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(54) Title: A NONWOVEN WEB DESIGNED FOR USE IN A HEALTHCARE WIPER

(57) Abstract: This invention relates to a nonwoven material suitable for use in a healthcare wiper or wipe, containing at least a first cellulosic nonwoven web, characterized in that the cellulosic nonwoven web is made from essentially pure cellulose formed of essentially continuous filaments and multibonded by merged filaments, hydrogen bonding and physical intermingling of the filaments. It further relates to the use of the inventive nonwoven material as a base sheet for the manufacture of a healthcare wiper, such wiper being loaded with a skin cleansing and/or antibacterial solution as well as to a compostable healthcare wiper, containing (a) the inventive nonwoven material as a base sheet and (b) a skin cleansing and/or antibacterial solution.



A nonwoven web designed for use in a healthcare wiper

This invention relates to a nonwoven web suitable to be used as the base sheet for a healthcare wiper, and, more particularly, to an essentially pure cellulose nonwoven web formed from essentially continuous filaments and
5 multibonded by merged filaments, hydrogen bonding and physical intermingling of the filaments, providing good skin cleaning, low linting, dimensional stability, softness, non-irritation, strength, absorbency, biodegradability and sustainability. This invention further relates to additional bonding of this web alone, or to other webs or materials through
10 hydroentangling to enhance these key performance properties needed in a healthcare wiper. For the purposes of this invention, the terms "wiper" and "wipe" shall be understood as synonymous.

The term "essentially pure cellulose" shall address the fact that cellulosic moulded bodies, e.g. made according to the lyocell process, always contain a
15 small amount of polymers other than cellulose, namely hemicellulose. This does not influence in any way the suitability for the use according to this invention.

Prior Art

20 There are several types of nonwovens known for use as antibacterial wipes. U.S. 5,652,049 describes a composite, multilayer nonwoven comprised of a base nonwoven layer and an antibacterial nonwoven layer, which are then hydroentangled together. This patent teaches that the base nonwoven layer can be composed of cellulose spunbond, polypropylene spunbond, or
25 polypropylene thermal bonded nonwovens. U.S. 6,986,897 teaches the use of a latex bonded carded cellulosic nonwoven as a base sheet for an antibacterial wipe. U.S. 8,461,066 teaches the use of a bulked, crimped cellulosic tow nonwoven for wipes and wound care. U.S. 8,748,693 describes a nonwoven including two or more layers of meltspun polymers
30 physically entangled to make a web suitable for wound care and wipes. U.S. 8,846,116 discloses the use of a coform product incorporating meltblown polypropylene with wood pulp to produce a nonwoven web useful for wound care and wipes.

There has been significant research in nonwovens for antibacterial wipes but the current technology is not yet optimal. Composites of spunbond thermoplastics and other staple fibers or wood pulp, as taught by U.S. 5,652,049 and U.S. 8,846,116, provide a compromise on absorbency, softness and biodegradability. In addition, these multistage composites are complex and expensive processes. Nonwovens of up to 100% cellulosic fibers, as taught by U.S. 6,986,897, are absorbent and biodegradable, but linting, strength and dimensional stability are unacceptable.

The optimal product would combine properties of both meltspun polyolefins and staple fiber cellulosic nonwovens.

Previous technology has targeted this optimal solution, though with limited success. Nonwovens described in U.S. 8,846,116 are composed of meltblown polypropylene comingled with air conveyed wood fluff pulp. This addresses many of the needs, notably strength, softness, dimensional stability, and absorbency. However, the polypropylene component is not biodegradable and the wood fluff component is susceptible to dusting and linting, definitely not permitted in wipes for healthcare and near open wounds.

The present invention relates to the use of specially designed nonwoven substrates produced using novel variants of the spunlaid nonwoven process, comprising 100% cellulose polymers. There are known methods and products using spunlaid cellulose webs. U.S. 6,358,461, U.S. 7,067,444, U.S. 8,012,565, U.S. 8,191,214, U.S. 8,263,506 and U.S. 8,318,318 all teach methods for producing and using spunlaid cellulose webs. None of these teaches production methods for or products addressing the specific substrate requirements for healthcare wipers or wipes.

