

Title: ACETYLATED WOOD COLOURING PROCESS

5 Field of the invention

The invention relates to a process for the acetylation of wood, whereby the wood is subjected to colouring.

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Background of the invention

Acetylation of wood has long been recognized as a method to improve the durability of otherwise non-durable softwood species. Also, it is known as a method to improve wood properties, such as hardness, durability and dimensional stability.

Throughout the decades since 1928, various processes for wood acetylation have been proposed. A background reference pertaining to a particularly suitable process is WO 2009/095687. Other references include EP 0 650 998, EP 0 799 272, WO 2010/151320. The various acetylation processes are disclosed in connection with various wood species, such as radiata pine, beech, poplar, southern yellow pine, spruce.

Main varieties of wood species applied in commercial developments of acetylated wood are particularly pine, such as Southern Yellow Pine and Radiata Pine. The latter, known under the brand name Accoya®, today is recognized as a gold standard in the art.

A great advantage of acetylated solid wood is that it allows outdoor use generally without significant protective measures, such as coatings. The latter advantage evidently is applicable to the acetylated wood when used as it comes. In fact, acetylated wood is generally praised for its natural wood colour. With the increased interest in acetylated wood for various

applications, such as outdoor furniture, decks, doors, windows, the interest also increases in the availability of acetylated wood of different colours.

Painting acetylated wood for protective purposes, however, would go against one of the main benefits of acetylated wood, viz. that it can be
5 used outdoors without coating it. In view hereof it has been proposed in the field, to provide coloured acetylated wood, by impregnating it with a colouring agent. This yields a wood material that provides the look and feel of natural wood, yet with a desired colour, and without the necessity of coating it. This comes with the further advantage that regular polymeric
10 components of paint, which would adversely contribute to the environmental impact of the wood products concerned, can be avoided.

A suitable example of an acetylated wood product coloured by providing a liquid comprising a colouring agent into the wood, has been marketed as Accoya® Color.

15 Background reference on colouring an acetylated wood include WO 2018/106923 and WO 2018/106925. Described are methods for colouring an acetylated wood in an energy-intensive multi-step process. The process comprises allowing a colouring medium to impregnate the acetylated wood provided in a chamber, subjecting the resulting impregnated acetylated
20 wood to a heat fixation step, and thereafter drying the coloured wood process to remove the liquid by evaporation. It would be desirable to find a less complex way to produce coloured acetylated wood, allowing to use less energy and requiring lower associated costs, such as equipment costs.

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Summary of the invention

In order to better address one or more of the aforementioned desires, the invention provides, in one aspect, a process for the production of
30 coloured acetylated wood, the process comprising providing wood and

subjecting the wood to a wood acetylation treatment and a wood colouring treatment, said wood colouring treatment comprising subjecting the wood to impregnation with a liquid comprising a colouring agent so as to provide impregnated wood; wherein the impregnated wood is subjected to a drying
5 process to remove liquid from the impregnated wood by evaporation, wherein the process does not include a separate step of heating the impregnated wood to a temperature of 90°C or more to fix the colouring agent within the impregnated wood prior to evaporation.

In another aspect, the invention presents a process for the
10 production of coloured acetylated wood, the process comprising providing acetylated wood; subjecting said wood to impregnation with a liquid comprising a colouring agent so as to provide impregnated wood; wherein the impregnated wood is subjected to a drying process to remove liquid from the impregnated wood by evaporation, wherein the process does not include
15 a separate step of heating the impregnated wood to a temperature of 90°C or more to fix the colouring agent within the impregnated wood prior to evaporation.

20 Detailed description

The invention, in its various aspects, is based on the judicious insight of colouring acetylated wood by impregnation with a colouring agent without the need for a dedicated heat fixation step and a subsequent drying
25 process. This is unexpected, as prior to the present invention, it was believed that, without heating after the impregnation step, the colouring agent does not fix to the acetylated wood, with the result that the colouring agent is migrated within the wood during the drying process and the acetylated wood is not sufficiently uniformly coloured internally and

externally, and furthermore, the colouring agent may leach out in outdoor use.

