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(54) METHODE DE FABRICATION DE PANNEAUX DE COMPOSITES DE COULEUR CLAIRE A L'AIDE DE LIANTS DE PHENOL-FORMALDEHYDE

(54) METHOD OF MANUFACTURING LIGHT COLORED COMPOSITE PANELS WITH PHENOL FORMALDEHYDE BINDERS

(57) A method is described for producing light colored composite panels by applying a buffer or weak acid system either in solution or in powder form prior to the hot press. The buffer or weak acid system, applied on the mat surfaces prior to hot pressing, reduces the pH of the environment on the mat surfaces and consequently reduces the degree of oxidation of the phenolic resin during hot pressing as well as retains the oxidized phenol formaldehyde polymers in their protonated forms after the hot press, thereby significantly reducing or eliminating the darkening of the finished composite panels.

ABSTRACT

A method is described for producing light colored composite panels by applying a buffer or weak acid system either in solution or in powder form prior to the hot press. The buffer or weak acid system, applied on the mat surfaces prior to hot pressing, reduces the pH of the environment on the mat surfaces and consequently reduces the degree of oxidation of the phenolic resin during hot pressing as well as retains the oxidized phenol formaldehyde polymers in their protonated forms after the hot press, thereby significantly reducing or eliminating the darkening of the finished composite panels.

METHOD OF MANUFACTURING LIGHT COLORED COMPOSITE PANELS WITH PHENOL FORMALDEHYDE BINDERS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a process for treating furnish mat in composite panel manufacturing, such as in the manufacture of particleboard, fiberboard, oriented strandboard and the like and compositions suitable for the practice of the process. More particularly, prior to pressing the furnish mat, which has been previously blended with phenol formaldehyde resins, into panels, the process uses a buffer or weak acid treatment to prevent the darkening of the panel surfaces which generally occurs during and after resin curing in a hot press.

2. Description of Related Technology

Phenol-formaldehyde resins are widely used as adhesives and binders in many products, including wood panel products such as plywood, particleboard, fiberboard, hardboard and oriented strandboard. Other adhesives like urea formaldehyde, melamine formaldehyde, melamine urea formaldehyde, and diisocyanate binders are also used in wood panel industry. However, phenolic resoles, either in liquid or powder form, have been the predominant adhesives for wood panel products for exterior application.

In general, the manufacturing process of particleboard, fiberboard, and oriented strandboard include furnish preparation, furnish drying, resin blending, mat formation, hot pressing, and post pressing treatment.

In the furnish preparation, wood and/or other lignocellulosic materials are reduced to either fibers or flakes or chips or strands of desired dimensions. The furnish then passes through a drier to remove excessive moisture. Undersized and/or oversized particles are removed either before or after the drying process. The dried furnish is blended with an adhesive in blenders for particleboard and oriented strandboard, or in blowlines for dry process fiberboard. The resinated furnish is formed into mats with desired orientations for orient strandboard, or with desired particle size differentials between core and surface layers for particleboard. The mats are conveyed to and pressed in a multi-opening press or a continuous press at elevated temperature and pressure to make the panels. The pressed panels are trimmed, cut to size, and may also be hot-stacked, sanded, conditioned, or edge sealed, and finally labeled and packaged for shipment.

When a phenolic resole adhesive, which is referred to PF resin hereafter, is employed in wood panel manufacturing, the top and bottom surfaces of pressed panels tend to have medium-brown or dark-brown color, which is undesirable for certain applications of these panels. Urea formaldehyde resins are capable of producing light colored wood panels, but only of interior grade. Melamine urea formaldehyde resins and diisocyanate binders also produce light colored panels of exterior grade, however at much higher production costs compared with using regular liquid or powder PF resins. Demands for light colored wood panels made from regular PF resins have therefore emerged from the panel industry.

3. Background of the Invention

PF resins bear reddish colors due to the absorption of visible light by phenolates generated in the presence of alkaline catalysts, most commonly sodium hydroxide. The resin's color is further darkened during the resin synthesis and storage due to oxidation of the PF resin. Using other catalysts such as amines or lithium hydroxide may produce lighter colored PF resins. A more sophisticated method for preparation of light colored PF resins was disclosed in Fl patent application 961331, in which a lighter resin color has been achieved by conducting resin synthesis, storage, and application under inert atmosphere such as nitrogen.

Even made with a light colored PF resin, the color of panel surfaces still turns to medium brown or dark-brown, and in some cases purplish brown after hot pressing. Adding anti-oxidants to a PF resins may slightly lighten the color of finished panels but not to the desired extent in most cases, and a high cost and/or incompatibility with the resin are often associated with addition of such strong anti-oxidants.