Problem

Healthcare wipers or wipes are used for a variety of purposes. Some are used for cleaning wounds, others for disinfecting hands and other skin surfaces; others are used for preparing patients' skin for injections or

incisions. All of these tasks share some common requirements. The healthcare wiper must be strong and soft, non-irritating to the skin, dimensionally stable to be efficient at cleaning or preparing a skin surface, low linting to avoid contaminating open wounds or incisions, absorbent to acquire and hold exudate from wounds and incisions, biodegradable and based on renewable resources, and cost effective in use. While such wipers can be based on nonwoven, paper or even textile materials, nonwoven wipers have been especially effective at meeting the needs of this product in a cost effective manner.

The problem with current healthcare wiper technology is that none addresses all of the needs. Meltspun polyolefins and products incorporating them are not very absorbent or biodegradable or sustainably sourced. Cellulosic nonwovens or products incorporating cellulosic fibers are neither very low linting, nor dimensionally stable especially when wet, and may not be strong enough or soft enough for some healthcare tasks. An optimal solution is not available.

There is distinct need for a strong, soft, skin cleaning, non-irritating, dimensionally stable (even wet), low linting, cost effective and biodegradable material for use in healthcare wipers or wipes.

Description

It is the object of the present invention to provide a nonwoven material suitable for use in a healthcare wiper, containing at least a first cellulosic nonwoven web, wherein the cellulosic nonwoven web is made from essentially pure cellulose formed of essentially continuous filaments and multibonded by merged filaments, hydrogen bonding and physical intermingling of the filaments.

Such a nonwoven material according to the invention (a) has low linting, (b) has good dimensional stability (wet and dry), (c) is absorbent, (d) provides excellent skin cleaning, (e) is soft and strong, (f) is non-irritating to skin, and (g) is biodegradable, compostable and based on renewable resources

The nonwoven material according to the invention is used in a healthcare wiper that is designed to be a cost effective, biodegradable and sustainable nonwoven that is strong, low linting, absorbent, dimensionally stable, wet and dry, soft and non-irritating with excellent skin cleaning properties. This nonwoven material which is essentially pure cellulose formed from essentially continuous filaments will provide the low linting, dimensional stability, and strength of a meltspun polyolefin with the absorbency of a cellulosic nonwoven in a cost effective, biodegradable and sustainable product.

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The process used to manufacture the inventive nonwoven web is a solution blown spinning process, which is often referred to as a cellulosic spunlaid process. The process is using a spunbond or meltblown die or head to form the continuous filaments, in principle known from the prior art cited above.

15 The degree of merged filament bonding also results in a range of filament diameters and cross-sections being present. This characteristic enables additional cleanability versus nonwoven webs with a tight range of fiber and/or filament diameters.

Preferably, the inventive nonwoven material is further bonded or treated by a hydroentanglement, needlepunch or chemical bonding process to modify the physical properties.

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The first cellulosic nonwoven web is preferably made according to a lyocell process.

Cellulosic fibres can be produced by various processes. In one embodiment a lyocell fibre is spun from cellulose dissolved in N-methyl morpholine N-oxide (NMMO) by a meltblown process, in principle known from e.g. EP 1093536 B1, EP 2013390 B1 and EP 2212456 B1. Where the term meltblown is used it will be understood that it refers to a process that is similar or analogous to the process used for the production of synthetic thermoplastic fibres (filaments are extruded under pressure through nozzles and stretched to required degree by high velocity/high temperature extension air flowing substantially parallel to

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the filament direction), even though the cellulose is dissolved in solution (i.e. not a molten thermoplastic) and the spinning & air temperatures are only moderately elevated. Therefore the term "solution blown" may be even more appropriate here instead of the term "meltblown" which has already become
5 somewhat common for these kinds of technologies. For the purposes of the present invention both terms can be used synonymously. In another embodiment the web is formed by a spun bonding process, where filaments are stretched via lower temperature air. In general, spunbonded synthetic fibres are longer than meltblown synthetic fibres which usually come in
10 discrete shorter lengths. Fibres formed by the solution blown lyocell process can be continuous or discontinuous depending on process conditions such as extension air velocity, air pressure, air temperature, viscosity of the solution, cellulose molecular weight and distribution and combinations thereof.

