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(11) **EP 1 340 621 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication: **03.09.2003 Bulletin 2003/36** (51) Int Cl.7: **B41M 5/00, D06P 5/00**

(21) Application number: **03003513.3**

(22) Date of filing: **15.02.2003**

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IT LI LU MC NL PT SE SI SK TR**
Designated Extension States:
AL LT LV MK RO

(30) Priority: **28.02.2002 GB 0204699**

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(54) **Recording materials**

(57) There is provided a recording material suitable for ink jet recording comprising a sheet like substrate and arranged on at least one side of the substrate at least one ink-receptive recording layer comprising:

- 1) gelatin;
- 2) at least one triazolopyrimidine compound or a salt thereof.

There is also provided a recording material suitable for ink jet recording comprising a sheet like substrate and arranged on at least one side of the substrate at least one ink-receptive recording layer comprising:

- 1) gelatin;
- 2) a cellulose derivative; and
- 3) at least one triazolopyrimidine compound or a salt thereof.

A preferred triazolopyrimidine compound is 4-hydroxy-6-methyl-1,3,3a,7-tetra-aza indene.

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DescriptionField of the Invention

[0001] The present invention relates to a recording material for recording using the ink jet printing process.

Background of the Invention

[0002] Ink jet recording is a non-impact printing method wherein droplets of a recording fluid, the ink, are formed by forcing the fluid through a tiny nozzle (or a series of nozzles) under computer control and deposited on a recording material such as paper or transparent film. There are several classes of ink jet printer, for instance thermal drop-on-demand printers, piezo drop-on-demand printers, and continuous ink jet printers. Ink jet recording has been intensively developed in recent years, and has found broad application as output for personal computers in the office and the home because of its low noise characteristic, capability of high speed printing, and facility of multi-colour printing. Ink jet printing techniques, particularly those using mainly aqueous inks, have undergone rapid development both in respect of reliability and the image quality that the printing apparatus can achieve, and in respect of the cost price of the printing apparatus. Consequently, increasingly severe requirements are being set for the recording materials. The recording produced by means of an ink jet processes is required to have, for example, good water and smear resistance, high resolution, high colour density, sufficient ink gradation, and good light fastness.

[0003] One type of recording material commonly used for the ink jet printing process is described as a swelling polymer system, and comprises one or more ink-receptive recording layer formed of one or more water-accepting polymeric binders arranged on a suitable substrate. The polymeric binder may, for example, be gelatin; a cellulose derivative such as hydroxyethyl cellulose, methyl hydroxypropyl cellulose, carboxymethyl cellulose, ethyl hydroxypropyl cellulose, or carboxymethylhydroxyethyl cellulose; a vinyl polymer such as poly (vinyl alcohol) or poly (vinyl pyrrolidone); or a mixture of such binders.

[0004] Optionally, the recording layer also comprises a cationogenic substance in order to bind the dyes from the inks, together with other functional additives such as an absorbent pigment or a surfactant. Suitable cationogenic substances for use in such recording layers are well known, and include, for example, polyvalent metallic ions, quaternary ammonium salts, polyamines and salts thereof, polymeric ammonium compounds, and basic latexes.

[0005] Further, United States Patent 5,457,486 discloses a recording sheet which comprises (a) a base sheet; (b) a material selected from the group consisting of tetrazolium compounds, indolinium compounds, imidazolinium compounds, and mixtures thereof; (c) an optional pigment; and (d) an optional binder; similarly United States Patent 5,441,795 discloses ink jet recording sheets containing pyridinium or piperazinium compounds.

[0006] Such recording materials may provide prints and images of good quality, and are suitable for their intended purposes. However, a need remains for improved recording sheets which exhibit good image quality when printed with aqueous inks, particularly when printing a multi-colour image in which very dark or dense tints are to be reproduced. Due to the greater quantity of ink laid down, the ink can be slow to absorb into the surface of the recording sheet as this absorption depends on swelling of the polymer layer. Further, this slow absorption is becoming more of a problem as printers develop and printing speeds increase, and can lead to visible print deficiencies such as coalescence caused by drops mixing on the print surface before the ink is absorbed.