Accordingly, in marked deviation from the teaching in the art, the process does not include a dedicated heat fixation step to fix the colouring agent within the impregnated wood prior to evaporation. With reference to
5 WO 2018/106923 and WO 2018/106925, it will be understood that the process of the invention thus does not include a separate step of heating the impregnated wood to a temperature of 90°C or more to fix the colouring agent within the impregnated wood prior to evaporation. Preferably, the
10 invention hereby presents either or both of the following non-obvious measures.

One measure, against the teaching in the art, comprises heating the impregnated wood to a temperature in a range of more than 40°C and below 90°C. Preferably this refers to a temperature in a range of from 50°C
15 to 85°C, preferably 60°C to 80°C. The inventors have found that heating at these temperatures results in coloured acetylated wood, that is not prone to migration of colouring agent. Advantageously, the process involves lower temperature, thus requiring less energy.

Another measure is to entirely omit a separate fixation step. As a
20 result, directly after impregnation, at any rate without a dedicated heating step required to result in fixation of the colouring agent before evaporation, the impregnated acetylated wood is subjected to the drying process. Preferably this comprises drying in a kiln at a kiln temperature of 20°C to 160°C, preferably 50°C to 140°C. More preferably, the temperature is 60°C
25 to 120°C, still more preferably 60°C to 100°C. Advantageously, the process is less complex, particularly involving a reduced number of different process stages. Also, by omitting the need for a chamber dedicated to heat fixation, lower equipment costs are involved.

Preferably, the above measures are combined. Accordingly, the
30 acetylated wood is subjected to the drying process, directly after

impregnation with a liquid comprising a colouring agent, and the drying is conducted at a temperature of more than 40°C and below 90°C, preferably at a temperature in a range of from 50°C to 85°C, more preferably 60°C to 80°C.

5 With reference to the energy advantages obtained with the process of the invention, it will be understood that the step of impregnating the acetylated wood with a liquid comprising a colouring agent, is preferably conducted at a relatively low temperature. This typically refers to a temperature of below 40°C, preferably at ambient temperature.

10 The invention is defined with reference to an acetylated wood product comprising at least one colouring agent within the wood. The colouring agent being within the wood serves to distinguish the colouring agent applicable to the present invention from any colouring agent that might be present in a coating or paint or otherwise applied from the outside.

15 The wood of the present invention is coloured specifically by impregnation with a colouring agent. A colouring agent can generally be any colorant, and particularly a dye or a pigment. A dye generally is a soluble colorant, whilst a pigment generally is a coloured substance that is completely or nearly insoluble in water or solvent, and is thereby provided as a dispersion. In

20 most instances, dyes are organic compounds. Dyes include acidic colourants. Pigments can be inorganic or organic compounds; frequently, pigments are inorganic compounds. Pigments can be ionic compounds or neutral compounds.

 Since the colouring agent is applied by impregnation, it is provided

25 comprised in a suitable liquid carrier, preferably an aqueous liquid, more preferably water with a cosolvent, more preferably water with 0-10% w/w cosolvent. A dye generally is water-soluble, and will be applied in the form of an aqueous solution. Pigments will be applied by impregnating the wood with an aqueous or solvent based dispersion. Preferably, the colouring agent

30 is provided in the form of a dispersion of a pigment in water. Preferably,

such dispersion has a pigment concentration of 0,1 to 10 % w/w, more preferably 0,2-8% w/w.

