

REPLACED SHEETS SG

☒ Description : paged ^{2,3,4,6} to paged
☒ Claim(s) : paged ¹⁴ to paged ¹⁷
☐ Drawing(s) : paged to paged
☐ Abstract : paged to paged

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COMPOSITION

The present invention relates to compositions which are especially suitable for use in the paper and

5 woodworking and related fields. The present compositions find particular, but not exclusive use, as adhesives, binding, coating and sealing materials.

Many adhesives currently available, particularly for
10 use in woodworking, contain polyvinyl alcohol (PVOH) or a dispersion of another polymer such as polyvinyl acetate in polyvinyl alcohol (PVAc) (PVOH). The adhesives operate by forming a physical bond with the wood substrate. In this respect the -OH groups in the adhesive composition and the
15 -OH groups from cellulose in the wood substrate together form strong hydrogen bonds. Problems arise with such adhesives in that they exhibit poor water resistance. This limits the number of potential uses for such adhesives. The inherent moisture content of the wood
20 substrate can also cause difficulties for such adhesives.

Also, many existing products in use in the woodworking field require metal salt catalysts in their crosslinking or curing reaction such as aluminium chloride
25 and chromium nitrate, for example. Use of such metal salts has disadvantages in terms of safety for both manufacturing and handling of the adhesive. Also, many of the formulations presently available have a low pH value (approximately 3) which can give rise to discoloration of
30 wood which contains tanin.



The present invention seeks to alleviate at least some of the aforementioned problems.

With this aim in mind, in one aspect the present invention concerns a two part pack including components A and B, wherein Component A contains Ai) a solution or dispersion which includes a polymer containing units having hydroxyl groups; and
10 Aii) a polymer containing units having carboxyl groups; and wherein Component B comprises Bi) a crosslinker, preferably comprising a polyfunctional aziridine, the crosslinker being capable of crosslinking
15 with at least one carboxyl group and at least one hydroxyl group.

In this aspect of the invention, suitably both components A and B are in liquid form. In preferred
20 embodiments the pack includes a first openable compartment containing both components Ai) and Aii) and a second openable compartment containing component Bi).

In another aspect the present invention provides a
25 composition obtainable by crosslinking Ai) a polymer containing hydroxyl units and Aii) a polymer containing units having carboxyl groups with Bi) a polyfunctional crosslinker which is capable of crosslinking with hydroxyl groups and with carboxyl groups.

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In another aspect the present invention also relates to use of a composition obtainable by crosslinking Ai) a

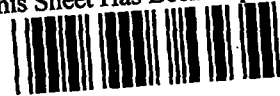


polymer containing hydroxyl units and Aii) a polymer containing units having carboxyl groups, with Bi), a polyfunctional crosslinker as a protective coating, especially for products derived from or containing
5 cellulose, including paper and wood products.

A yet further aspect of the present invention concerns use of a composition obtainable by crosslinking Ai) a polymer containing hydroxyl units; and Aii) a polymer
10 containing units having carboxyl groups; with Bi) a polyfunctional crosslinker as an adhesive, especially for wood products and other products derived from or containing cellulose.

15 Other aspects of the present invention concern methods of providing protective coatings especially for wood and paper products and methods for adhering surfaces of wood and paper products to other substrates. Preferably the methods of coating include applying the
20 present compositions in the form of a spray. Suitably the method of adhering substrates involves applying the compositions to one substrate using brushes, rollers etc.

In some preferred embodiments Component Ai) is in the
25 form of an aqueous solution of polyvinyl alcohol. The polyvinyl alcohol may be selected from both low and high molecular weight polymers. Also, polyvinyl alcohols of various degrees of hydrolysis may be employed. The appropriate choice of polyvinyl alcohol will depend upon
30 the desired characteristics of the composition, for example the desired viscosity.