[0007] United States Patent 5,657,064 discloses ink jet recording sheets containing pyrrole, pyrrolidine, pyridine, piperidine, homopiperidine, quinoline, isoquinoline, quinuclidine, indole, or indazole compounds; United States Patent 5,659,348 discloses recording sheets containing purine, pyrimidine, benzimidazole, imidazolidine, urazole, pyrazole, triazole, benzotriazole, tetrazole, or pyrazine compounds; United States Patent 5,729,266 discloses recording sheets containing oxazole, isoxazole, oxazolidinone, oxazoline salt, morpholine, thiazole, thiazolidine, thiadiazole, and phenothiazine compounds; however these inventions particularly relate to improving the drying performance of recording sheets, and especially to reducing the curl of sheets dried with microwave radiation and not to improving the rate of absorption of the ink.

[0008] Thus there is still a requirement for an improved image receiving material which is rapid to dry without coalescence when printed with heavy ink loads and which provides good quality dense images. We have developed such a material.

Summary of the Invention

[0009] According to this invention there is provided a recording material suitable for ink jet recording comprising a sheet like substrate and arranged on at least one side of the substrate at least one ink-receptive recording layer comprising:

- gelatin; and
- at least one triazolopyrimidine compound or a salt thereof.

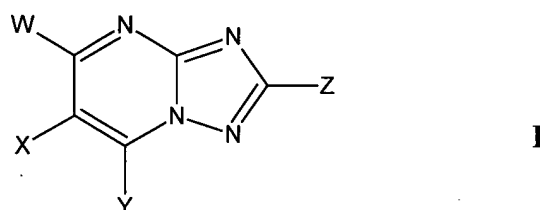
Detailed Description of the Invention

[0010] The supporting substrate for the recording materials of the invention may be any of those known for use in printing and imaging media. Suitable substrates include, for example paper, high wet-strength paper, tracing paper, heavyweight paper, fine art paper, card, board, coated paper such as resin coated, polyethylene coated, and barrier layer coated paper, synthetic papers, canvas, cloth, fabric, metals such as aluminium, and polymeric substrates such as filled plastics, opaque plastics, or transparent materials, for example cellulose acetates, poly(ethylene), poly(propylene), poly(vinyl chloride), poly(ethylene terephthalate) and poly(ethylene naphthalate), polycarbonate, polysulphone, polyether sulphone, poly(arylene sulphone), poly(arylene ether ketone sulphone), cellophane, polyvinyl fluoride, polyimide, and the like. Preferably the supporting substrate is polyethylene coated paper or barrier layer coated paper.

[0011] By barrier layer coated paper is meant a paper coated with a water repellent resin barrier layer provided in the form of a latex comprising fine particles of a film-forming polymer suspended in an aqueous carrier. The latex is allowed to form a film during the coating and drying process. The barrier layer may comprise almost any film-forming latex polymer. The polymer of the barrier layer may preferably have a glass transition point of at least 40°C., more preferably approximately 50-100°C. The polymer of the barrier layer may optionally contain other additives as are known in the art, such as for example, UV absorbers, light stabilisers such as hindered amines, optical brightening agents, or tinting agents. The barrier layer may additionally contain a proportion of an inorganic filler and other additives to improve the operation of the coating process, for example polymeric thickeners, lubricating agents, dispersants, and adhesion promoters.

[0012] The gelatin for the ink-receptive layer of the recording materials of the invention may be any gelatin known for use in imaging materials, for example skin or bone gelatin, treated gelatin such as deionised gelatin, modified gelatin such as phthalated gelatin or phenylcarbamoylated gelatin, or a cationically modified gelatin. A particularly suitable gelatin is a deionised ossein gelatin of high isoelectric point.

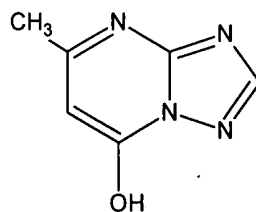
[0013] Various permutations of the triazolopyrimidine ring system are known, but especially suitable triazolopyrimidine compounds are *s*-triazolo[1,5-*a*]pyrimidine compounds commonly referred to as tetra-aza indene compounds and having the general structure I.



wherein the substituents W, X, Y, and Z, which may be the same or different, are individually R, OR, SR, SOR, SO₂R, NRR', NR(COR'), CO₂R, CONRR', SO₂NRR', NRSO₂R', CN, NO₂, halogen, sulphonic acid, or phosphonic acid, wherein the groups R and R' are independently hydrogen, branched or unbranched C₁ - C₂₀ substituted or unsubstituted, saturated or unsaturated hydrocarbon, e.g., alkyl, alkenyl, alkynyl, cycloalkyl, cycloalkenyl, aryl, heteroaryl, alkylaryl, or arylalkyl or wherein two or more of the groups W, X, Y, R, and R', may be combined to form a ring system or systems. Preferred substituents W, X, Y, and Z, include in particular hydrogen, methyl, ethyl, and hydroxy groups.