Preferably the liquid carrier employed is largely aqueous and the colorant(s) employed are essentially insoluble in this liquid medium so that the

5 resulting colouring medium is in the form of a particulate dispersion of colorant(s) in the chosen liquid medium. In this implementation the colorants are chosen from the classes of colorant defined by Colour Index International as Pigments (including organic pigments, inorganic pigments and Lakes, Disperse Dyes, Vat Dyes and Sulfur Dyes) and either a single

10 colorant or multiple colorants from within the same Colour Index class or either single or multiple colorants from two or more different Colour Index classes can be used. The selection of suitable colorants includes, but is not limited to, pigments that have low to no solubility in an aqueous medium (at neutral pH or in an acidic environment), either by their own chemical

15 nature or by pigment surface modification techniques such as coating: [C.I. Pigment Yellows 1, 3, 34, 35, 42, 53, 73, 74, 83, 93, 97, 109, 110, 120, 128, , 150, 151, 154, 138, 155, 139, 170, 175, 180, 181, , 184, , 194, 213], [C.I. Pigment Oranges 36, 38, 43, 62, 64, 66, 71, 72, 73, ,], [C.I. Pigment Reds 31, 48, , , , 112, 122, 123, 144, 146, 149, 166, 168, 170, 175, 176, 177, 178, 179,

20 184, 185, 187, 188, 190, 202, 208, 224, 242, 254, 255, 264, , 266, 268, 269, 275], [C.I. Pigment Violets 19, 23, 28, 32], [C.I. Pigment Blues 15.1, 15.2, 15.3, 15.4, 15.5, 15.6, 36, 60], [C.I. Pigment Greens 7,36], [C.I. Pigment Browns 23, 25,], [C.I. Pigment Blacks 7,28], [C.I. Disperse Yellows 23, 42, 54, 64, 82, 114, 211], [C.I. Disperse Oranges 25, 29, 30, 44, 61,73, 76], [C.I.

25 Disperse Reds 50, , 55, 59, 60, 73, 74, 82, 91, 146, 153, 167, 179, 190, 343,364], [C.I. Disperse Violets 26, 28, 31, 33, 63, 73, 77, 93], [C.I. Disperse Blues 56, 60, 72,73, 77, 79, 87, 143, 148, 165, 183.1, 257, 359, 360, 367], [C.I. Disperse Browns 1, 1.1, 19,], [C.I. Vat Yellows 1, 33], [C.I. Vat Oranges 1, 2, 3, 9], [C.I. Vat Reds 1, 10, 13, 14, 15,29, 31, 54], [C.I. Vat Violet 1], [C.I. Vat

30 Blues 4, 6, 13, 14, 15, 18, 20, 43], [C.I. Vat Greens 1, 3, 8, 9, 13], [C.I. Vat

Browns 1, 3, 68, 72], [C.I. Vat Blacks 8, 9, 25, 27, 29, 38], [Solvent Yellows 16, 163, 193, 232], [Solvent Red 242], [Solvent Violet 11], [Solvent Blues 36, 63, 78, 97, 102], [Solvent Green 3], [C.I. Sulphur Yellows 2, 9], [C.I. Sulphur Orange 1], [C.I. Sulphur Red 6], [C.I. Sulphur Blues 5, 7, 13, 15], [C.I. Blacks 1, 6], [C.I. Sulphur Green 6].

A preferred colouring agent is an aqueous carbon black based pigment dispersion, such as EFI/Rialco AWC1 grey pigment dispersion.

The final pigment or dye-loading of the coloured wood is typically depending on pigment/dye extinction coefficient and concentration.

Preferable the pigment loading of the wood ranges from 0,05 to 10% w/w, more preferably from 0,05 to 5% w/w.

The impregnation can be conducted by an impregnation method known to the skilled person in the field of wood impregnation, such as a Lowry or Bethel process. Generally, the pigment concentration will be chosen at the higher end in the event of a Lowry process, which involves forcing an impregnation fluid into the wood under pressure. Similarly, a Rueping process can also be used.

Typical impregnation conditions (preferably at room temperature) for Lowry type process comprise, consecutively: fluid filling at atmospheric pressure, impregnation pressure 12.0 Bara for 15 to 30 min, removal of liquid, and a final vacuum at 0.13 Bara for 20 to 25 min.