The most effective modification of regular PF resins to achieve light colored panels is to reduce the pH of the resin to 9.0 or below. By doing so two difficulties inevitably arise: insufficient curing speed and poor stability of the resin. A significantly reduced amount of the catalyst or the use of a weaker catalyst is required for low pH PF resins, which often reduces the curing speed of the resin so much that the resin is no longer suitable for today's fast press cycles in most panel mills. The viscosity of such low pH resins will increase rapidly at ambient temperature, causing problems in storage and transportation. To compensate for the lost curing speed due to low pH, the resin has to be cooked further to a markedly higher molecular weight. The trouble with conventional solution type of low pH PF resins is that the resin precipitates before reaching the desired molecular weight advancement.

An answer to the precipitation of highly advanced low pH PF resins is to convert the resin from solution type to emulsion or suspension form. A method for manufacturing light colored inorganic fiber panels was disclosed in 1993 (JP 95 18158) that described the synthesis and application of such emulsion PF resin. Another two patents filed in 1999 (Fl 990 674 and Fl 990 675) described the synthesis and production of emulsion PF resins and powder PF resins spray dried from the emulsion resins, respectively. These two patents claimed that the emulsion PF resins and powders resulted from emulsion PF resins produced colorless or light colored glue line or panel surface when cured.

While emulsion PF resin technology provides a viable method of producing light colored panels, the complexity of emulsion production and the extra cost associated with the significant amount of emulsifier and/or protective colloids needed for emulsification certainly reduces its cost efficiency. The solid content of emulsion resins is usually significantly lower than conventional solution type of PF resins in order to keep the viscosity in a workable range of 50 – 300 cps. The presence of emulsifiers and/or protective colloids reduces the effective phenol formaldehyde content in the resins and also tends to lower the yields of the spray drying process in the case of power resin. All of the above further increase the cost of using emulsion PF resins for panel manufacturing.

In general, regardless of the exact composition and method of application, PF resins produce oxidized phenolic polymers upon curing that give a dark color to the finished panels. Many consumers find the resulting dark appearance of some of composite panel products, particularly wood panels such as particleboard, fiberboard, and oriented strandboard, undesirable. The development of a simple and inexpensive method to produce light colored panels with traditional liquid or powder PF resins is therefore warranted.

SUMMARY OF THE INVENTION

The invention follows conventional practice in many respects concerning the manufacture of composite panels, which utilize PF resins as the adhesive or binder. The present invention modifies conventional practice by treating the furnish, before or after formation into mats, with a buffer or acid system before the mat is hot pressed in a conventional manner. This treatment provides a low pH environment on the surfaces of the furnish mat, which is to be hot pressed to make panels, and generally prevents the oxidation of the resin that darkens the color of the finished panels during and after the hot press.

The method in this invention utilizes the neutralization effects of the buffer or acid system on the PF resins existing on the outer surfaces of the furnish mat to provide a low pH environment, specifically to maintain the pH on the outer surfaces within the range of 2.0 to 9.0, preferably 6.0 to 8.0. This environment is believed to significantly slow down the oxidation of PF resins during and after hot pressing and virtually eliminated the deprotonated oxidized phenol species that are believed to be the main source of dark color of finished panels.

The method of this invention reduces or eliminates the darkening of the color of the composite panels that occurs in methods that utilize phenolic resins as adhesives or binders.

DETAILED DESCRIPTION OF THE INVENTION

The present invention is directed to a process for the bonding of lignocellulosic materials and other natural or artificial fibers in the manufacture of composite panels which utilize PF resins as the adhesive or binder, where the use of a buffer or acid system provides a low pH environment for the phenolic resins, and therefore reduces or prevents color darkening of the panels during and/or after the hot press.

The said lignocellulosic materials include, but are not restricted to wood strands, chips, veneers, wafers, fibers, particles, saw dust, and mixtures thereof. The said other natural and artificial fibers include, but are not restricted to, fibers from agricultural products or byproducts, glass and mineral fibers, synthetic fibers, and mixtures thereof.

The said composite panels include wood panels and panels made from other natural or artificial fibers or mixtures thereof. The panels utilize PF resins as the thermosetting adhesive and the color of panel surfaces darkens during and/or after hot press. Wood panels applicable to this invention are oriented strandboard, particleboard, fiberboard, and the like.