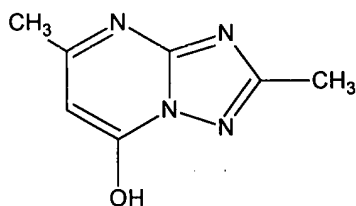
[0014] Tetra-aza indene compounds are known compounds or may be prepared by known methods, and in particular by the condensation of an appropriate aminotriazole with a suitable β-dicarbonyl compound.

[0015] An especially preferred class of tetra-aza indene compounds according to formula I are those wherein the group Y is a hydroxy group. A particularly preferred compound is 4-hydroxy-6-methyl-1,3,3a,7-tetra-aza indene having the structure:



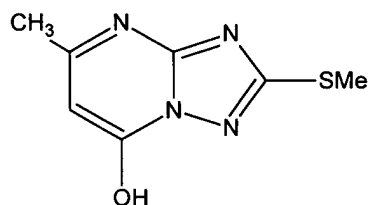
which is hereinafter referred to as compound 1

[0016] Another suitable compound is 4-hydroxy-2,6-dimethyl-1,3,3a,7-tetra-aza indene having the structure:



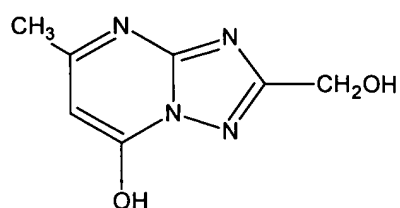
which is hereinafter referred to as compound 2.

[0017] Another suitable compound is 4-hydroxy-2-methylthio-6-methyl-1,3,3a,7-tetra-aza indene having the structure:



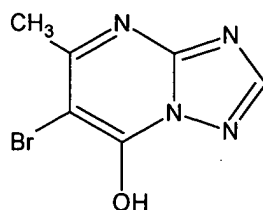
which is hereinafter referred to as compound 3.

[0018] Another suitable compound is 4-hydroxy-2-hydroxymethyl-6-methyl-1,3,3a,7-tetra-aza indene having the structure:



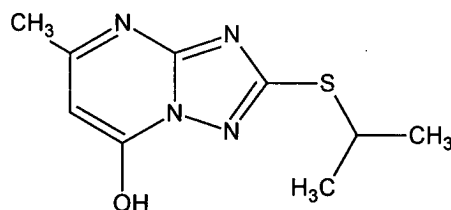
which is hereinafter referred to as compound 4.

[0019] Another suitable compound is 5-bromo-4-hydroxy-6-methyl-1,3,3a,7-tetra-aza indene having the structure:



which is hereinafter referred to as compound 5.

[0020] Another suitable compound is 4-hydroxy-2-isopropylthio-6-methyl-1,3,3a,7-tetra-aza indene having the structure:



which is hereinafter referred to as compound 6.

[0021] It is to be understood that many tetra-aza indene compounds are potentially tautomeric and that this invention also includes all relevant tautomers of such compounds. In particular, compounds of formula I wherein one of the groups W, X, Y, or Z is a hydroxy group or an NHR group, including the hereinbefore described compounds 1 - 6, may exist as tautomers.

[0022] It is further to be understood that certain tetra-aza indene compounds, particularly those having an ionisable group as a substituent group, may form salts and that this invention also includes relevant salts of such compounds. An ionisable group is one which is capable of forming an anionic group or a cationic group in the medium of use. Suitable ionisable groups include salt forming substituents such as sulphonic acid, carboxylic acid, phosphonic acid, and basic nitrogen containing groups. Further, hydroxy groups located as substituents W or Y of the formula I are frequently sufficiently acidic to enable salt formation and therefore salts of such compounds, including the hereinbefore described compounds 1 - 6, may be used in the invention.

[0023] There may also be present in the ink-receptive layer or layers additional water receptive polymeric binders compatible with the gelatin. Suitable binders include poly (vinyl alcohol) and copolymers and derivatives thereof; carbohydrates such as tragacanth gum, sodium alginate, or water-soluble starch derivatives; water-accepting cellulose derivatives such as hydroxyethyl cellulose, methyl hydroxypropyl cellulose, carboxymethyl cellulose, or carboxymethylhydroxyethyl cellulose; polyalkylene oxides such as polyethylene oxide and polypropylene oxide or derivatives thereof; water-accepting acrylate, methacrylate, or maleate polymers and copolymers and derivatives thereof; poly (vinyl pyrrolidone) and copolymers and derivatives thereof; casein; and mixtures of such binders. Preferred additional binders include cellulose derivatives such as hydroxyethyl cellulose, methyl hydroxypropyl cellulose, carboxymethyl cellulose, methyl hydroxyethyl cellulose, or carboxymethylhydroxyethyl cellulose.