Typical impregnation conditions (preferably at room temperature) for a Bethel type process comprise, consecutively: a pre-vacuum at 0.15 Bara for 7 to 15 min, fluid filling while applying vacuum, an impregnation pressure of 12.0 Bara for 15 to 30 min, removal of liquid, and, optionally, a final vacuum at 0.13 Bara for 20 to 25 min.

The aforementioned impregnation pressures may typically range from 7.0 to 12.0 Bara, preferably 10.0-12.0 Bara.

The impregnation process is preferably designed to fulfil the following deliverables: a fluid uptake of between 250 and 700 litres per m³ of

wood (depending on process of choice); a pigment dispersion penetration throughout the wood product; an even penetration and retention throughout the height, width and length of the stacks. With wood of the species *Pinus taeda*, this can be achieved more easily than with radiata pine.

5 In a generally preferred embodiment, the impregnation comprises placing the wood in a vacuum chamber, optionally applying a pre-vacuum to draw air from the wood, adding the liquid comprising a colouring agent to the chamber while optionally retaining the wood in said chamber under vacuum so as to fill the chamber with liquid; increasing the pressure of the
10 chamber filled with liquid to above atmospheric pressure for 1 – 180mins; reducing the pressure so as to provide impregnated wood; and finally removing the excess liquid from the chamber and optionally applying a final vacuum.

 After the colour impregnation step, the resulting product is kiln
15 dried at typically (but not limited to) 60 – 80 °C to remove the water used during the colouring process, preferably but not necessarily down to a moisture content of 8% or below. This generally takes between 3 and 18 days depending on kiln loading, liquid-uptake and kiln configuration, and wood size.

20 In the field of wood acetylation, generally two types of substrates for acetylation are distinguished, viz. solid wood and wood elements. The latter refers to smaller pieces of wood, generally ranging from larger elements, such as chips or strands, to small elements, such as fibres. The term “solid wood” is generally employed to indicate relatively large wood
25 forms, such as beams or boards. Another representative relatively large wood form is that of veneers. Whilst essentially thin in one dimension (thickness), veneers come in relatively large dimensions of length, and possibly width.

 The acetylated wood product disclosed herein, including, but not
30 limited to *Pinus Taeda* or *Radiata Pine*, is typically a solid wood product or

a veneer. Apart from practical considerations known to the skilled person, such as the availability of sufficiently large equipment, the wood can have any size. The solid wood (*e.g.*, boards/planks) or veneers of wood of this invention preferably has a length or width of at least 8 cm. The thickness
5 preferably is at least 1mm. In some embodiments, the wood has a width of 2 cm to 30 cm, a thickness of 1 cm to 16 cm and a length of from 0.5 to 6.0 m. In other embodiments, the wood has a thickness of at least 1mm, a width of 10 cm – 25 cm and length of 1 to 6m.

The wood acetylation process by which the wood is acetylated, can
10 be a batch process, a semi-continuous process (such as a process combining batch-wise feeding and continuous acetylation) process, or a continuous process. The acetylation of the wood of the invention is generally conducted in accordance with optimized acetylation processes as are known in the field. Preferred processes comprise the following steps:

- 15 - Providing wood (solid wood or wood veneers);
- Controlling, and if necessary adjusting, the moisture content of the solid wood or wood elements;
- Impregnating the solid wood or wood veneers with acetylation fluid;
- 20 - Subjecting the impregnated solid wood or wood veneers to one or more heating steps in order to effectuate acetylation of the solid wood or wood elements;
- Separating the acetylated solid wood or wood veneers from excess acetylation fluid.

25 The acetylation process itself can be conducted, as known in the art, using liquid and/or gaseous acetylation fluid. Typical acetylation fluids are acetic acid, acetic anhydride, and mixtures thereof. Preferably the initial acetylation fluid used is acetic anhydride, more preferably comprising a minor amount of acetic acid, generally 2 wt.% to 20% wt.%, such as 5 wt.%
30 to 10 wt.%. As a result of the acetylation reaction, the composition of the

acetylation fluid will change during the process, since acetic acid is thereby formed.