In one embodiment for making a nonwoven web the fibres are contacted with
15 a non-solvent such as water (or water/NMMO mixture) by spraying, after extrusion but before web formation. The fibres are subsequently taken up on a moving foraminous support to form a nonwoven web, washed and dried.

Freshly-extruded lyocell solution ('solvent spun', which will contain only, for example, 5-15% cellulose) behaves in a similar way to 'sticky' and deformable
20 thermoplastic filaments. Causing the freshly-spun filaments to contact each other while still swollen with solvent and with a 'sticky' surface under even low pressure will cause merged filament bonding, where molecules from one filament mix irreversibly with molecules from a different filament. Once the solvent is removed and coagulation of filaments completed, this type of
25 bonding is impossible.

It is another object of the present invention to provide a process for the manufacture of a nonwoven material consisting of essentially continuous cellulosic filaments by:

- a. Preparation of a cellulose-containing spinning solution
- 30 b. Extrusion of the spinning solution through at least one spinneret containing closely-spaced meltblown jet nozzles

- c. Attenuation of the extruded spinning solution using high velocity air streams,
 - d. Forming of the web onto a moving surface [e.g. a perforated belt or drum],
 - e. Washing of the formed web
 - 5 f. Drying of the washed web
- wherein in step c. and/or d. coagulation liquor, i.e. a liquid which is able to cause coagulation of the dissolved cellulose; in a lyocell process this preferably is water or a diluted solution of NMMO in water, is applied to control the merged filament bonding. The amount of merged filament bonding is
- 10 directly dependent on the stage of coagulation of the filaments when the filaments come into contact. The earlier in the coagulation process that the filaments come into contact, the greater the degree of filament merging that is possible. Both placement of the coagulation liquor application and the speed at which the application liquor is applied can either increase, or decrease, the
- 15 rate of coagulation. Which results in control of the degree (or amount) of merged filament bonding that occurs in the material.

Preferably the merged filament bonding is further controlled by filament spinning nozzle design and arrangement and the configuration and

20 temperature of filament extension air. The degree of molecular alignment that is present as the solution exits the spinning nozzle has an impact on the coagulation rate. The more aligned the molecules are, the faster the coagulation rate, and conversely, the less aligned the molecules are, the slower the coagulation rate. The spinning nozzle design and arrangement,

25 along with the molecular weight of the cellulosic raw material used will determine the starting coagulation rate at the exit of the spinning nozzle. Additionally, the rate of cooling (temperature decrease) of the solution upon spinning nozzle exit will impact the coagulation rate as well. The slower the cooling rate, the slower the coagulation rate, and conversely, the faster the

30 cooling rate, the faster the coagulation rate. Therefore, configuration of the filament extension air can directing impact the cooling rate and therefore, impact the coagulation rate, which impacts the achievable amount of merged filament bonding that is possible.

In a preferred embodiment of the process according to the invention at least two spinnerets (also known as jets), preferably between two and ten, and further preferred between 2 and 6, each one arranged to form a layer of nonwoven web, are used to obtain a multilayer nonwoven material. By
5 applying different process conditions at the individual spinnerets it is even possible to obtain a multilayer nonwoven material wherein the individual layers have different properties. This may be useful to optimize the nonwoven material according to the invention for different applications. In one
10 embodiment this could provide a gradient of filament diameters from one side of the material to the other side by having each individual web having a standard filament diameter that is less than the web on top, it is possible to create a material suitable for use as an air filter media that will provide a gradient of pore size (particle size capture). This will provide an efficient filtration process and result in a lower pressure drop across the filter media
15 compared to a single web with similar characteristics at the same basis weight and pore size distribution.