[0024] Therefore according to one especially preferred embodiment of the invention there is provided a recording material suitable for ink jet recording comprising a sheet like substrate and arranged on at least one side of the substrate at least one ink-receptive recording layer comprising:

- gelatin;
- a cellulose derivative; and
- at least one triazolopyrimidine compound or a salt thereof;

wherein the substrate, gelatin, and triazolopyrimidine compound are as hereinbefore defined and the cellulose derivative is selected from hydroxyethyl cellulose, methyl hydroxypropyl cellulose, carboxymethyl cellulose, carboxymethylhydroxyethyl cellulose, methyl hydroxyethyl cellulose, or mixtures thereof.

[0025] Further, the ink-receptive recording layer of the recording materials of the present invention may comprise additional components as known in the art for use in recording materials. For instance the ink receptive layer or layers may comprise one or more absorbent filler or pigment. Suitable absorbent fillers or pigments for the ink-receptive recording layer or layers include for example clay, kaolin, talc, silica, calcium carbonate, diatomaceous earth, barium sulphate, titanium dioxide, aluminium oxide, zinc oxide, boehmite, starch, synthetic organic pigments, a blend of calcium fluoride and silica, zinc oxide, blends of zinc sulphide with barium sulphate, satin white, and the like, as well as mixtures of two or more of the above fillers. Preferred fillers include porous synthetic amorphous silica, porous boehmite, porous synthetic alumina, and precipitated calcium carbonate. Fillers may be present in any effective amount, and if present, typically are present in amounts of from about 1 to about 60 percent by weight of the coating composition.

[0026] Further, the ink-receptive recording layer of the recording materials of the present invention may additionally comprise one or more cationogenic substance. Suitable cationogenic substances for the ink-receptive recording layer include quaternary ammonium polymers such as poly (dimethyl diallyl ammonium chloride); quaternary phosphonium polymers; basic polymers such as polyethyleneimine, polyvinylamine and copolymers and derivatives thereof; polymers

and copolymers comprising basic monomers such as vinyl pyridine, vinyl imidazole, and amine containing (meth) acrylates; salts and quaternised reaction products from such basic polymers; reaction products of a low molecular weight polyfunctional amine with a compound polyfunctional to amino groups such as epichlorohydrin; cationically modified poly (vinyl alcohols); or a polyvalent metallic cation. The cationogenic substances best known for this purpose are polymeric quaternary ammonium compounds.

[0027] In addition to the components already mentioned, it is to be understood that the ink-receptive layer or layers may advantageously also comprise further auxiliary agents as are known in the art, for example surfactants, plasticisers, lubricants, latexes, cross linking agents, antistatic agents, fungicides, dispersants, antifoams, toning agents, ultraviolet absorbers, and optical brighteners.

[0028] Furthermore there may also be present additional layers in the recording materials of this aspect of the invention. Specifically, the recording material of the invention may comprise two or more ink-receptive layers, any or all of which may comprise the inventive combination of gelatin and a triazolopyrimidine compound as hereinbefore described.

[0029] Preferably, the inventive combination is provided in the upper layer or layers of an ink-receptive system comprising two or more layers according to this aspect of the invention. The lower layer or layers may be any ink receiving system as is known in the art.

[0030] According to a particularly preferred embodiment of the invention there is provided a recording material suitable for ink jet recording comprising in the following order:

- 1) a sheet like substrate;
- 2) at least one lower ink-receptive recording layer; and
- 3) at least one upper ink-receptive recording layer comprising in combination:
 - gelatin;
 - a cellulose derivative; and
 - at least one triazolopyrimidine compound or a salt thereof;

wherein the supporting substrate, gelatin, cellulose derivative, and triazolopyrimidine compound are as hereinbefore defined and the lower ink receptive layer comprises at least one water accepting polymeric binder.

[0031] Preferably, the binder in the lower ink-receptive layer or layers of a recording material according to this aspect of the invention comprises gelatin.

[0032] In addition to the components already mentioned, it is to be understood that any of the ink-receptive layers may advantageously also comprise further auxiliary agents as hereinbefore described, for example additional binders, cationogenic substances, fillers or pigments, surfactants, plasticisers, lubricants, latexes, cross linking agents, antistatic agents, fungicides, dispersants, antifoams, toning agents, ultraviolet absorbers, and optical brighteners.