The said composite panels are manufactured by using a PF resin as either the sole adhesive or one component in a mixed adhesive system co-used with other binders, which include, but are not restricted to diisocyanate, urea formaldehyde resins, melamine formaldehyde resins, melamine urea formaldehyde resins, tannin resins.

The said PF resins are phenol formaldehyde resole resins with pH equal to or greater than 9.0, either in liquid or powder form or a mixture of each, with or without additives. The said additives include, but are not restricted to substituted phenols and phenol derivatives, organic or inorganic curing accelerators, urea, and other amino compounds, lignin and derivatives, organic or inorganic fillers and extenders.

The said pH is the pH of the resin deposited on the surfaces of furnishes, regardless of whether the resin is applied as one-component system or two-component system.

The said buffer and acid system can be either in liquid form or solid form. The liquid form is a buffer solution or acid solution; the solid form is either a solid mixture of buffer components that constitute a buffer solution when dissolved in water or a solid acid, both preferably exist in fine powders. Because larger amounts of reagents are required for the powder buffer or acid systems than corresponding solution systems, solution systems are preferred.

The said acid system contains an organic or inorganic acid or acidic compounds preferably a weak acid or acidic compound, or mixture thereof. The said acids refer to organic or inorganic proton acids, which are also called Brönsted acids. The said acidic compounds refer to organic or inorganic acidic salts, esters, anhydrides and compounds which react with water to release acids. The pH of said acid solution is between 2.0 and 9.0, preferably between 6.0 and 8.0. The said acids and acidic compounds include, but are not restricted to, hydrochloric acid, sulfuric acid, sulfurous acid, substituted sulphonic acids like phenolsulphonic acid and naphthalenesulfonic acid, phosphoric acid, phosphorous acid, sulfamic acid, boric acid, tetraboric acid, carbonic acid, sillcic acids, formic acid, acetic acid and substituted acetic acids, acrylic acid, propionic acid, butyric acid, cinnamic acids, citric acid, nicotinic acids, fumaric acids, furancarboxylic acid, furoic acid, gallic acid, itaconic acid, lactic acid, lutidinic acid, maleic acid, malic acid, malonic acid, naphtholic acids, oxalic acid, succinic acid, tataric acids, toluic acids, uric acid, mono- and di-nitrophenols, ammonium chloride and substituted amine chlorides, ammonium sulfate and substituted amine sulfates, ammonium phosphates and substituted amine phosphates, acetyl acetate, propylene carbonate, triacetin, acetic anhydride, maleic anhydride, succinic anhydride, and the like.

The said buffer system is either an organic or inorganic buffer solution with a pH range of 4.5 – 9.0, preferably 6.0 – 8.0 or a powder mixture of compounds that constitute a buffer solution when dissolved in water. Suitable buffer systems include, but are not restricted to, sodium dihydrogen phosphate with sodium hydroxide or their potassium equivalent, tris(hydroxymethyl) aminomethane with hydrochloric acid, borax with hydrochloric acid, borax with boric acid, boric acid with sodium hydroxide, boric acid with potassium hydroxide, citric acid with its salts, potassium hydrogen phthalate with dipotassium phthalate, sodium dihydrogen phosphate with disodium phosphate, acetic acid with sodium acetate, benzoic acid with sodium benzoate, sodium hydrogen oxalate with disodium oxalate, propionic acid with sodium propionate, ammonia with hydrochloric acid, ammonia with ammonium chloride, sodium hydrogen sulfite with disodium sulfite, sodium hydrogen carbonate with disodium carbonate, and the like.

Controlling the pH in the preferred range of 6.0 – 8.0 is important because of the concern about the corrosion of the equipment if lower pH systems are used. Therefore, buffer or weak acid systems are preferred.

The buffer or weak acid system can be used alone or in combination with other furnish mat surface treatment system such as, but not restricted to, water spray on the mat surfaces in the manufacturing processes of particleboard and oriented strandboard. The buffer or weak acid system may be applied onto the mat surfaces before of after the mat is formed, preferably after. In the application of this invention to wood panel manufacturing, the buffer or weak acid system may be applied onto the surfaces of the lignocellulosic furnishes when the mat is being transported from the forming station to the hot press. A set of nozzles may be used to evenly distribute the acid or buffer solution to completely cover the outer surfaces of the furnish on the upper and bottom surfaces of the mat. Methods other than nozzle spray can also be used to deliver the buffer or weak acid solution. The amount of the buffer or weak acid solution is dependent on several parameters: the concentration and/or the buffer capacity of the solution, the amount of the PF resin on the furnish surfaces, the alkalinity of the PF resin, the type of the PF resin, and the minimum volume needed to cover the entire mat surfaces. For instance, the required spray coverage of a buffer or weak acid solution on the wood strands in oriented strandboard manufacturing is at least 20 g/m^2, preferably 25 - 40 g/m^2 when a liquid PF resin is used as the adhesive and preferably 40 – 70 g/m^2 when a powder PF resin is used.