Preferably the filaments are spun using a solution of cellulose in an aqueous amine oxide and the coagulation liquor is water, preferably with a content of amine oxide not being able to dissolve cellulose, also referred to as a lyocell
20 process; the manufacture of such a solution is in principle known, e.g. from U.S. 6,358,461, U.S. 7,067,444, U.S. 8,012,565, U.S. 8,191,214, U.S. 8,263,506 and U.S. 8,318,318; preferably the amine oxide is NMMO.

The present invention describes a cellulosic nonwoven web produced via a meltblown or spunbond-type process. The filaments produced are subjected
25 to touching and/or compaction and/or intermingling at various points in the process, particularly before and during initial web formation. Contact between filaments where a high proportion of solvent is still present and the filaments are still swollen with said solvent causes merged filament bonding to occur. The amount of solvent present as well as temperature and contact pressure
30 (for example resulting from extension air) controls the amount of this bonding.

In particular the amount of filament intermingling and hydrogen bonding can be limited by the degree of merged filament bonding. This is the result of a

decrease in filament surface area and a decrease in the degree of flexibility of the filaments. For instance, as the degree of merged filament bonding increase, the amount of overall surface area is decreased, and the ability of cellulose to form hydrogen bonds is directly dependent on the amount of hydroxyl groups present on the cellulosic surface. Additionally, filament intermingling happens as the filaments contact the forming belt. The filaments are traveling at a faster rate of speed than the forming belt. Therefore, as the filament contacts the belt, it will buckle and sway side to side, and back and forth, just above the forming belt. During this buckling and swaying, the filaments will intermingle with neighboring filaments. If the filaments touch and merge prior to the forming belt, this limits the number of neighboring filaments by which it can intermingle with. Additionally, filaments that merge prior to contacting the forming belt will not have the same degree of flexibility as a single filament and this will limit the total area over which the filament will buckle and sway.

Surprisingly, it has been found that high levels of control of filament merging can be achieved by modifying key process variables. In addition, physical intermingling of at least partially coagulated cellulose filaments can occur after initial contact with non-solvent, particularly at initial filament laydown to form the web. It arises from the potential of the essentially continuous filaments to move laterally during initial filament formation and initial laydown. Degree of physical intermingling is influenced by process conditions such as residual extension air velocity at the foraminous support (forming belt). It is completely different from the intermingling used in production of webs derived from cellulose staple fibers. For staple fibers, an additional process step such as calendaring is applied after the web has been formed. Filaments which still contain some residual solvent are weak, tender and prone to damage. Therefore, in combination with controlling degree and type of bonding at this stage, it is essential that process conditions are not of a type which could cause filament and web damage. Initial drying of the washed but never-dried nonwoven, together with optionally compacting, will cause additional hydrogen bonding between filaments to develop. Modifying temperature, compacting

pressure or moisture levels can control the degree of this hydrogen bonding. Such treatment has no effect on intermingling or the merged filament bonding.

In a preferred embodiment of the invention the nonwoven material is dried prior to subsequent bonding/treatment.

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In a preferred embodiment of the invention the percentage of each type of bonding is controlled using a process with up to two compaction steps, where one of these compaction steps is done after step d. of the inventive process where the spun filaments are still swollen with a solvent, and one of these compaction steps is done before or in step e. of the inventive process where all or most of the solvent has been removed and the web has been wet with water. As previously discussed, control of the coagulation of the spun solution is a factor in controlling the degree of merged filament bonding. This preferred embodiment concerns decreasing the coagulation rate to a state where additional compaction steps can be used after filament laydown to further increase the actual amount of merged filament bonding that is achievable. It might be helpful to view the maximum achievable filament bonding as the state where we have merged all filaments into an essentially film-like structure.

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The present invention describes a process and product where merged filament bonding, physical intermingling and hydrogen bonding can be controlled independently. However, the degree of merged filament bonding can limit the degree of physical intermingling and hydrogen bonding that can occur. In addition, for the production of multi-layer web products, process conditions can be adjusted to optimise these bonding mechanisms between layers. This can include modifying ease of delamination of layers, if required.