In interesting embodiments, the acetylation is conducted in accordance with any one of the acetylation processes as described in
5 WO2009/095687, WO2011/95824, WO2013/117641, WO2013/139937, or WO2016/008995, the disclosures of which are herein incorporated by reference.

A preferred process, in WO 2009/095687. Herein a process is described for the acetylation of wood, comprising the steps of submerging
10 wood into an acetylation liquid in a reaction pressure vessel, conducting an impregnation procedure, removing excess acetylation fluid, introducing an inert fluid (typically nitrogen gas, the inert fluid possibly comprising non-inert acetic anhydride and/or acetic acid) into the vessel, circulating and heating the inert fluid following a heating regime so as to bring about
15 suitable acetylation of the wood, and removing the circulating fluid and allowing the acetylated wood to cool.

Another preferred process is that of WO2013/117641, which discloses an acetylation process that is suitable to achieve high acetyl contents in high density wood species, such as *Pinus taeda* (loblolly / Taeda
20 pine) and other Southern Yellow Pine species. Herein the moisture content of the wood to be acetylated is controlled so as to be at a level of less than 5 wt.%, preferably 1-4 wt.%.

The acetylated wood obtained by the above methods has a high acetylation degree. In particular, it has an acetyl content of higher than 20%
25 by weight at its geometrical centre. Preferably, the acetyl content is higher than 21% by weight, more preferably, higher than 22% by weight, yet more preferably higher than 23 % by weight at its geometrical centre. In a preferred embodiment, the acetyl content of the acetylated wood is from 21 to 26 wt.% at its geometrical centre.

In order to determine the acetyl content of the wood, samples are ground to wood particles. From these samples residual trace amounts of acetic acid and/or acetic anhydride are removed, by washing with water and subsequent drying at $103\pm 2^{\circ}\text{C}$ for between 14-24 hrs. After weighing these
5 dried samples, the acetyl groups are released from the wood in the form of acetate ions by saponification with sodium hydroxide solution at elevated temperature. This saponification reaction runs for 4 hrs, with stirring every 15 minutes. The acetate ions are quantified by means of high-pressure liquid chromatography (HPLC), after calibrating this HPLC with standard
10 acetate solutions and using sodium butyrate as internal reference. This gives a direct measure of acetyl content that is preferred over general weight percentage gain (WPG) frequently used in other studies.

The invention pertains to a process for the production of coloured acetylated wood.

15 The process comprises providing wood and subjecting the wood to a wood acetylation treatment and a wood colouring treatment. This process may comprise first subjecting the wood to colouring treatment, and then subjecting the resulting coloured wood to a wood acetylation treatment. Alternatively, the process may comprise subjecting the colouring and
20 acetylation treatments in parallel. Preferably, the wood is first subjected to acetylation treatment, and the resulting acetylated wood is thereafter subjected to the wood colouring treatment.

In all of these embodiments, the wood colouring treatment comprises subjecting wood to impregnation with a liquid comprising a
25 colouring agent so as to provide impregnated wood, followed by a drying process to remove liquid from the wood by evaporation. In all of these embodiments, the acetylation treatment is preferably done by means of a wood acetylation process as described hereinbefore.

The wood colouring treatment as such can be conducted, e.g., in accordance with the processes as disclosed in WO 2018/106923 and WO 2018/106925, the disclosures of which are incorporated herein by reference.

In the preferred embodiment of conducting the colouring treatment

5 after the acetylation treatment, the process comprises providing acetylated wood. Said wood is thereupon subjected to impregnation with a liquid comprising a colouring agent so as to provide impregnated wood. Preferably the liquid is water, and more preferably the liquid comprising the colouring agent is an aqueous dispersion of a pigment, preferably as described above.