Various procedures are known in the art for the manufacture of lignocellulosic material-containing products. The choice of raw material for the lignocellulosic component is based mainly on availability and cost. As is common in board manufacturing operations, the wood from which particles are produced may be in the form of logs that are unsuitable for conversion into lumber or plywood because they are too small, crooked or knotty, or the like. When such logs are reduced to small particle form, defects are screened out.

The invention is useful in the production of panels that are made from homogeneous lignocellulose material or from mixtures of different kinds of such material. A panel may be made, for example, completely from wood particles, or completely from wood flakes, or from fibers, planer shavings or the like, or from mixtures of these. Similarly, a panel may be formed with multiple layers, with fine surface flakes and a core of coarse flakes, or it may have a coarseflaked core with an overlay of fibers on each of its surfaces. Other combinations may also be produced.

Wood flakes or strands are generally made by a machine that shaves off flakes or strands of the wood in a direction such that the length of each flake or strands is parallel to the wood grain. A normal flake or strand has dimensions from ¼" by 1" up to 1" by 6", with a thickness in the range from about 0.005" to about 0.075", depending upon the intended end use.

The lignocellulosic material may also be in the form of wood fibers. In the production of such fibers, wood chips are generally mechanically reduced to fiber form in an atrition mill. The fibers so produced are either directly used as the furnish in dry process fiberboards manufacturing or placed in the form of a pulp slurry containing from about 1% to 2% by weight of fiber for wet process.

The wood pieces employed in making the composite panel have some affinity for water and a tendency to absorb it. Water entering a composite panel tends to weaken it, may cause some swelling of surface fibers, and increases the dimensional instability of the composition panel. To prevent this tendency to absorb water, a wax may be applied to the wood furnish to provide a built-in resistance of the panel to water absorption. The wax employed may be any wax, either slack wax or emulsified wax, that will suffice. It is applied, generally, at a rate of from about 10% by weight to about 30% by weight of the binder, and preferably about 20% by weight, dry solids basis. When expressed in terms of oven-dried furnish solids, the amount of wax ranges from about 0.3% to about 3.0% by weight of wax to wood.

The amount of phenol formaldehyde resin used generally will depend upon the characteristics required in the final product. For oriented strandboard, the amount of PF resins are generally 1.8 – 3.5% for powder resins and 2.8 – 4.5 for liquid resins. Some specialty oriented strandboard such as rim-board and webstock may require significantly higher dosage of PF resins. For a high performance grade of particleboard, the amount of resin should be sufficient to provide from about 3% to about 8% dry resin solids based on the weight of the furnish for the composite panel. In a multi-layered board, a lesser amount of resin will often be used in the core than is used for the surface layers, such as, for example, 3% of resin solids for the core, and 8% of resin solids in the two surface layers. The added amount of resin in the surface layers imparts added strength and resistance to swelling as compared to the core. More resin can be used, but a greater amount presently may not be cost-efficient.

Hot pressing conditions will depend upon the thickness of the board as well as on resin characteristics. A representative press cycle for the production of a 23/32" thick phenolic bonded particleboard would be about 4.5-6.5 minutes at a press platen temperature of about 380° - 420° F. For instance 23/32" three layer oriented strandboard typically requires a pressing time of 5 minutes.

PF resins deposited on furnish surfaces without the treatment described in this invention are in an alkaline environment. The pH of PF resins is usually higher than 9.0, often 10.0 or above. At such a high pH environment, the phenol nuclei in the resins exist mainly in their deprotonated forms, namely phenolates. Phenolates are far more electron negative and easier to be oxidized comparing with their phenol counterparts. When the furnish mat is hot pressed at elevated temperature, the oxidation of these phenolates occurs, resulting in the formation of oxidized phenol derivatives which remain in deprotonated form, further darkening the color of the finished panels. When a buffer or weak acid system is applied on to the mat surfaces prior to the hot pressing, the phenolates in the PF resin are protonated back to corresponding phenol forms, which lessens the degree of oxidation during hot-pressing and renders the oxidized phenol species also in the protonated forms. Therefore, the color darkening of the finished panel is significantly reduced or virtually eliminated.