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In addition to merged filament, intermingling and hydrogen bonding being independently set as described above, additional bonding/treatment steps may optionally be added. These bonding/treatment steps may occur while the web is still wet with water, or dried (either fully or partially). These bonding/treatment steps may add additional bonding and/or other web property modification. These other bonding/treatment steps include

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hydroentangling or spunlacing, needling or needlepunching, adhesive or chemically bonding. As will be familiar to those skilled in the art, various post-treatments to the web may also be applied to achieve specific product performance. By contrast, when post-treatments are not required, it is possible to apply finishes and other chemical treatments directly to the web of this invention during production which will not then be removed, as occurs with, for example, a post-treatment hydroentanglement step.

Varying the degree of merged filament bonding provides unique property characteristics for nonwoven cellulose webs with regards to softness, stiffness, dimensional stability and various other properties. Properties may also be modified by altering the degree of physical intermingling before and during initial web formation. It is also possible to influence hydrogen bonding, but the desired effect of this on web properties is minor. Additionally, properties can be adjusted further by including an additional bonding/treatment step such as hydroentangling, needlepunching, adhesive bonding and/or chemical bonding. Each type of bonding/treatment provides benefits to the nonwoven web. For example, hydroentangling can add some strength and soften the web as well as potentially modifying bulk density; needling is typically employed for higher basis weights and used to provide additional strength; adhesive and chemical bonding can add both strength and surface treatments, like abrasive material, tackifiers, or even surface lubricants.

The present invention allows independent control of the key web bonding features: merged filaments, intermingling at web formation, hydrogen bonding and optional additional downstream processing. Manipulation of merged filament bonding can be varied to predominantly dictate the properties of the nonwoven web.

In a further preferred embodiment of the invention the nonwoven material contains a second layer, consisting of a cellulosic nonwoven web, which is formed of essentially continuous filaments, pulp fiber or staple fiber, which is formed on top of the first cellulosic nonwoven web, and subsequently both layers are hydroentangled together. One useful advantage of two layers is

that one layer can be higher density, and have a more abrasive surface and clean a surface better ("scrubby layer") while the other is lower density, and more absorbent ("absorbent layer"). Another useful advantage of a dual-layer structure is that one layer can be designed to provide the tensile strength, while another layer can be designed to provide the absorbency, cleanability, or other desired attribute.

In a further preferred embodiment of the invention the nonwoven material contains a third layer, consisting of a cellulosic nonwoven, which is formed of essentially continuous filaments, pulp fiber or staple fiber, which is formed on top, and subsequently all three layers are hydroentangled together. Here, another useful advantage is to have one outer layer as high density for cleaning a surface ("scrubby layers"), another outer layer to have a high surface area for excellent lotion distribution with the center layer designed to have a high absorbent capacity.

In especially preferred embodiments of the invention one or more of the cellulosic nonwoven layers within the nonwoven material, if formed of essentially continuous filaments, are made according to a lyocell process. As known to an expert in the art, the lyocell process allows for use of a sustainable raw material (pulp) and provides a final filament with high purity (very low residual chemicals).

In particularly preferred embodiments of a three-layer material according to the invention either all three layers consist of continuous filaments, made according to a lyocell process, or the two outer layers consist of continuous filaments, made according to a lyocell process, and the middle layer consist of pulp fiber.

Nonwoven materials according to the invention may even consist of more than three layers, composed according to the same principles as outlined above; in particular of four, five or six layers.

In preferred embodiments of the invention, the cellulosic nonwoven web essentially formed of pulp fiber is formed by an airlaid or wetlaid process, is general commonly known.

5 In particularly preferred embodiments of a three-layer material according to the invention either all three layers consist of continuous filaments, made according to a lyocell process, or the two outer layers consist of continuous filaments, made according to a lyocell process, and the middle layer consist of pulp fiber.