10 It will be understood that the impregnated wood is an intermediate product, whereby the coloured wood is eventually obtained after removing at least part of the liquid carrier from the wood, in such a way as to leave in the colouring agent. Typically, such removal is by evaporation. In the event of having water as the liquid, the evaporation will typically involve a drying

15 process in a kiln, preferably with a kiln temperature, and therefore ultimately wood temperature of 20°C to 160°C, more preferably 50°C to 140°C, yet more preferably 60°C to 120°C, yet more preferably 60°C to 100°C, most preferably more than 60°C and below 90°C. It should be noted that, in some embodiments, the liquid is not subjected to a heat fixation step

20 before, during or after impregnation and before the drying process.

The coloured acetylated wood of the invention can be used in many applications, preferably outdoor so as to benefit from the properties of acetylated wood. Typical applications include joinery, decking and cladding. With reference to the colouring of the wood, applications possibly involving

25 design desires are preferred, such as decking or outdoor furniture.

After the colouring process, planing of the product (coloured acetylated wood) is performed to assess the quality/uniformity of the through-and-through colouring process. Typically, 0.5 to 2mm of the product is planed off.

In sum, a process is disclosed for the production of coloured acetylated wood. Herein wood is subjected to a wood acetylation treatment and a wood colouring treatment. The wood colouring treatment comprises subjecting the wood to impregnation with a liquid comprising a colouring agent so as to provide impregnated wood, and subjecting the impregnated wood to a drying process to remove liquid from the impregnated wood by evaporation. According to the invention, the process can be conducted without a dedicated heat fixation step to fix the colouring agent within the impregnated wood prior to evaporation.

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Working example 1 – colouring of acetylated *Pinus taeda*:

Pinus taeda boards of 25x250x2400 mm, sourced from Uruguay, have been acetylated according to WO2013/117641. The colouring process is performed in a typical pressure impregnation vessel. Prior to treatment with colour, the acetylated *Pinus taeda* boards are stacked in packs in which the boards are separated using untreated softwood sticks or equivalent, to allow sufficient liquid and gas transport throughout the wood packs. Then the acetylated wood is pressure treated with an EFI/Rialco AWC1 grey colourant in the standard high pressure timber treatment plant. An AWC1 working solution is prepared by mixing the AWC1 concentrate with water to a concentration of 6.5% w/w of the AWC1 concentrate in water. The solution concentration can be measured on-site using a spectrophotometer and is done after every mix. The impregnation is performed at 12 bara pressure for a period of 30min.

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The impregnation process is designed to meet the following deliverables:

- An uptake of fluid of between 250 and 350 litres/m³ of wood
- Full penetration throughout the boards
- Even penetration and retention throughout the height of the packs

Following this colour treatment, the product is kiln-dried at 70 °C for 10 days to remove the water used during the treatment process, down to a moisture content of 8% or below while monitoring the moisture content. For the kiln drying process, sticks of 19mm minimum thickness were used to allow sufficient airflow through the packs.

In the final step, the kiln-dried product is planed to visualise the difference between uniform and non-uniform colouring. Typically planing is performed to remove the top 0.5 – 1.5mm of the wood surface.

The product showed good colour uniformity as visually assessed.

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Working example 2 – colouring of acetylated *Radiata Pine*:

Radiata Pine boards of 25x250x2400 mm, sourced from New Zealand, have been acetylated according to WO2013/117641. The colouring process is performed in a typical pressure impregnation vessel. Prior to treatment with colour, the acetylated *Radiata Pine* boards are stacked in packs in which the boards are separated using untreated softwood sticks or equivalent, to allow sufficient liquid and gas transport throughout the wood packs.

Then the acetylated wood is pressure treated with an EFI/Rialco AWC1 grey colourant in the standard high pressure timber treatment plant. An AWC1 working solution is prepared by mixing the AWC1 concentrate with water to a concentration of 6.5% w/w of the AWC1 concentrate in water. The solution concentration can be measured on-site using a spectrophotometer and is done after every mix. The impregnation is performed at 12 bara pressure for a period of 30min.