EXAMPLES

Example 1

Buffer #1 (1M boric acid + 0.1 M borax, pH 6.4) was sprayed onto the top surface of a 12"x12" Aspen oriented strandboard mat prior to hot pressing at a coverage of 25 g/m^2 and 50 g/m^2. A 55% solids liquid resin with a total caustic content of 3.8 – 4.0% (pH of 10.0 – 10.2) and a viscosity of between 40 and 90 cps was used throughout the board at 4.0% by weight of resin solid to wood. The blended moisture content of the furnish was 5.8%. Mats were pressed for a total of 240 seconds at 410°F to obtain a final thickness of 7/16" and a density of 39 lb/ft^3. The panels which had the buffer spray applied prior to pressing were significantly lighter (whitish yellow) in color compared to those without the treatment (dark brown). Thickness swelling and water absorption were not significantly different between the treated and untreated panels.

Example 2

Buffer #1 (1M boric acid + 0.1 M borax, pH 6.4) was sprayed onto the top surface of a 12"x12" Southern Yellow Pine oriented strandboard mat prior to hot pressing at a coverage of 50 g/m^2. Powder resin #1 with a total caustic content of 8.0 – 8.4% was used throughout the board at 4.0%

by weight of resin to wood. Mats were pressed for a total of 260 seconds at 400°F to obtain a final thickness of 7/16" and a density of 44 lb/ft^3. The panels which had the buffer spray applied prior to pressing were significantly lighter (whitish yellow) in color compared to those without the treatment (dark brown). Thickness swelling and water absorption were not significantly different between the treated and untreated panels.

Example 3

Buffer #1 (1M boric acid + 0.1 M borax, pH 6.4) was applied onto the top and bottom surfaces of a 12"x12" Southern Yellow Pine oriented strandboard mat prior to hot pressing at a coverage of 50 g/m^2. Powder resin #1 with a total caustic content of 7.0 – 7.4% was used throughout the board at 4.0% by weight of resin to wood. Mats were pressed for a total of 260 seconds at 400°F to obtain a final thickness of 7/16" and a density of 44 lb/ft^3. The panels which had the buffer spray applied prior to pressing were significantly lighter (whitish yellow) in color compared to those without the treatment (dark brown). Thickness swelling and water absorption were not significantly different between the treated and untreated panels.

Example 4

Acid #1 (1M boric acid solution) was applied onto the top and bottom surfaces of a 12"x12" Aspen oriented strandboard mat prior to hot pressing at a coverage of 25 g/m^2 and 50 g/m^2, respectively. A 55% solids liquid resin with a total caustic content of 3.8 – 4.0% (pH of 10.0 – 10.2) and a viscosity of between 40 and 90 cps was used throughout the board at 4.0% by weight of resin solid to wood. Mats were pressed for a total of 240 seconds at 410°F to obtain a final thickness of 7/16" and a density of 39 lb/ft^3. The panels which had the acid solution applied prior to pressing were significantly lighter (whitish yellow) in color compared to those without the treatment (dark brown).

Example 5

Acid #2 (1M formic acid solution) was sprayed onto the top surface of a 12"x12" Aspen particleboard mat prior to hot pressing at a coverage of 35 g/m^2. A 55% solids liquid resin with a total caustic content of 3.8 – 4.0% (pH of 10.0 – 10.2) and a viscosity of between 40 and 90 cps was used throughout the board at 5.0% by weight of resin solid to wood. Mats were pressed for a total of 300 seconds at 410°F to obtain a final thickness of 7/16" and a density of 44 lb/ft^3. The panels which had the buffer spray applied prior to pressing were significantly lighter (whitish yellow) in color compared to those without the treatment (dark brown).

Example 6

Acid #3 (1 M powdered citric acid) was applied onto the top and bottom surfaces of a 12"x12" Aspen oriented strandboard mat prior to hot pressing at a coverage 50 g/m^2. A 55% solids liquid resin with a total caustic content of 3.8 – 4.0% (pH of 10.0 – 10.2) and a viscosity of between 40 and 90 cps was used throughout the board at 4.0% by weight of resin solid to wood. Mats were pressed for a total of 240 seconds at 410^{o}F to obtain a final thickness of 7/16" and a density of 39 lb/ft^3. The panels which had the buffer spray applied prior to pressing were significantly lighter (whitish yellow) in color compared to those without the treatment (dark brown).