In other preferred embodiments component Ai) is an aqueous dispersion of a polymer which includes polyvinylalcohol as a stabiliser. Preferably any such polymers include units having acetate groups which are popular for use in the woodworking field, but many other types of polymer are suitable. Preferred polymers containing units having acetate groups include polyvinyl acetate homopolymers or copolymers, most preferably as a dispersion with polyvinyl alcohol. Other example polymers as component Ai) include ethylene vinyl acetate copolymers and terpolymer dispersions. Preferably any component Ai) is water miscible. It is also preferred that the polymer has a viscosity of between about 20,000 and 80,000 mPas when measured at 23°C. Preferably any such dispersion has a solids content of from about 35% to about 65%. Any such polymers which include units having acetate groups may be used alone or in combination. Polymers containing ethylene vinyl acetate units may be preferred in some circumstances as they may produce films which are harder than those obtainable with ethylene vinyl acetate.

Preferably the component Aii) comprises a polymer derived from at least one ethylenically unsaturated monomer. It is also preferred that Aii) comprises a polymer derived from styrene units. Most preferably Aii) comprises a carboxylated styrene butadiene rubber latex. It is also preferred that any component Aii) be water miscible. Preferably the component has a solids content of from about 30% to about 70%.

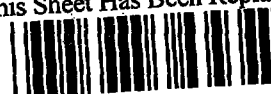
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In addition to Ai) and Aii), component A may optionally additionally include filler materials. Any

such filler materials are desirable for improving water resistance. Example fillers include talc, silica, kaolin or calcium carbonate. Preferably, one or more such fillers are provided in fine powder form or as a suspension in water.

The amount of any filler employed may be varied in accordance with the desired end properties of the composition. The fillers may prevent excessive penetration of the composition into the substrate. They may also impart better water resistance and film hardness to the final adhesive/coating. Suitably component A includes no more than about 70 weight % filler(s). Preferably the component A includes up to about 50 weight % filler, preferably from about 1% to about 50%, most preferably between 30 and 45%. Component A may also additionally include agents to ease its storage and handling, as are common in this field. Component A may also include other agents for modifying the properties of the crosslinked film product. Optional additional agents/ingredients include thickening agents (e.g. a polyacrylic or cellulose thickener such as methyl cellulose or hydroxyl ethyl cellulose, aromatic solvents, and plasticisers (e.g. dibutyl phthalate or butyl benzyl phthalate) to improve flexibility of the final polymer film.

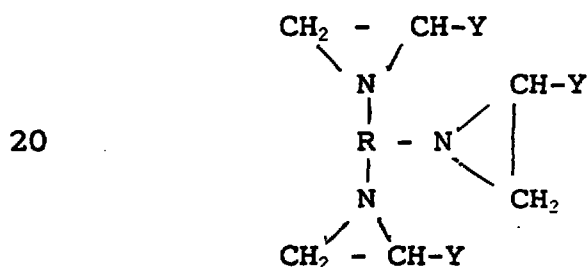
Various weight ratios of components Ai) and Aii) may be employed, depending upon the desired characteristics of the composition. Preferably the ratio of Ai) to Aii) ranges from about 1:10 to about 10:1. Most preferably, component A includes approximately equal weight quantities



of Ai) and Aii). If the relative amount of Ai) is increased beyond this level, this results in a decrease in the water and heat resistance of the subsequent composition. On the other hand, if the level of component
 5 Aii) is increased this results in a reduction in the bonding strength of the subsequent composition.

In the various aspects of the present invention the polyfunctional crosslinker is one which is capable of
 10 crosslinking with a hydroxyl group from component Ai) and a carboxyl group from component Aii)

Preferably the crosslinker Bi comprises a polyfunctional aziridine crosslinker. It is especially
 15 preferred that the aziridine crosslinker is trifunctional and most preferably it has the following formula:



wherein Y is a lower alkyl group of from 1 to about 4
 25 carbon atoms. Preferably Y is a methyl group. R is a polymer chain. A particularly preferred polyfunctional aziridine crosslinker in which Y is methyl is commercially available. The crosslinker is designated CAS number
 64265-57-2.

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Whereas polyfunctional aziridine crosslinkers are

most preferred, other crosslinkers which are capable of crosslinking with at least one carboxyl group and at least one hydroxyl group may be employed. Other example crosslinkers include melamine resin.