The impregnation process is designed to meet the following deliverables:

- An uptake of fluid of between 250 and 350 litres/m³ of wood
- Full penetration throughout the boards
- Even penetration and retention throughout the height of the packs

- Following this colour treatment, the product is kiln-dried at 70 °C for 10 days to remove the water used during the treatment process, down to a moisture content of 8% or below while monitoring the moisture content. For the kiln drying process, sticks of 19mm minimum thickness were used
- 5 to allow sufficient airflow through the packs.
- In the final step, the kiln-dried product is planed to visualise the difference between uniform and non-uniform colouring. Typically planing is performed to remove the top 0.5 – 1.5mm of the wood surface.
- The product showed good colour uniformity as visually assessed.

Claims

1. A process for the production of coloured acetylated wood, the process comprising providing wood and subjecting the wood to a wood
5 acetylation treatment and a wood colouring treatment, said wood colouring treatment comprising subjecting said wood to impregnation with a liquid comprising a colouring agent so as to provide impregnated wood; wherein the impregnated wood is subjected to a drying process to remove liquid from the impregnated wood by evaporation, wherein the process does not include
10 a separate step of heating the impregnated wood to a temperature of 90°C or more to fix the colouring agent within the impregnated wood prior to evaporation.
2. A process according to claim 1, wherein the wood colouring treatment is conducted prior to or during the wood acetylation treatment.
- 15 3. A process according to claim 1, wherein the wood colouring treatment is conducted after the wood acetylation treatment.
4. A process for the production of coloured acetylated wood, the process comprising providing acetylated wood; subjecting said wood to impregnation with a liquid comprising a colouring agent so as to provide
20 impregnated wood; wherein the impregnated wood is subjected to a drying process to remove liquid from the impregnated wood by evaporation, wherein the process does not include a separate step of heating the impregnated wood to a temperature of 90°C or more to fix the colouring agent within the impregnated wood prior to evaporation.
- 25 5. A process according to any one of the preceding claims, comprising heating the impregnated wood to a temperature in a range of more than 40°C and below 90°C.
6. A process according to claim 5, wherein the temperature is in a range of from 50°C to 85°C, preferably 60°C to 80°C.

7. A process according to any one of the claims 1 to 4, comprising subjecting the impregnated wood to the drying process without a separate heating step prior to the drying process.

8. A process according to any one of the preceding claims,
5 wherein the drying process comprises drying in a kiln at a kiln temperature of 20°C to 160°C, preferably 50°C to 140°C.

9. A process according to claim 8, wherein the temperature is 60°C to 120°C, preferably 60°C to 100°C, most preferably more than 60°C and below 90°C

10 10. A process according to any one of the preceding claims, comprising conducting the impregnation at a temperature below 40°C, preferably at ambient temperature.

11. A process according to claim 10, wherein the impregnated wood is subjected to heating in a kiln dryer.

15 . 12. A process according to any one of the preceding claims, wherein the liquid is water or a mixture of water with an organic cosolvent.

13. A process according to any one of the preceding claims, wherein the liquid comprising the colouring agent is a dispersion of a pigment in water or a mixture of water with an organic cosolvent.

20 14. A process according to claim 13, wherein the pigment is a carbon black pigment such as the EFI/Rialco AWC1 grey pigment.

15. A process according to any one of the preceding claims, wherein the impregnation comprises placing the wood in a vacuum chamber, optionally applying a pre-vacuum to draw air from the wood,
25 adding the liquid comprising a colouring agent to the chamber while optionally retaining the wood in said chamber under vacuum so as to fill the chamber with liquid; increasing the pressure of the chamber filled with liquid to above atmospheric pressure for 1 – 180mins; reducing the pressure so as to provide impregnated wood; and finally removing the excess liquid
30 from the chamber and optionally applying a final vacuum.