10 In a further preferred embodiment of the invention, the nonwoven material contains a surface treatment chemical to improve the release of a preloaded antibacterial and skin cleansing lotion. This surface treatment chemical can be applied to any of the cellulosic web layers. In particular suitable are the following substances: Chitosan, polyamide-epichlorhydrine resin, polyamide
15 resin, melamine resin, polyaluminium chloride, polyaluminium chlorohydrate, polyaluminium sulfate, polyamine including a backbone comprising a cationic amine group. It can be applied either to a layer before combining it with the other layer or layers or it can be applied to the material once all cellulosic web layers are combined. These surface treatments would consist of any
20 chemistry that is designed to alter the polarity, or the ionic charge of the cellulosic filament and/or fiber surface and also designed to be compatible with the antibacterial and skin cleansing lotion. All antibacterial and skin cleansing wipes contain both active and inert ingredients in their lotions. The active ingredients are the disinfecting chemicals. The most commonly used
25 active ingredient chemicals today are quaternary ammonium compounds, alcohols, and hydrogen peroxide.

Still another object of the present invention is to provide a compostable healthcare wiper, containing (a) a nonwoven material according to claim 1 as a base sheet and (b) a skin cleansing and antibacterial solution. A healthcare
30 wiper according to the invention can be loaded with a skin cleansing and antibacterial solution, has low linting, has good dimensional stability (wet and dry), is absorbent, provides excellent skin cleaning, is soft and strong, is non-

irritating to skin, and is biodegradable, compostable and based on renewable resources.

In a preferred embodiment of the invention the nonwoven material of the compostable healthcare wiper is further bonded or treated by a hydroentanglement process. Undergoing this additional process enables a greater range of wipe functionality design. Such attributes as thickness, drape, softness, strength and aesthetic appearance can be tailored to meet specific wipe requirements.

The invention will now be illustrated by examples. These examples are not limiting the scope of the invention in any way. The invention includes also any other embodiments which are based on the same inventive concept.

Examples

All samples for testing were conditioned at $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ rel. humidity 50% $\pm 5\%$ for 24 hours.

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Example 1

A 50-gsm fabric of the invention was analyzed for water uptake versus a 50-gsm commercial product being comprised of SBPP (spunbond polypropylene) + wetlaid pulp and hydroentangled together.

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The water uptake was measured using an ATS (Absorbency Testing SystemATS-600). With that, the test sample (sample size round, diameter 5 cm) is supplied with water from the bottom and water taken up by the sample, without having any hydrostatic pressure, and is evaluated. The measurement for each sample is stopped when the amount of water taken up is below 0.005g/20sec

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Figure 1 shows the water uptake speed, average of 5 measurements.

Sample 1 is cellulosic, fabric of invention

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Sample 2 is the commercial sample (spunbond polypropylene, wetlaid pulp and hydroentangled).

In figure 1, it can be seen that the fabric of the invention has a much faster average liquid uptake and levels off at a higher average end value than the commercial sample. This is especially beneficial if water based body fluids are wiped.

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Example 2

The product of invention of example 1 was tested for its visible wet lint by an in house built up method.

- 10 For this evaluation, the product of invention was wetted with water 3 fold (equilibrium time 2 h). Then it was used in MD for a wiping test wiping over a collagen foil, which was checked to be free of visible particles prior to test. The wiping equipment of this test system is simulating a real wiping movement with 550 g wiping pressure. The product of invention showed within
15 a threefold determination no visible wet lint within this test.