Each of the references referred to herein is expressly incorporated by reference. The invention being thus described, it will be clear that the same may be varied in many ways. Such variations are not to be regarded as a departure from the spirit and scope of the invention, and all such modifications as would be obvious to one skilled in the art are intended to be included within the scope of the following claims.

What is claimed is:

1. A composite panel product bonded with a phenol formaldehyde resin, which comprises at the outer surfaces thereof a buffer or weak acid to maintain the pH of said material at 2.0 to 9.0, thereby retarding the darkening of said outer surfaces.

2. The composite panel product according to claim 1, selected from the group consisting of oriented strand boards (OSB), particleboard, hardboard, fiberboard, strawboard, and panels made from other natural or synthetic fibers.

3. The surfaces of the composite panel product according to claim 1, wherein said pH is maintained at 2.0 to 9.0, preferably 6.0 to 8.0, after the treatment by using said buffer or weak acid systems

4. The method for retarding the darkening of the outer surface of a composite panel product which comprises treating mat surfaces of composite material mats with a buffer or weak acid system prior to hot pressing of the mats.

5. The method according to claim 4, wherein said buffer or weak acid system is in solution form or powder form.

6. The method according to claim 4 and 5, wherein said buffer or weak acid solution system is applied by spray or other wetting method, directly or indirectly; said buffer or weak acid powder system is applied by vibrating screen or other spreading method, directly or indirectly.

7. The method according to claim 4- 6, wherein the pH of said buffer or weak acid system is 2.0-9.0.

8. The method according to any one of claims 4-7, wherein said buffer or weak acid system is applied at greater than or equal to 0.1 gram solid per square meter of mat surfaces.

9. The method according to claim 8, wherein said solid is the weight of components of said buffer or weak acid except water or other solvents.

10. The method according to any one of claims 4-9, wherein the buffer system comprises an organic or inorganic buffer component pair.

11. The method according to any one of claims 4-8, wherein said acid system comprises an organic or inorganic acid.

12. The method according to claim 10, wherein said buffer comprises, but is not restricted to, a member selected from the group consisting of sodium dihydrogen phosphate with sodium hydroxide or their potassium equivalent, tris(hydroxymethyl) aminomethane with hydrochloric acid, borax with hydrochloric acid, borax with boric acid, boric acid with sodium hydroxide, boric acid with potassium hydroxide, citric acid with its salts, potassium hydrogen phthalate with dipotassium phthalate, sodium dihydrogen phosphate with disodium phosphate, acetic acid with sodium acetate, benzoic acid with sodium benzoate, sodium hydrogen oxalate with disodium oxalate, propionic acid with sodium propionate, ammonia with hydrochloric acid, ammonia with ammonium chloride, sodium hydrogen sulfite with disodium sulfite, sodium hydrogen carbonate with disodium carbonate.

13. The method according to claim 11, wherein said acid or acidic compound comprises, but is not restricted to, a member selected from the group consisting of hydrochloric acid, sulfuric acid, sulfurous acid, substituted sulphonic acids like phenolsulphonic acid and naphthalenesulfonic acid, phosphoric acid, phosphorous acid, sulfamic acid, boric acid, tetraboric acid, carbonic acid, sillcic acids, formic acid, acetic acid and substituted acetic acids, acrylic acid, propionic acid, butyric acid, cinnamic acids, citric acid, nicotinic acids, fumaric acids, furancarboxylic acid, furoic acid, gallic acid, itaconic acid, lactic acid, lutidinic acid, maleic acid, malic acid, malonic acid, naphtholic acids, oxalic acid, succinic acid, tataric acids, toluic acids, uric acid, mono- and di-nitrophenols, ammonium chloride and substituted amine chlorides, ammonium sulfate and substituted amine sulfates, ammonium phosphates, substituted amine phosphates, acetyl acetate, propylene carbonate, triacetin, acetic anhydride, maleic anhydride, and succinic anhydride.

14. A method for producing light colored oriented strandboard comprising spraying the mat surfaces with a boric acid/borax buffer system prior to hot pressing.

15. A method for producing light colored oriented strandboard comprising spraying the mat surfaces with a formic acid solution prior to hot pressing.

16. A method for producing light colored oriented strandboard comprising applying the mat surfaces with citric acid powder prior to hot pressing

17. The method according to claim 14, wherein the pH of said buffer system is between 4.0 and 9.0.

18. A method according to any one of claims 4-17 wherein said resin comprises phenolic formaldehyde.

19. A method according to any one of claims 4-17, wherein said phenolic resin is a liquid or powdered resin.