[0033] The coated amount of the ink-receptive layer or layers may be determined by the printing apparatus, the quantity of ink to be printed, the substrate, and the components used. The total dry coating weight of the ink-receptive layer or layers may be up to about 50 gm⁻², preferably from about 2 gm⁻² to about 10 gm⁻², most preferably from about 5 gm⁻² to about 10 gm⁻². One of the advantages of the recording materials of the present invention comprising a triazolopyrimidine compound as a coalescence-reducing additive is that good image quality may be achieved with a low coating weight of the ink-receptive layer or layers.

[0034] The ratio of the dry coating weight of the gelatin and cellulose derivative of the preferred embodiments is not particularly limited and may vary between about 1:0.1 and about 1:5.

[0035] The triazolopyrimidine compound may be present in any effective amount in the coated ink-receptive recording layer. Typically, the triazolopyrimidine compound is present in an amount of from about 0.001 to about 4 gm⁻² of the substrate surface to which it is applied, and preferably from about 0.01 to about 0.5 gm⁻², although the amount can be outside these ranges depending on the application and compound used. One of the advantages of the preferred tetra-aza indene compounds of the invention is that significant image quality improvements may be realised from the incorporation of only a small quantity of the tetra-aza indene compound as a coalescence-reducing additive.

[0036] The tetra-aza indene compound may be provided to the coating formulation by any convenient means, such as a solution in a suitable solvent or as a dispersion in a suitable carrier. Preferably the compound is provided as an aqueous solution. Therefore preferable compounds include those possessing a water solubilising group such as an ionisable substituent. The preferred compounds **1 - 6** of the invention may be dissolved in aqueous base, such as sodium or potassium carbonate, and provided to the coating formulation as a solution of the salt. Alternatively the preferred compounds may be dissolved in the coating formulation at a suitable pH. Alternatively the tetra-aza indene compounds may also be provided as a dispersion of the solid.

[0037] Another advantage of the invention is that the ink-receptive layer or layers may conveniently be produced as aqueous formulations and coated on to the substrate by any suitable coating means, such as a slide bead coater, a

curtain coater, a rod coater, a gravure coater, a blade coater, an air knife coater, or a bar coater. Some of these methods allow for simultaneous coatings of two or more layers, which is preferred from a manufacturing economic perspective.

[0038] If desired, the surface of the support may be treated in order to improve the adhesion of the bottom layer to the support prior to applying the coating layer to the support. Suitable treatments include buffing, corona discharge, or the application of an undercoating or subbing layer to the surface of the support. Such subbing layers are known in the art.

[0039] The back surface of the material may be left uncoated or may have a coating for lay-flat or for write on properties. Additionally, lubricants to promote paper transport in the printing apparatus may be added to the back layer. Alternatively, the ink-receptive layer or layers may be provided on both sides of the substrate.

[0040] According to another aspect of the present invention, there is provided an ink jet recording method comprising the steps of ejecting droplets of an ink composition comprising at least a colorant and a carrier liquid onto the recording medium of the present invention to deposit the ink droplets onto the recording medium in an imagewise pattern, thereby generating images on the recording sheet. Preferably the ink is an aqueous ink, that is to say an ink in which the carrier liquid is predominantly water, but may also comprise one or more water soluble organic cosolvent such as a polyhydric alcohol. Frequently the ink also comprises one or more surfactants. The materials of the invention are suitable for use with inks comprising dyes or pigments as colorants, but are most suitable for use with dyed inks. Such inks are well known in the art. The materials of the invention are suitable for use with any type of ink jet printer, for instance a thermal drop-on-demand printer, a piezo drop-on-demand printer, or a continuous ink jet printer. The printer may be a desk top ink jet printer or a wide format ink jet printer. In a particularly preferred embodiment, the printing apparatus is a desk top drop-on-demand ink jet printer.

[0041] Although the recording materials disclosed herein have been referred to primarily as being useful for aqueous ink jet printers, they may also be used in any other printing or imaging process, such as printing with pen plotters, handwriting with ink pens, and with conventional printing processes such as flexographic printing and the like, provided that the ink employed to form the image is compatible with the ink-receptive layer of the recording sheet.

[0042] The following examples will serve to illustrate the invention.

Example 1

[0043] A comparison recording material was prepared as follows:

Coating formulation **A** was prepared using the components given in Table 1.