Example 3

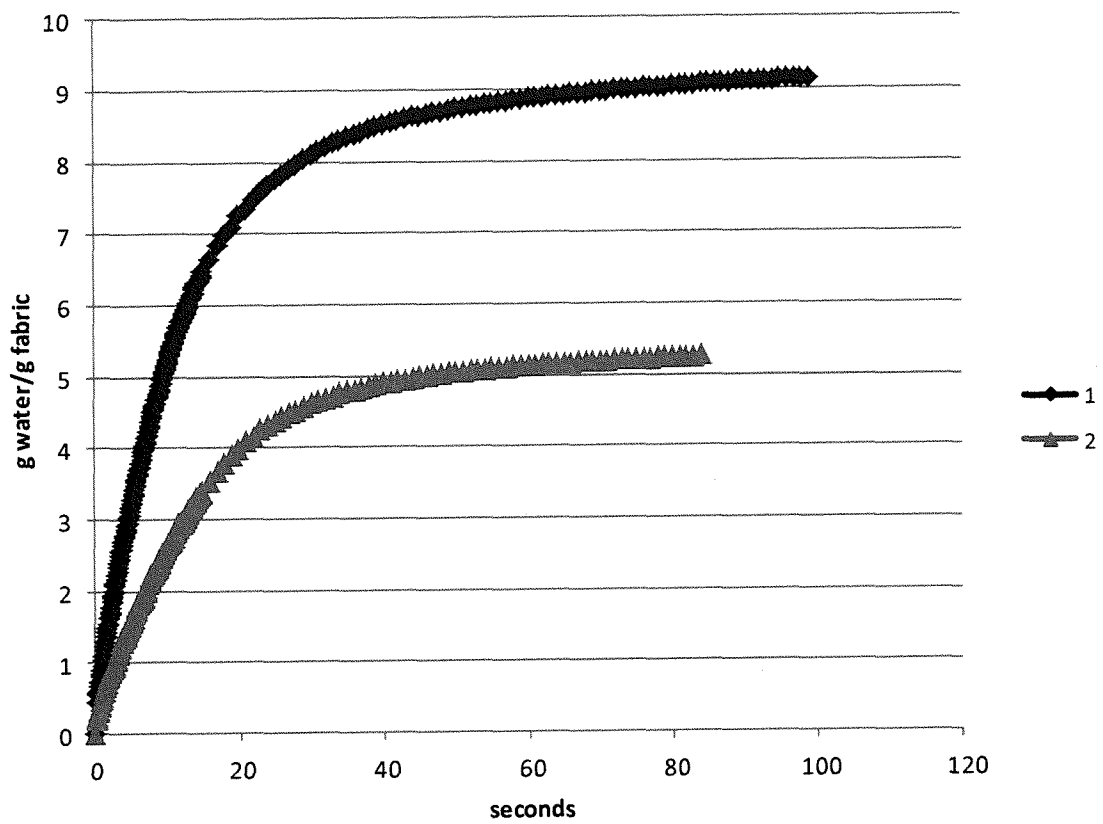
- A 40-gsm product of invention was compared in terms of stiffness to a commercial wipe product being SBPP (spunbond polypropylene) + wetlaid
20 pulp, hydroentangled, also 40 gsm. The product of invention was showing 77 % less overall stiffness than the commercial wipe. This means that the product of invention is especially soft and drapeable and therefore fits perfectly for wiping uneven body surfaces.

- 25 Stiffness was measured using a 'Handle-o-meter', according to standard method WSP 90.3, with ¼ inch slot width, stainless steel surface, 1000 g beam. Sample size was to 10 x 10 cm.

Claims

1. A nonwoven material suitable for use in a healthcare wiper or wipe, containing at least a first cellulosic nonwoven web, characterized in that the cellulosic nonwoven web is made from essentially pure cellulose
5 formed of essentially continuous filaments and multibonded by merged filaments, hydrogen bonding and physical intermingling of the filaments.
2. The nonwoven material of Claim 1 that is further bonded or treated by a hydroentanglement, needlepunch or chemical bonding process to modify the physical properties.
- 10 3. The nonwoven material of Claim 1 where the first cellulosic nonwoven web is made according to a lyocell process.
4. The nonwoven material of Claim 1 where a second cellulosic nonwoven web, which is essentially formed of continuous filaments, pulp fiber or staple fiber, is formed on top of the first cellulosic nonwoven web, and
15 subsequently both layers are hydroentangled together.
5. A nonwoven material according to claim 1, wherein the number of layers is at least two, preferably between two and ten, with a further preferred range from 2 to 6.
6. The nonwoven material of Claim 5, where the layers are formed of
20 essentially continuous filaments, pulp fiber or staple fiber, and subsequently all layers are bonded together bonded together using merged filament bonding, hydrogen bonding and filament intermingling.
7. The nonwoven material of Claim 5, where the layers are formed of essentially continuous filaments, pulp fiber or staple fiber, and
25 subsequently all layers are hydroentangled together.
8. The nonwoven material of Claim 4 or 6, where one or more of the cellulosic nonwoven layers within the nonwoven material, if formed of essentially continuous filaments, are made according to a lyocell process.
- 30 9. The nonwoven material of Claim 4 or 5, where the average filament diameters of the different cellulosic nonwoven layers within the nonwoven material, if formed of continuous filaments, are different.

