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(54) **PACKAGING MATERIAL AND METHOD OF WRAPPING ARTICLES**

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**ABSTRACT**

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The present invention provides a packaging material comprising paper having a wet shrinkage in the CD direction of at least 3% and a method of wrapping articles with said packaging material, wetting the packaging material, wrapping said articles with said wetted packaging material, and drying the packaging material such that it shrinks to tightly bind the wrapped articles.

## PACKAGING MATERIAL AND METHOD OF WRAPPING ARTICLES

### FIELD OF THE INVENTION

[0001] This invention relates to packaging material for wrapping multiple products and in particular to a paper based replacement for plastic shrink-wrap and to a method of wrapping articles using such packaging material.

### BACKGROUND OF THE INVENTION

[0002] Plastic is commonly used as a packaging material to bundle multiple products in an easy and cheap way by wrapping the products in a plastic foil and shrinking the foil around the products by the application of heat. Such “shrink wrap” plastic packaging is extremely versatile due to the high level of shrinkage of the plastic film foil when exposed to heat and the stability and strength of the wrapping material once shrunk. However, the use of single use fossil based plastic as a packaging material is not sustainable and the heat required to shrink the plastic foil generates CO<sub>2</sub>.

[0003] It is desirable to replace plastic packaging by paper packaging wherever possible. However, the inability of paper to shrink when heated in the manner of plastic wrapping limits its use for this purpose. Some attempts to use paper as a wrapping material have found success in limited applications, such as wrapping palletised goods, by optimising the limited stretchability of the paper, whereby paper removed from a roll can be tensioned as it is wrapped around palletised goods. However, such paper wrap does not provide the advantageous properties of “shrink-wrap” plastic packaging of shrinking around the wrapped products upon the application of heat and therefore find limited success in wrapping irregularly shaped articles.

### SUMMARY OF THE INVENTION

[0004] According to a first aspect of the present invention there is provided a packaging material comprising paper having a wet shrinkage in the CD of at least 3%, more preferably at least 4.5%.

[0005] Preferably the paper has a length weighted mean fibre length of at least 1.5 mm, more preferably at least 2 mm.

[0006] Preferably the packaging material has a tensile stiffness index MD/CD ratio of at least 2.0, more preferably at least 2.5.

[0007] Preferably the packaging material has a wet tensile strength in the CD direction of at least 10% of the material's dry tensile strength, more preferably at least 15% of the material's dry tensile strength.

[0008] According to a further aspect of the present invention there is provided a method of wrapping articles comprising providing a packaging material as claimed in any preceding claim, wetting the packaging material, wrapping said articles with said wetted packaging material, and drying the packaging material such that it shrinks to tightly bind the wrapped articles.

[0009] The packaging material may be dried by blowing unheated air over the packaging. Alternatively the packaging material is dried by the application of heat or blowing heated air over the packaging.

[0010] Preferably the packaging material is oriented in such a way that it preferentially shrinks around the articles in the material's CD direction.

## BRIEF DESCRIPTION OF AN EMBODIMENT OF THE INVENTION

[0011] The present invention provides a paper packaging material that can replace shrink-wrap plastic by optimising the properties of the paper packaging material to maximise shrinkage of the damp or wet paper upon drying while providing sufficient resistance to tearing.

[0012] Paper is sensitive to humidity. A change in the humidity will result in a (anisotropic) dimensional change of the paper, which in most applications is to be avoided. For that reason a lot of effort goes into making paper more stable to dimension changes and less sensitive to humidity. In many cases the environment in which the paper is used should be stable in humidity.

[0013] The present invention uses the “negative” property of this dimensional change of paper upon changes in humidity in a positive way. The inventors have selected paper properties to enhance dimensional instability of the paper to select a paper packaging material that preferentially maximises expansion and contraction of the paper upon wetting and subsequent drying while providing sufficient wet-strength for wrapping. Also, while others describe the hygro-expansion of the paper in humid air, the inventors have focussed on the hydroexpansion of paper wetted by water.

[0014] Paper properties required for hydroexpansion and shrinking are:

[0015] Hydroexpansion after wetting;

[0016] Sufficient wet-strength for wrapping;

[0017] Large wet-shrinkage >4% (measured in NEN1827);

[0018] Resistant to the shrinkage stress (=no tearing during drying).

[0019] The test method used to determine wet-shrinkage of paper samples was NEN 1827 (Fenchel wet expansion meter). Samples were conditioned at 23 C/50% RH, wetted by water, dried and reconditioned to 23 C/50% RH, while the change in length was measured.

[0020] The wet-shrinkage referred to herein is defined as the length reduction between the “wet” situation and the “reconditioned to 23 C/50% RH” situation.

[0021] Several papers score values higher than 3% and some higher than 4.5%.

[0022] Not all papers perform equally well. In order to achieve good wet-shrinkage properties the papers should have:

[0023] long fibres/fibrils (i.e. a length weighted mean length greater than 1.5 mm as measured via ISO16065-2);

[0024] wet tensile strength retention of at least 10% of dry tensile strength, more preferably at least 15% of dry tensile strength (as measured via ISO3781, executed as ISO1924-2);

[0025] high fibre orientation giving a tensile stiffness index MD/CD ratio of at least 2.0 and preferably higher than 2.5. (as measured in test methods such as ISO1924-2).