Table 1

Component	% by weight
Deionised water	79.4
Deionised ossein gelatin	11.98
Optical brightener	4.47
Toning agent	0.2
4% sodium hydroxide solution	3.19
Glycerol	0.16
Surfactant A 50% solution	0.6
Total	100

Surfactant A was Olin 10G commercially available from Olin Chemicals. Glycerol was present as a plasticiser. The toning agent was an 0.25% dispersion of a combination of C.I. Pigment Blue 15:1 and C.I. Pigment Violet 23. The optical brightener was a 3.33% solution of a diaminostilbene optical brightener.

Coating formulation **B** was prepared using the components given in Table 2.

Table 2

Component	% by weight
Deionised water	84.07

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Table 2 (continued)

Component	% by weight
Deionised ossein gelatin	11.98
4% sodium hydroxide solution	3.19
Glycerol	0.16
Surfactant A 50% solution	0.6
Total	100

1.9g of a 1% solution of 1-(N,N-dimethylcarbamoyl)-4-(2-sulphoethyl) pyridinium inner salt cross linking agent was added to this formulation before coating as a hardener.

Coating formulation **C** was prepared using the components given in Table 3.

Table 3

Component	% by weight
Deionised water	91.64
20% Phenol	0.75
Deionised ossein gelatin	2.69
Methyl Hydroxypropyl Cellulose	2.69
4% sodium hydroxide solution	0.92
Surfactant C	1.2
Surfactant B	0.08
Total	100

Surfactant B was a 5% solution of a fluorinated surfactant commercially available under the trade name Lodyne S-107 from Ciba. Surfactant C was a 3% solution of an alkyl phenol ethoxylate surfactant commercially available under the trade name Triton X-100 from Union Carbide Chemicals and Plastics Company Inc.

The comparison recording material was prepared by simultaneously coating four layers onto a barrier coated plain paper base of total substance 160 gm⁻² according to the details given in table 4. The two upper layers were coated separately for ease of coating but comprise the same components.

Table 4

Layer	Formulation	Dry Coating Weight
First coating layer	A	1.71 gm ⁻²
Second coating layer	B	1.69 gm ⁻²
Third coating layer	C	1.53 gm ⁻²
Fourth coating layer	C	1.53 gm ⁻²
Total dry coat weight:		6.46 gm ⁻²

Formulations for recording materials according to the invention were then prepared by adding tetra-aza indene compounds to samples of the coating formulation **C** using the compounds and quantities shown in table 5 to provide the formulations **D - L** for the invention. Formulation **C** has a pH of approximately 9 and the compounds dissolve to provide a solution of the salt of the tetra-aza indene compound.

Table 5

Formulation	Compound added	Quantity
D	Compound 2	0.5 %

Table 5 (continued)

Formulation	Compound added	Quantity
E	Compound 2	1.0 %
F	Compound 3	0.5 %
G	Compound 3	1.0 %
H	Compound 6	0.5 %
I	Compound 4	0.5 %
J	Compound 1	0.25 %
K	Compound 1	0.5 %
L	Compound 1	1.0 %

Recording materials wherein the upper ink-receptive layer comprises a combination of gelatin, a cellulose derivative, and a triazolopyrimidine compound according to a preferred embodiment of the present invention were then coated according to the coating assembly shown in table 4 except that formulation **C** for the upper two layers was replaced by formulations **D - L** shown in table 5. In these coatings, an addition of 0.25% by weight of tetra-aza indene compound to the formulations for the two upper layers gives a total coating weight for the tetra-aza indene compound of 0.14 gm⁻², an addition of 0.5% gives a coating weight of 0.28 gm⁻², and an addition of 1% gives a coating weight of 0.56 gm⁻².

The coated samples were printed using dyed inks and a Epson 870 ink jet printer with a test pattern comprising patches of cyan, magenta, yellow, and black inks at an ink loading of 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%, and 100%, and blue, green, and red patches made by printing the coloured inks in combination at the same loadings to give a maximum ink loading of 200% (i.e. a 100% blue patch by printing 100% cyan + 100% magenta inks and so on, and similarly with the green patches made by printing cyan + yellow inks, and the red patches by printing magenta + yellow inks). It is expected that coalescence will start to appear when the ink is not absorbed sufficiently rapidly at the higher ink loadings. With each colour, the density of the patch at which coalescence was first observed is given in table 6.