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Suitably the component B is added at a level of no more than about 10 weight % to component A, preferably at the level of between about 1 to 5 weight % component A.

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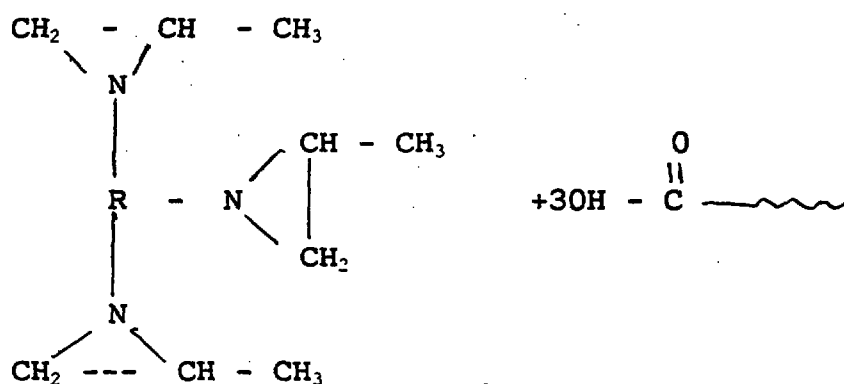
Most preferably the crosslinker is water miscible. An aqueous dispersion of the crosslinker may be stabilised with the aid of solvents such as methylglycol acetate and glycol solvents, for example.

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Such a trifunctional aziridine crosslinker may crosslink components Ai) and Aii) and the wood substrate as follows:

Reaction with carboxyl group in Aii)

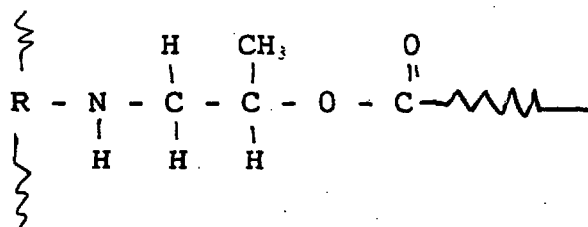
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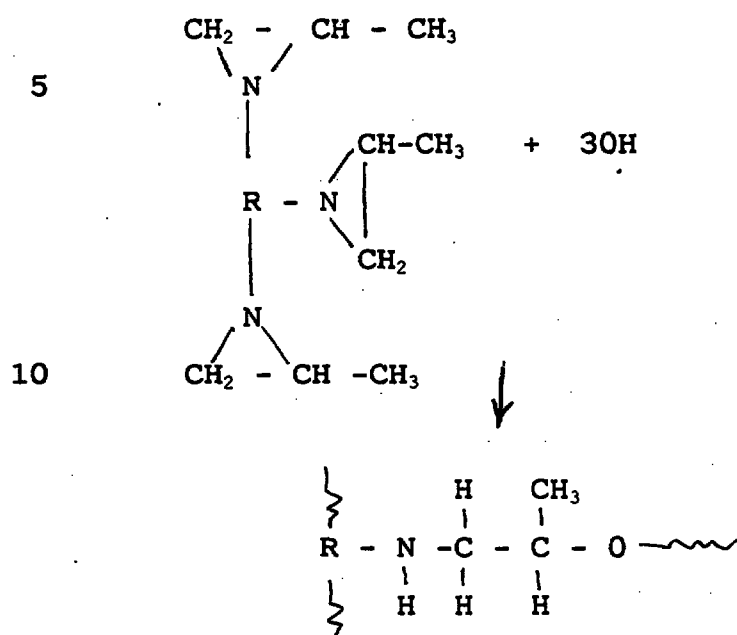
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Reaction with hydroxyl group in Al) and wood
substrate



application for the present invention is the wood working industries, for example wood bonding, formation of particle board by binding woodchips and wood coating to improve abrasion, chemical and water resistance. However
5 the present invention is also applicable to paper industries, particularly for coating paper to improve water resistance and stiffness. This may be useful in the production of paper cartons.

10 In this regard, another aspect of the present invention relates to a particle board obtainable by bonding woodchips with a composition comprising components Ai), Aii) and Bi) as defined above.

