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METHOD FOR PRODUCING A SURFACE LAYER OF HIGH BRIGHTNESS ON LIGNOCELLULOSE-CONTAINING MATERIAL

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Several methods have been proposed to produce from lignocellulose containing fibres boards and other thick sheet material with high brightness. According to one of the said methods, the wet web of the material during its production is provided with one or several surface layers of fibrous material having a brightness considerably exceeding the brightness of the underlaying main web layer. The medium used for said surface layer or layers is usually a fibrous material pre-treated in one way or another, for example a bleached fibrous material, the thickness of the bleached surface layer being chosen to be such that it provides a satisfactory covering effect. The aforesaid method is predominantly used, for example, in the manufacture of card-board, box-board, paper-board and fibre building board. As an alternative, a surface layer of non-fibrous material may be applied, for example, a bright pigment with a binding agent.

Non-flat, multiformed products, usually called moulded pulp products are wet-formed for example by vacuum-dewatering of a pulp stock and usually in a single step, whereafter the partly dewatered, ready-formed product is dried in hot air. Such moulded pulp products are egg cartons, fruit trays, rough-trays, flower containers etc. They usually are produced from groundwood or from waste paper stock or from mixtures of these two. Methods of wet-forming a surface layer of bleached pulp on one or the other side of such moulded pulp product so far are complicated and expensive.

It has now been found, according to the present invention, that lignocellulose containing materials of desirable thickness and high brightness can be produced in a simple as well as a technically and economically advantageous manner by applying to the ready-dried paper board or moulded pulp product a bleaching agent composed entirely or substantially of reducing bleaching agents, without subsequently removing degradation products of the bleaching reaction. The bleaching agent may be applied to the surface in the form of an aqueous solution immediately after or in connection with the drying of the material and prior to cutting or dividing it up into units for use.

In many cases it is preferred that only one major surface of the material to be brightened is treated with the bleaching agent. Illustrative of such materials are moulded egg cartons, corrugated container board and corrugated container blanks being treated in advance of printing. Also the treatment may be applied to a part of the material surface, e.g. a part forming a single face of a corrugated container.

As bleaching agents showing good results mention may be made of hydrosulphite, such as sodium or zinc hydrosulphite (dithionite), possibly with an addition of ethylenediamine tetrasodium acetate, and sodium or potassiumborohydride, and also combinations of the same in such a manner that, for example, first sodium hydrosulphite is applied and thereafter sodiumborohydride.

The bleaching agent is preferably applied to a dry and heated web of the material as it leaves a dryer. It has been found that, for obtaining maximum bleaching effect, the amount of aqueous solvent to be applied to the web together with a certain amount of bleaching agent, must be adjusted in accordance with the temperature of the web. Higher temperatures have proved to require a greater amount of aqueous solvent. It is essential that the bleaching agent be applied in an amount that ensures a thin but fully covering bleached layer.

The maximum bleaching effect depends on the bleaching reaction, the necessary bleaching time at different temperature in view of the reaction speed, the surface temperature and the surface pH of the web, as well as on the depth to which the bleaching agent may act and penetrate in view of the temperature, the water amount added and the porosity of the material.

The bleaching agent may be sprayed on the material in conventional manner by means of fine nozzles using high water pressure or an air stream, but may under certain conditions even be applied together with the wetting water in the combined reconditioning and cooling of the product mat.

The material to be treated is usually paperboard, cardboard or boxboard especially of high basis weight, e.g. at least 200 gms. per square metre and preferably exceeding 500 gms. per square metre. It may be kraft liner. Valuable as material are also a multiform moulded pulp product manufactured of a substance comprising lignocellulose containing fibres. Illustrative of such a product are egg cartons, fruit trays, rough trays, plates and flower containers. The material may be made up entirely or partially of groundwood or kraft pulp. If desired, it may also contain or completely be made up of waste paper stock.

The following examples are illustrative of the invention. It is to be appreciated that the materials and the manufacturing conditions set forth are exemplary and the invention should not be considered to be limited thereto. The brightness is indicated as diffused reflection of light of 4570 A. wave length in percent of magnesium oxide reflection measured with the General Electric brightness meter on flat pieces of the material.

