo dyes, e.g.:		C.I. classification
Coomassie Blue R.L.	13390	Acid Blue 92
Tartrazole Yellow	19140	Acid Yellow 23
Disazo dyes, e.g.:		
Resorcine Brown	20170	Acid Orange 24
Triphenylmethane type dyes, e.g.:		
Disulphine Blue	42045	Acid Blue 1
Acid Magenta N	42685	Acid Violet 19
Soluble Blue B	42755	Acid Blue 22
Lissamine Violet	43525	Acid Violet 15
Xanthene dyes, e.g.:		
Coomassie Violet 2RS	45190	Acid Violet 9
Azine dyes, e.g.:		
Nigrosine	50420	Acid Black 2
Xylene Fast Blue FF	50315	Acid Blue 59
Coomassie Dark Blue BL	50330	Acid Blue 61
Anthraquinone dyes, e.g.:		
Solway Purple R125	60730	Acid Violet 43
Brilliant Alizarine Milling Blue	61585	Acid Blue 80
Carbolan Violet 2RS	62165	Acid Violet 51
Carbolan Blue HR	62075	Acid Blue 138
Premetallized dyes:		
Both 1:1 and 2:1 complexes e.g. Neolan Black 2R	15691	Acid Black 43
Mordant dyes, e.g.:		
Solochrome Black 6RN	14640	Mordant Black 3
Acid Alizarine Black N	15690	Mordant Black 15
Solochrome Black F130	26695	Mordant Black 5
Disperse dyes, e.g.:		
Celliton Blue B	61500	Disperse Blue 14
Celliton Fast Blue FFB	62050	Disperse Blue 6
Celliton Blue 36	64505	Disperse Blue 31
Direct dyes, e.g.:		
Melanthine BH	22590	Direct Blue 2
Diphenyl Fast Black B	27720	Direct Black 51
Diphenyl Brilliant Violet BC	27905	Direct Violet 51
Solvent dyes, e.g.:		
Zapon Fast Violet R	15680	
Coomassie Violet 2RS	45190	Solvent Violet 10

As will be seen from the above mentioned specifications, a large number of different solvents are known to be used in dyeing compositions and those mentioned can be used in carrying out this invention. Among the solvents which may be used in accordance with the present invention are:

aliphatic alcohols, e.g. those containing 1–6 carbon atoms, including cyclohexanol;
aralkanols, e.g. benzyl alcohol;
alkoxy alcohols e.g. 3-methoxybutanol, ethoxyethanol and methoxyethanol;
aliphatic ketones, e.g. ethyl methyl ketone and methyl isobutyl ketone;
higher glycols, e.g. hexylene glycol;
aliphatic esters, e.g. amyl lactate;

as well as ethanol 2-methoxyacetate, geraniol, "Carbitols" and digols, and tetraethyl urea. "Carbitols" are monoethers and monoesters of dihydroxyethyl ether.

As is known, the more miscible the solvent the greater the proportion that is to be used.

The dyeing composition may also contain further ingredients known in the art. For instance, in compositions intended for dyeing human hair there may be included thickeners, surface active agents or aliphatic acids, such as acetic or lactic acid. One may also include where the

solvent is not miscible with water, a liquid miscible with both the water and solvent.

In a modification of the invention the material to be dyed is contacted successively with an aqueous solution or dispersion of the dye and also with a liquid organic solvent for the dye (either the said solution or solvent being applied first), the solid aromatic compound being dissolved in either the aqueous solution or in the organic solvent or in both of them.

In a further modification of the invention the material to be dyed is contacted successively with a solution of the dye in a liquid organic solvent for the dye and also with water (either the organic solvent or the water being applied first), the solid aromatic compound being dissolved in either the organic solvent or in the water or in both of them.

The following examples illustrate the invention. All percentages are by weight.

The dyeing compositions employed in the following examples each comprised an organic solvent, a solid aromatic compound (in solution in the composition), 1% dye, 1% monoethanolamine lauryl sulphate and the balance water. The pH of the dyeing composition in each case was about 4.

The dye in each of Examples 1 to 34 was the acid dye Solway Purple R 125 (C.I. 60730 Acid Violet 43).

In Examples 1 to 26 the amount of the solvent was 10%; in Examples 27–30, 5%; and in Examples 31–34, 15%. In Examples 1 to 9 the concentration of the solid aromatic compound was 2% and in Examples 10–34, 3%.