15 Suitably, an aziridine crosslinker as component Bi) has a pH of between about 10 and 11, especially about 10.5. Typically component Ai) has a pH of about 4 to 5. Preferably component Aii) is selected so as to have a pH of between about 7.5 to 9.5. In this respect, a
20 composition comprising components Ai), Aii) and Bi) will typically have a pH which is higher than the pH-3 value of prior art compositions. Embodiments of the present invention provide compositions having a pH of between about 6.5 to 8.5, especially approximately 7/8. This has
25 advantages in reducing the possibility of causing discoloration of wood containing tanin.

As discussed above, suitably components Ai), Aii) and B are selected so as to be water miscible. Thus, the
30 present invention also has advantages in providing a cost effective water borne system, which may be free of undesirable solvents such as formaldehyde and phenol. In

this regard the present invention has advantages over prior art compositions.

Embodiments of the present invention will now be described further, by way of example, with reference to the accompanying examples:

Example

A first example formulation was prepared as follows:

	<u>Component</u>	<u>Parts by weight</u>
15	Ai) Homopolymer Polyvinyl Acetate Dispersion (PVOH) (Solid content approx. 60%)	30 p.b.w.
20	Aii) Carboxylated Styrene Butadiene Latex Dispersion (S.C. approx 46-52%)	30 p.b.w.
25	Aiii) Filler - Paste form (Calcium carbonate powder 60-70% in water)	40 p.b.w.
	In can preservative	0.5 "

A pack contains two compartments, one accommodating Part A and the other accommodating Part B.

Part A is a blend of the above preferred components Ai) to Aiii). Part B (crosslinker) is preferably in an amount of added 3 p.b.w to the compounded dispersion (Part A) before use. In this example B is of Formula I wherein Y is methyl.

The properties of the first example formulation were determined and compared with those of an existing adhesive

which is commercially available. The test results are shown below.

5	<u>Test Results</u>		
	<u>Example 1</u>	<u>Commercially available adhesive</u>	
10	Crosslinker	Polyfunctional aziridine	Metal salt catalyst
15	Bonding effect	Chemical Bond	Physical bond
	Water resistance	Reasonable	Reasonable
20	Solvent resistancy	Reasonable	Poor
	Abrasion resistance	Reasonable	Poor
25	pH	Approx. 7-8 -low discoloration effect	Approx. 3-high discoloration effect
30	Setting speed	Fast - readily adjustable	Moderate - difficult to adjust.
35	Ageing time*	Fast - less than 3 hours	Slow - at least 6 hours

*Ageing relates to the time for which the substrates are left to stand at room temperature after pressing to enable them to be suitable for processing such as by sawing or sanding.

All the proportions in this Example I formulation can be varied subject to the desired end application and cost. However, the above formulation stated has been developed to provide a desirable balance in the end properties such as adhesion, cohesion and film hardness.

It will be appreciated that the Example 1 formulation included equal amounts of components Ai) and Aii). The following Examples 2 and 3 illustrate the effect of varying the weight ratios of the two components on the final properties of the crosslinked product. The components Ai), Aii) and Bi) are the same as those employed above; only the weight ratios have been varied.

15 Example 2

	Component	Parts by weight
	Ai) PVAc Homopolymer (PVOH) dispersion	54
	Aii) XSBR	6
20	Aiii) Filler paste	40
	B: as Example 1	

Example 3

	Ai) PVAc Homopolymer (PVOH) dispersion	6
25	Aii) XSBR	54
	Aiii) Filler paste	40
	B: as Example 1	

Packs were prepared containing a first vessel of components Ai) to Aiii) and a second vessel containing solely component B.

In comparison to the formulation of Example I, the

Example 2 formulation exhibited a lower bonding strength and lower water and heat resistance. Also, in comparison to the Example 1 formulation, the product of Example 3 was very low in viscosity and thus was more difficult to apply to the wood substrate. It also gave rise to various levels of bonding strengths depending upon the nature of the wood substrate. It did, however, exhibit good water and heat resistance.

10 The above examples illustrate the effects of varying the levels of the respective components in the present packs and compositions. Various modifications may be made to the above Examples.