Table 6

Sample Formulation		Ink loading for coalescence						
		Blue	Green	Red	Black	Yellow	Magenta	Cyan
Comparison	C	40%	50%	50%	40%	-	70%	70%
Invention	D	50%	60%	-	60%	-	-	-
Invention	E	-	-	-	-	-	-	-
Invention	F	-	-	-	-	-	-	-
Invention	G	-	-	-	-	-	-	-
Invention	H	-	-	-	-	-	-	-
Invention	I	-	-	-	-	-	-	-
Invention	J	-	-	-	-	-	-	-
Invention	K	-	-	-	-	-	-	-
Invention	L	-	-	-	-	-	-	-

In the above table the symbol - means that coalescence was not observed even at the highest ink loading. It is seen that the comparison sample showed significant coalescence at moderate to high ink loads, that the inventive sample containing formulation **D** comprising the lowest level of compound **2** in the two upper layers showed a significant improvement, and that none of the other inventive samples showed any coalescence at all in this test. This shows the usefulness of the inventive materials.

Example 2

[0044] Three further inventive recording materials were prepared as in example 1 by coating four layers as shown in table 4 except that compound **1** was added to formulation **C** for the two upper layers as granules of a solid dispersion diluted with 70% lactose as inert excipient. Because of this dilution, an addition of 0.25% gives a total coating weight for the tetra-aza indene compound of 0.042 gm⁻², an addition of 0.5% gives a coating weight of 0.083 gm⁻², and an addition of 1% gives a coating weight of 0.167 gm⁻². The coated samples were printed as in example 1 and the coalescence results are given in table 7.

Table 7

Quantity added to formulation		Ink loading for coalescence						
		Blue	Green	Red	Black	Yellow	Magenta	Cyan
Invention	0.25 %	60%	100%	80%	60%	-	-	-
Invention	0.5 %	-	-	-	-	-	-	-
Invention	1.0 %	-	-	-	-	-	-	-

[0045] It is seen that the inventive sample containing the lowest quantity of compound **1** in the two upper layers showed a significant improvement in coalescence performance over the comparison coating of example 1 containing no additive, and that all the other inventive samples showed excellent performance in this test.

Example 3

[0046] In this example, two coatings were prepared as in example 1 except that tetra-aza indene compound **1** was added to formulations **B** and **C** to provide inventive materials with the compound present in the lower layer as well as the upper layer. In these coatings an addition of 0.5% to both formulations **B** and **C** gives a total coating weight for the tetra-aza indene compound of 0.34 gm⁻² and an addition of 1% gives a total coating weight of 0.69 gm⁻². The samples were printed as in example 1 and the coalescence results are given in table 8. It is seen that neither inventive sample showed any coalescence at all in this test.

Table 8

Quantity added to formulation		Ink loading for coalescence						
		Blue	Green	Red	Black	Yellow	Magenta	Cyan
Invention	0.5 %	-	-	-	-	-	-	-
Invention	1.0 %	-	-	-	-	-	-	-

Example 4

[0047] Four layer coatings were prepared similarly to example 1, except that the bottom layer was coated from a formulation prepared using the components given in Table 9.

Table 9

Component	% by weight
Deionised water	79.4
Deionised ossein gelatin	11.7
Optical brightener	8.7
Toning agent	0.4
4% sodium hydroxide solution	2.92
Glycerol	0.16
Surfactant A 50% solution	0.6
Total	100

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[0048] Surfactant A, the toning agent, and the optical brightener were as in Example 1. This formulation has pH 7.5, and was coated to give a dry coating weight of 1.73 gm⁻². The second layer was coated from a formulation prepared using the components given in Table 10.

Table 10

Component	% by weight
Deionised water	84.07
Deionised ossein gelatin	11.52
4% sodium hydroxide solution	2.88
Glycerol	0.16
Surfactant A 50% solution	0.6
Hardener	3.86
Total	100

[0049] The hardener was a 1% solution of 1-(N,N-dimethylcarbamoyl)-4-(2-sulphoethyl) pyridinium inner salt cross linking agent. This formulation has pH 7.5, and was coated to give a dry coating weight of 1.69 gm⁻².

[0050] The top two layers of a comparison material were each coated from a formulation according to table 11.

Table 11

Component	% by weight
Deionised water	90.44
Deionised ossein gelatin	3.3
Methyl Hydroxypropyl Cellulose	2.22
4% sodium hydroxide solution	1
Surfactant C	2.4
Surfactant B	0.17
Pigment	0.24
Glycerol	0.23
Total	100

[0051] Surfactants B and C were as in example 1, and the pigment was an untreated silica matting agent of particle size 3 µm. This formulation has pH 9.0; two layers were coated to give a dry coating weight of 1.98 gm⁻² for each layer.

