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(54) **NONWOVEN FABRIC, ARTICLES MADE THEREOF AND METHOD FOR PRODUCING THE NONWOVEN FABRIC**

VLIESTOFF, DARAUS HERGESTELLTE ARTIKEL UND VERFAHREN ZUR HERSTELLUNG DES VLIESTOFFS

TISSU NON TISSÉ, ARTICLES FABRIQUÉS À PARTIR DE CELUI-CI ET PROCÉDÉ DE PRODUCTION DE CE TISSU NON-TISSÉ

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Description

[0001] The invention refers to a nonwoven fabric comprising polylactide fibers and articles made thereof. The invention further refers to a method for producing the nonwoven fabric.

[0002] A nonwoven fabric is a textile-like material made from long fibers, entangled and bonded by chemical, mechanical, heat or solvent treatment etc. Nonwoven materials denote fabrics which are neither woven nor knitted like felt, for example. Nonwoven fabrics may be engineered for absorbency, liquid repellence, resilience, stretch, softness, strength, flame retardancy, washability, cushioning, thermal insulation, acoustic insulation, filtration, use as a bacterial barrier and sterility. Nonwoven materials are used in numerous applications like medical applications, filters, geotextiles, and other applications, such as diapers, feminine hygiene, and other absorbent materials, disposable clothing (foot coverings, coveralls), and cleanroom or cosmetic wipes, for example.

[0003] For manufacturing nonwovens, small fibers are put together in form of a sheet, forming a precursor web and bonded together. Bonding of the fibers may be performed either via an adhesive, thermally by applying binder (in the form of powder, paste, or polymer melt) and melting the binder onto and into the web by increasing temperature, or mechanically - by interlocking the fibers with serrated needles such that the inter-fiber friction results in a stronger fabric as given for felts, for example. An alternative mechanical method regarding needlepunching is spunlacing (hydroentanglement) employing jets of water on a formed web (usually air-laid or wet-laid, but sometimes spun-bond or melt-blown, etc.) to entangle fibers and thereby provide fabric integrity. The spunlace fabrics have characteristic softness, drape, conformability, and relatively high strength and sturdiness.

[0004] Both the fiber and precursor web properties have effects on the performance of the resulting nonwoven fabric. Fiber properties comprise fineness, profile, length and wettability. For the precursor web isotropic or anisotropic characteristics may be achieved by different forming processes as air laying systems for isotropic character and carding for products with high MD strength (machine direction) than CD strength (cross direction), for example. Furthermore, it is known, that there is a relationship between absorbency capacity and hydroentangling energy: the higher the hydroentangling energy, the lower the absorbency capacity and absorbency rate.

[0005] The use of polylactic acid or polylactide (PLA) fibers in nonwovens is known in the state of the art. PLA is a biodegradable thermoplastic aliphatic polyester which is produced by polymerization of lactic acid or lactide, the cyclic di-ester thereof. One production route is the ring-opening polymerization of lactide, the other route is condensation of lactic acid monomers. Lactic acid or lactide for polymerization derive from renewable resources, such as corn starch, tapioca roots, chips or starch,

or sugarcane. Processing of PLA into fibers is performed by conventional melt spinning processes.

[0006] Due to biodegradability of PLA, nonwovens containing PLA fibers are known in producing tea bags and the like as disclosed in WO 2012 027 539 A2, for example.

[0007] In EP 2 305 862 A1 a disposable absorbent article is described, containing natural and / or biodegradable compounds. The top sheet of the article may be a nonwoven fabric containing PLA and the back sheet of the article may be a waterproof film containing PLA, or a polyethylene film containing PLA, laminated with a nonwoven fabric containing PLA. The article may be used as superabsorbent materials, fastening systems, and barrier cuffs.

[0008] In view of this prior state of the art it is desirable to provide a nonwoven fabric containing PLA fibers with enhanced softness and enhanced performance in handling humidity, i. e. transferring humidity between the surface and the inside of the fabric and keeping humidity within the fabric.