CLAIMS

1. A pack containing components A and B, wherein:
component A contains Ai) a solution or dispersion
5 comprising a polymer containing units having hydroxyl
groups, and
Aii) a polymer containing units having carboxyl
groups;
component B comprises Bi) a polyfunctional
10 crosslinker capable of crosslinking with at least one
carboxyl group and at least one hydroxyl group.
2. A pack according to claim 1 wherein Ai) is a solution
of polyvinyl alcohol.
- 15 3. A pack according to claim 1 wherein Ai) is a
dispersion which contains polyvinyl alcohol.
4. A pack according to claim 3 wherein Ai) is a
20 dispersion which includes a polyvinylacetate homopolymer
or copolymer.
5. A pack according to claim 3 or claim 4 wherein Ai)
includes an ethylenevinylacetate copolymer or terpolymer.
- 25 6. A pack according to any preceding claim wherein Aii)
comprises a polymer derived from at least one
ethylenically unsaturated monomer.
- 30 7. A pack according to claim 6 wherein Aii) comprises a
polymer derived from an optionally substituted styrene
monomer.



8. A pack according to claim 6 or claim 7 wherein Aii) comprises a carboxylated styrene butadiene rubber latex.

9. A pack according to any preceding claim wherein
5 component A contains Ai) and Aii) in a weight ratio of between 1:10 and 10:1.

10. A pack according to claim 9 wherein component A contains Ai) and Aii) in a weight ratio of between 1:5 and
10 5:1.

11. A pack according to claim 10 wherein component A contains Ai) and Aii) in a weight ratio of approximately 1:1.

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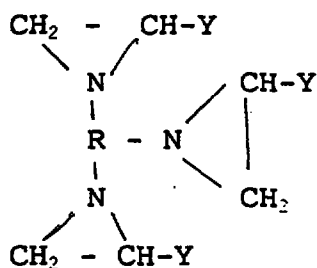
12. A pack according to any preceding claim wherein component A additionally contains Aiii) one or more fillers, and/or Aiv) one or more preservatives.

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13. A pack according to any preceding claim wherein component B comprises Bi) a polyfunctional aziridine crosslinker.

25 14. A pack according to claim 13 wherein component B comprises Bi) a trifunctional aziridine crosslinker of formula I

30 I





wherein R is a polymer chain and Y is a lower alkyl group of from 1 to 4 carbon atoms.

15. A pack according to claim 14 wherein Bi) is a
5 trifunctional aziridine crosslinker in which Y is methyl.

16. A pack according to any preceding claim wherein Bi) is water miscible.

10 17. A pack according to any preceding claim wherein Ai) and Aii) are water miscible.

18. A pack according to any preceding claim wherein components A and B are provided in a weight ratio of from
15 100 to 10 to 100 to 0.1.

19. A pack according to claim 18 wherein components A and B are provided in a weight ratio of from 100 to 5 and 100 to 0.1.

20

20. A pack substantially as hereinbefore described with reference to the accompanying Examples.

21. A composition obtainable by crosslinking components
25 Ai) and Aii) as defined in any one of claims 1 to 11 with a component Bi) as defined in any one of claims 13 to 16.

22. Use of a composition according to claim 21 as a protective coating for substrates derived from or
30 containing cellulose.

23. Use of a composition according to claim 22 as an



adhesive for substrates derived from or containing
cellulose.

24. A method of adhering a first cellulosic substrate to
5 a second substrate which method comprises combining
components A and B as defined in any one of claims 1 to 17
to provide an adhesive combination, applying the
combination to the first substrate, and bringing the first
and second substrates together in the region of applied
10 adhesive combination.

25. A method of protecting a cellulosic substrate, which
method comprises combining components A and B as defined
in any one of claims 1 to 17 and applying the combination
15 to the substrate to provide a protective coating.

26. A particleboard obtainable by adhering woodchips
together with a composition comprising a mixture of
components A and B as defined in any one of claims 1 to
20 17.

27. A wood product obtainable by adhering wood substrates
together with a composition comprising a mixture of
components A and B as defined in any one of claims 1 to
25 17.