[0026] During paper-making, paper is stretched in the machine direction (MD) and then compacted in the machine direction while still wet. The cross-machine direction (CD) tensile strength of the paper is typically less than half that of the MD value.

[0027] A further key property required is sufficient tensile stiffness when wet and dry. This is defined by a Tensile Stiffness Index MD/CD ratio, as measured in test methods such as ISO1924-2.

[0028] In order to be suitable for use as a shrink wrap packaging material, as well as a wet-shrinkage in the CD direction of at least 3% (preferably measured in accordance with NEN1827), more preferably at least 4.5%, a length weighted mean fibre length of at least 1.5 mm, more preferably at least 2 mm, is required to avoid tearing during wrapping and subsequent drying.

[0029] It was found that thin papers (grammage < 100 g/m<sup>2</sup>) performed better than thicker papers. It was found that virgin papers performed better than recycled papers.

[0030] In one embodiment a suitable paper was found to be machine glazed paper with a grammage of 60 g/m<sup>2</sup> and a tensile stiffness index MD/CD ratio of 2.8. This provided an expansion after wetting with 3.4% in length and shrunk after drying to -1.8% of its original length, resulting in a total wet-shrinkage of 5.2%.

[0031] In use, the paper packaging material in accordance with the present invention is expanded by wetting the paper, by the application of water or water vapour. After wrapping the products, the paper is dried, preferably at ambient temperature, and it shrinks around the products. Drying may be facilitated by the use of air blowers, preferably without additional heating.

[0032] The paper for packaging may be fed to the products in the form of sheets or by unwinding and cutting sheets from a reel of paper.

[0033] The paper may be wetted by submersing it in water via a transport roll that is below a water level. Alternatively the paper may be coated with water using a roller or by a water spray or a vapour.

[0034] The paper is preferably oriented in such a way that it preferentially shrinks around the products in the paper's CD direction.

[0035] The wet paper can be wrapped around the products and glued to itself. An alternative is to use pre-glued paper, for example in the form of a paper cylinder that is positioned around the products after wetting. Another alternative is to partially wrap the wet paper around the products and glue the ends of the paper to a paper-based tray within which the products are located.

[0036] After wrapping the wet paper around the products, the paper is dried by evaporating the water from the paper, preferably by blowing air of ambient temperature over the wet wrapped packaging. The air is preferably not heated, saving energy compared to prior art plastic shrink-wrap. An alternative is to use air that is heated to 50° C. to 80° C. This is still a lower temperature than used in a plastic shrink-wrap installation.

[0037] While drying, the paper will shrink around the products and bundle them to a level whereby they can be held together and handled as a single unit.

[0038] The use of a sustainable material and low temperature solves both issues with the prior art plastic shrink-wrap packaging.

[0039] The present invention provides a method for packaging primary products to create SKUs (Stock Keeping Units) or consumer multipacks, leveraging paper material exhibiting an elongation of more than 2% under moisture conditions, comprising:

[0040] a) Employing said paper material to bundle primary products;

[0041] b) Utilizing the paper's shrinkage properties under moisture conditions;

[0042] c) Adjusting packaging parameters based on the paper's properties to optimize the creation of SKUs or consumer multipacks.

[0043] The paper's elongation properties under moisture conditions are advantageously utilised to enhance the packaging process, facilitating the creation of SKUs or consumer multipacks with improved efficiency and quality, while ensuring full recyclability of the packaging material and reducing energy requirements compared to prior art plastic shrink-wrap.

[0044] The invention is not limited to the embodiment described herein but can be amended or modified without departing from the scope of the present invention.

1. A packaging material comprising paper having a wet shrinkage in the CD direction of at least 3%.

2. A packaging material as claimed in claim 1 having a wet shrinkage in the CD direction of at least 4.5%.

3. A packaging material as claimed in claim 1 or claim 2, having a length weighted mean fibre length of at least 1.5 mm.

4. A packaging material as claimed in claim 1 or claim 2 having a length weighted mean fibre length of at least 2 mm.

5. A packaging material as claimed in any preceding claim, having a wet tensile strength of at least 10% of the material's dry tensile strength.

6. A packaging material as claimed in any of claims 1 to 5, having a wet tensile strength of at least 15% of the material's dry tensile strength.

7. A packaging material as claimed in any preceding claim having tensile stiffness index MD/CD ratio of at least 2.0.

8. A packaging material as claimed in any preceding claim having tensile stiffness index MD/CD ratio of at least 2.5.

9. A method of wrapping articles comprising providing a packaging material as claimed in any preceding claim, wetting the packaging material, wrapping said articles with said wetted packaging material, and drying the packaging material such that it shrinks to tightly bind the wrapped articles.

10. A method as claimed in claim 9, wherein said packaging material is dried by blowing unheated air over the packaging.

11. A method as claimed in claim 10, wherein said packaging material is dried by the application of heat or blowing heated air over the packaging.

12. A method as claimed in any of claims 8 to 11, wherein the packaging material is oriented in such a way that it preferentially shrinks around the articles in the material's CD direction.

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