Example 1

A thoroughly dried web of wet formed trays of groundwood with a basis weight of 400 g./m.^{2}, when leaving the dryer with a surface temperature of 80° C., was sprayed with 200 ml./m.^{2} of 8% sodium hydrosulphite solution ($Na_2S_2O_4$). The solution had the adjusted pH-value 6.5 and was mixed with 3% of EDTA (ethylenediamine tetrasodium acetate) calculated on the basis of the $Na_2S_2O_4$ content. After the spraying, the material was worked in conventional manner. As a result of this treatment, the brightness of the product increased from 53% to 62%. The brightness stability was measured in a Fade-o-meter whereby the brightness after 10 hours light treatment decreased from 62% to 56%, while the brightness of the untreated sheet decreased from 53% to 44%.

In another test the surface temperature of the dry sheet was reduced by cold air blowing to 49° C. whereafter the sheet was sprayed with 100 ml./m.^{2} of a 3% zinc hydrosulphite solution. The brightness increased from 53% to 60% and decreased after Fade-o-meter treatment for 10 hours to 50%.

Example 2

Wet formed moulded egg cartons with a basis weight of 385 gms. per square metre and a projected basis weight of 730 gms. per square metre and with a surface temperature of 80° C. were sprayed first with 50 ml./m.^{2} of a 20% sodium hydrosulphite solution and thereafter with 50 ml./m.^{2} of a 0.5% sodiumborohydride solution. By

this treatment, the brightness of the material was increased from 60.3% to 65.2%.

If instead of the dry web was sprayed with 50 ml./m.^{2} of a 1.0% solution of sodiumborohydride the brightness of the material increased from 60.3% to 68.8%.

Example 3

A moulded egg carton of groundwood and waste newspaper stock with a basis weight of 330 g./m.^{2} was sprayed with 100 ml./sq. m. of a 1.0% water solution of sodium borohydride. The brightness of the product increased from 40% to 46% while as well the yellow colour of the product essentially into a more pleasant grey colour.

Example 4

A triplex groundwood card-board with a weight of 1200 gms. per square metre was sprayed with 100 ml./m.^{2} of a 0.2% sodiumborohydride solution. The spraying was carried out in the form of atomized spray applied to the running web after its drying. By this treatment, the brightness was increased from 53% to 59%. After light treatment in a Fade-o-meter for 10 hours the brightness decreased from 59% to 55%, while the brightness of the untreated card-board decreased from 53% to 50%.

Example 5

A high yield unbleached kraftliner with a basis weight of 215 gms./sq. m. was sprayed at room temperature with 30 ml./sq. m. of a 20% solution of sodium hydrosulphite (sodium dithionite) containing also 0.3% of ethylendiaminotetrasodium acetate the reflectance of this sheet at 4570 A. increased from 18.0% to 20.7%. The reflectance at 5500 A. increased from 28.0% to 34.2%.

If instead the sheet was sprayed with 50 ml./m.^{2} of a 2% solution of sodium borohydride the reflectance of 4570 A. increased from 18.1 to 23.4% and the reflectance at 5500 A. from 27.9% to 37.1%.

Spraying the same solutions on one side of a ready made corrugator box gave essentially similar results.

The invention in its broader aspects is not limited to the specific processes, materials, bleaching agents, combinations and improvements described but departures may be made therefrom within the scope of the accompanying claims without departing from the principles of the invention and without sacrificing its chief advantages.

What we claim is:

1. A method of providing pre-formed, dried lignocellulose-containing material with only a surface layer of high brightness comprising applying a bleaching agent consisting essentially of reducing bleaching agents to said surface of the pre-formed and dried lignocellulose-containing material in an amount sufficient to react with only a surface layer of the latter, and permitting the reaction products to remain in the surface layer of the material.

2. A method as in claim 1; wherein said bleaching agent is applied in an amount of water small enough to be absorbed by the material without requiring further drying of the latter.

3. A method as in claim 2; wherein said bleaching agent and water are applied immediately after drying of the lignocellulose-containing material.

4. A method as in claim 1; wherein said bleaching agent is sodium hydrosulphite.

5. A method as in claim 4; wherein said sodium hydrosulphite has an addition thereto of ethylenediamine tetrasodium acetate.

6. A method as in claim 1; wherein said bleaching agent is zinc hydrosulphite.

7. A method as in claim 6; wherein said zinc hydrosulphite has an addition thereto of ethylenediamine tetrasodium acetate.

8. A method as in claim 1; wherein said bleaching agent is an alkaliborohydride.

9. A method as in claim 1; wherein said lignocellulose-containing material is made up, at least in part, from ground wood pulp.

10. A method as in claim 1; wherein said lignocelluose-containing material is made up, at least in part, from unbleached kraft pulp.

11. A method as in claim 1; wherein said material is of sheet-like form and has a basic weight of at least 200 gms. per square meter.

12. A product prepared by the method according to claim 1.

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