10. The nonwoven material of any of Claims 1 to 7, where the cellulosic nonwoven web is essentially formed of pulp fiber according to an airlaid or wetlaid process.
- 5 11. The nonwoven material of any of Claims 1 to 6, containing a surface treatment chemical to modify antibacterial and/or skin cleansing chemical compatibility.
12. The nonwoven material of any of Claims 1 to 11, containing a three-layer material, wherein either all three layers consist of continuous filaments according to claim 1, made according to a lyocell process, or the two
10 outer layers consist of continuous filaments according to claim 1, made according to a lyocell process, and the middle layer consist of pulp fiber.
13. Use of the nonwoven material of claim 1 as a base sheet for the manufacture of a healthcare wiper, such wiper being loaded with a skin cleansing and/or antibacterial solution.
- 15 14. A compostable healthcare wiper, containing (a) a nonwoven material according to claim 1 as a base sheet and (b) a skin cleansing and/or antibacterial solution.
15. The compostable healthcare wiper of Claim 14 wherein the nonwoven material is further bonded or treated by a hydroentanglement process.

Figure 1

INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER INV. D04H1/4258 A45D44/00 A61Q19/00 A61K8/02 D04H3/013 D04H3/11 D01D5/098 B32B5/26 D04H1/4374 ADD.																				
According to International Patent Classification (IPC) or to both national classification and IPC																				
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) D04H A45D A61Q A61K D01D B32B D01F Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal, WPI Data																				
C. DOCUMENTS CONSIDERED TO BE RELEVANT <table border="1"> <thead> <tr> <th>Category*</th> <th>Citation of document, with indication, where appropriate, of the relevant passages</th> <th>Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td>X</td> <td>US 2005/056956 A1 (ZHAO RONGGUO [US] ET AL) 17 March 2005 (2005-03-17)</td> <td>1-3,8</td> </tr> <tr> <td>Y</td> <td>paragraph [0012] - paragraph [0016] paragraph [0027] - paragraph [0028]; claims 1, 12; figures 3-6; example 1</td> <td>4-7,9-15</td> </tr> <tr> <td>X</td> <td>WO 98/26122 A1 (COURTAULDS FIBRES HOLDINGS LTD [GB]; LAW STEPHEN JOHN [GB]; STREET HEA) 18 June 1998 (1998-06-18)</td> <td>1-4,8</td> </tr> <tr> <td>Y</td> <td>page 3, line 6 - line 11 page 7, line 13 - page 8, line 29; figure 1; table 3</td> <td>5-7,9-15</td> </tr> <tr> <td></td> <td style="text-align: center;">----- -/-</td> <td></td> </tr> </tbody> </table>			Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	X	US 2005/056956 A1 (ZHAO RONGGUO [US] ET AL) 17 March 2005 (2005-03-17)	1-3,8	Y	paragraph [0012] - paragraph [0016] paragraph [0027] - paragraph [0028]; claims 1, 12; figures 3-6; example 1	4-7,9-15	X	WO 98/26122 A1 (COURTAULDS FIBRES HOLDINGS LTD [GB]; LAW STEPHEN JOHN [GB]; STREET HEA) 18 June 1998 (1998-06-18)	1-4,8	Y	page 3, line 6 - line 11 page 7, line 13 - page 8, line 29; figure 1; table 3	5-7,9-15		----- -/-	
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X	US 2005/056956 A1 (ZHAO RONGGUO [US] ET AL) 17 March 2005 (2005-03-17)	1-3,8																		
Y	paragraph [0012] - paragraph [0016] paragraph [0027] - paragraph [0028]; claims 1, 12; figures 3-6; example 1	4-7,9-15																		
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Y	page 3, line 6 - line 11 page 7, line 13 - page 8, line 29; figure 1; table 3	5-7,9-15																		
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☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.																				
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Date of the actual completion of the international search		Date of mailing of the international search report																		
10 October 2017		19/10/2017																		
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer Demay, Stéphane																		

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