[0052] The top two layers of an inventive material were each coated from the formulation given in table 11, except that additionally 0.5% of the granulated dispersion of compound 1 diluted with 70% lactose as used in example 2 above was added to the formulation for each layer. This gives a total coating weight for compound 1 of 0.1 gm⁻².

[0053] The comparison and inventive materials were printed as in example 1 and coalescence of the prints assessed as described for example 1. The results are given in table 12.

Table 12

Sample	Ink loading for coalescence						
	Blue	Green	Red	Black	Yellow	Magenta	Cyan
Comparison	50%	10%	40%	50%	30%	10%	50%
Invention	-	-	-	-	-	-	-

[0054] It is seen that the comparison sample showed significant coalescence at low to moderate ink loads and that the inventive sample containing compound 1 in the two upper layers showed no coalescence at all in this test. This shows the usefulness of the inventive material.

Claims

1. A recording material suitable for ink jet recording comprising a sheet like substrate and arranged on at least one side of the substrate at least one ink-receptive recording layer, **characterised in that** the recording layer comprises:

a. gelatin; and
b. at least one triazolopyrimidine compound or a salt thereof.

2. A recording material suitable for ink jet recording comprising a sheet like substrate and arranged on at least one side of the substrate at least one ink-receptive recording layer, **characterised in that** the recording layer comprises:

a. gelatin;
b. a cellulose derivative; and
c. at least one triazolopyrimidine compound or a salt thereof.

3. A recording material suitable for ink jet recording comprising in the following order:

1) a sheet like substrate;
2) at least one lower ink-receptive recording layer; and
3) at least one upper ink-receptive recording layer, **characterised in that** the upper recording layer comprises in combination:

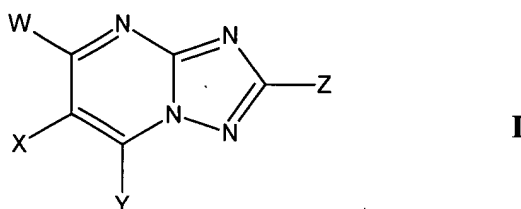
a. gelatin;
b. a cellulose derivative; and
c. at least one triazolopyrimidine compound or a salt thereof.

4. A recording material according to either of claims 2 or 3 wherein the cellulose derivative is selected from hydroxyethyl cellulose, methyl hydroxypropyl cellulose, carboxymethyl cellulose, carboxymethylhydroxyethyl cellulose, methyl hydroxyethyl cellulose, and mixtures thereof.

5. A recording material according to any of claims 1 - 4 wherein the substrate is selected from paper, high wet-strength paper, tracing paper, heavyweight paper, fine art paper, card, board, resin coated paper, polyethylene coated paper, barrier layer coated paper, synthetic paper, canvas, cloth, fabric, cellulose acetates, poly(ethylene), poly(propylene), poly(vinyl chloride), poly(ethylene terephthalate) poly(ethylene naphthalate), polycarbonate, polysulphone, polyether sulphone, poly(arylene sulphone), poly(arylene ether ketone sulphone), cellophane, polyvinyl fluoride, and polyimide.

6. A recording material according to claim 5 wherein the substrate is a coated paper selected from resin coated paper, polyethylene coated paper, and barrier layer coated paper.

7. A recording material according to any of claims 1 - 6 wherein the triazolopyrimidine compound is a tetra-aza indene compound of formula I



wherein the substituents W, X, Y, and Z, which may be the same or different, are individually R, OR, SR, SOR, SO₂R, NRR', NR(COR'), CO₂R, CONRR', SO₂NRR', NRSO₂R', CN, NO₂, halogen, sulphonic acid, or phosphonic acid, wherein the groups R and R' are independently hydrogen, branched or unbranched C₁ - C₂₀ substituted or unsubstituted, saturated or unsaturated hydrocarbon, e.g., alkyl, alkenyl, alkynyl, cycloalkyl, cycloalkenyl, aryl, heteroaryl, alkylaryl, or arylalkyl; or wherein two or more of the groups W, X, Y, R, and R', may be combined to form a ring system or systems.

8. A recording material according to claim 7 wherein the tetra-aza indene compound is 4-hydroxy-6-methyl-1,3,3a,7-tetra-aza indene.

5 9. An ink jet recording method comprising the steps of ejecting droplets of an aqueous ink composition comprising at least a colorant and a carrier liquid onto a recording material according to any of claims 1 - 8 to deposit the ink droplets onto the recording material in an imagewise pattern, thereby generating images on the recording material.

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