The solvent and solid aromatic compound used in Examples 1 to 34 are set out in Table I

TABLE I

Example	Solvent	Solid aromatic compound
1	Butanol	Benzoic acid.
2	do	Cinnamic acid.
3	do	Methoxy phenyl-acetic acid.
4	do	Salicylic acid.
5	do	p-Amino benzoic acid.
6	do	Hippuric acid.
7	do	Acetyl salicylic acid.
8	do	Phthalic acid.
9	do	Sulphanilic acid.
10	do	Phenol.
11	do	o-Cresol.
12	do	Catechol.
13	do	Resorcinol.
14	do	Hydroquinone.
15	do	Thymol.
16	do	o-Amino phenol.
17	do	p-Chloro phenol.
18	do	p-Nitro-benzyl alcohol.
19	do	Phenylurea.
20	do	m-Nitrobenzaldehyde.
21	do	o-Anisaldehyde.
22	do	2,4-dichloronitro benzene.
23	do	m-Nitrochlorobenzene.
24	do	p-Dichlorobenzene.
25	do	Sulphanilanilide.
26	do	o-Dimethoxy benzene.
27	Benzyl alcohol	Benzoic acid.
28	do	Salicylic acid.
29	do	p-Amino benzoic acid.
30	do	Thymol.
31	n-Propanol	Benzoic acid.
32	do	Salicylic acid.
33	do	p-Aminobenzoic acid.
34	do	Thymol.

In Examples 35 to 40 the composition employed was the same as that in Example 27 except that the dye employed was Coomassie Dark Blue BL (C.I. 50330 Acid Blue 61) and instead of benzyl alcohol the solvent was as set out in Table II.

TABLE II

Example:	Solvent
35	Cyclohexanol.
36	3-methoxybutanol.
37	Ethyl methyl ketone.
38	Hexylene glycol.
39	Ethanol 2-methoxy acetate.
40	2-[(β-ethoxy)-ethoxy]-ethanol.
41	Tetraethyl urea.

In Examples 42 to 52 the composition employed was the same as that in Example 31 except that the dye employed was as indicated in Table III.

TABLE III

Example	Name of dye	C.I. classification of dye
42	Coomassie Blue R.L	13390 Acid Blue 92.
43	Resorcine Brown	20170 Acid Orange 24.
44	Disulphine Blue	42045 Acid Blue 1.
45	Coomassie Voilet 2RS	45190 Acid Violet 9.
46	Nigrosine	50420 Acid Black 2.
47	Neolan Black 2R	15691 Acid Black 43.
48	Solochrome Black 6RN	14640 Mordant Black 3.
49	Celliton Blue B	61500 Disperse Blue 14.
50	Melanthine BH	22590 Direct Blue 2.
51	Coomassie Violet 2RS	45190 Solvent Violet 10.

Switches of human hair were dyed with each of the compositions of the above examples by immersing the switches for 10 minutes in the dyeing compositions at 25° C. They were then washed with water and dried. Switches of hair were also treated in a similar manner with the corresponding compositions from which the solid aromatic compound had been omitted. In every case the intensity of the color of the hair was noticeably greater in the case of dyeings with the compositions set out in the tables than with those compositions from which the solid organic compounds had been omitted.

In Examples 53 to 55 materials other than human hair were dyed. The dyeing composition used in each case consisted of:

	Percent
Monoethanolamine lauryl sulphate	0.3
n-Propanol	15.0
Benzoic acid	3.0
Solway Purple R	1.0

Water to 100.0%.

The materials used are indicated in Table IV.

TABLE IV

Example:	Fiber treated
53	Wool
54	Silk
55	Mohair

The fibers were dyed by immersing them for 10 minutes in the dyeing composition at 25° C. They were then washed with water and dried. The intensity of color of the dyed fibers was in each case greater than that obtained using dyeing compositions of the same pH but containing no benzoic acid or containing in place of the n-propanol and benzoic acid, 6% of benzyl alcohol.

What is claimed is:

1. A process for dyeing human hair attached to the head which comprises contacting the hair at a temperature below about 45° C. with an effective amount of a dyeing composition comprising an aqueous solution, suspension or dispersion of a direct dye and an organic solvent for the dye which solvent is liquid at the dyeing temperature and is selected from the group consisting of aliphatic alcohols, aralkanols, alkoxy alkanols, aliphatic ketones, hexylene glycol, aliphatic esters, tetraethyl urea and 2-(beta-ethoxy)-ethoxyethanol, the dyeing composition additionally comprising dissolved therein from about 1% to about 5% by weight of the composition of an aromatic compound which compound is solid at the dyeing temperature, acts to increase the rate of uptake of the dye by the hair and contains one phenyl or naphthyl ring.

2. A process as claimed in claim 1, in which the organic solvent is benzyl alcohol.

3. A process as claimed in claim 2, in which the aromatic compound is a carboxylic acid.

4. A process as claimed in claim 3, in which the carboxylic acid is benzoic acid.

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