[0009] This object is solved by the fabric with the features of claim 1 and by the multilayer fabric with the features of claim 7.

[0010] The further object of providing a nonwoven fabric article with enhanced softness of the fabric and enhanced performance in handling humidity is solved by the article with the features of claim 9.

[0011] Production of a nonwoven fabric or a multilayer nonwoven fabric with enhanced softness and enhanced performance in handling humidity is disclosed by the method having the features of claim 10 and 13, respectively.

[0012] Preferred embodiments of said fabrics, said article and the method are described in the dependent claims.

[0013] The invention refers to a nonwoven fabric containing PLA fibers and further fibers of at least a second fiber type, which is eucalyptus fiber.

[0014] The relatively high hydrophilicity of PLA fibers - when compared with thermoplastic polymer fibers - contributes to a good wettability of the fibers and humidity transmission and transport, which is enhanced by the cross-shaped profile of the PLA fibers with the cross lobes forming grooves in between. Water may be transported along these grooves. The eucalyptus fibers have humidity managing characteristics as well and provide enhanced humidity retention.

[0015] Preferably, the PLA fibers may have micro-engravings on their surface, wherein these micro-engravings extend along the fiber's length direction. The micro-engravings allow a quick migration of the liquid along the axis of the fiber and therefore enable removing the liquid away from the liquid receiving surface as fast as possible. Furthermore, distribution of the liquid on a largest possible surface is supported and/or transport of the liquid to the other side of the nonwoven enabled. So, the liquid receiving surface of the nonwoven fabric may be kept

comfortably dry in case of skin contact for hygiene purposes. Low amounts of liquid which may not be removed from said surface by the cross-shaped PLA fibers with the micro-engravings, but as they are spread across a wide surface, the liquid residues therefore may be evaporated by body heat, so that the nonwoven fabric is dry on the surface being in contact with skin.

[0016] In a nonwoven fabric according to the invention the ratio of the PLA fibers can be at least 20 % by weight and up to 50 % by weight with reference to the total weight of the nonwoven fabric. The ratio may depend on the article which is made from the nonwoven fabric. A PLA fiber portion of 20 to 30 % by weight with reference to the total weight of the nonwoven fabric may be preferred. These 20 to 30 % by weight PLA allow an optimum speed of the production equipment at the textile mill during production of the nonwoven fabric, with minimum heat generation caused by friction of the fibers. Furthermore, the post-life composting of the nonwoven fabric is also more effective, when the portion of PLA fiber is 20 to 30% by weight with reference to the total weight of the nonwoven fabric, as the respective portion of eucalyptus fibers will add humidity to the composting process.

[0017] In a further embodiment the nonwoven fabric comprises further fibers of a third fiber type, which may be alginate fiber. Due to their ion-exchange and gel-forming capability, alginate fibers made from sodium alginate are known for their use in treating wounds. Sodium alginate is a polymer derived from brown seaweeds. Furthermore, alginate fibers are capable of absorbing humidity and have anti-microbial properties.

[0018] Alternatively to alginate fibers, the third fiber type in an inventive nonwoven could be a chitosan containing fiber. Chitosan is a polyaminosaccharide which is produced commercially by deacetylation of chitin. Natural origins of chitin are the exoskeletons of crustaceans (such as crabs and shrimps) and cell walls of fungi. Due to structural similarity with cellulose, chitosan may be blended with cotton or viscose in forming fibers. Chitosan in fibers accounts for a strong antibacterial and fungicide effects combined with high humidity absorption. Like in eucalyptus fibers, antibacterial and antimicrobial performance is associated with the inhibition of growth of bacteria combined with an anti-smell function.

[0019] All fiber types used in the inventive nonwoven fabric exhibit good biocompatibility (antiallergic properties) and biodegradability.

[0020] Furthermore, it is not excluded that an inventive nonwoven fabric based on PLA fibers and eucalyptus fibers may comprise both, alginate and chitosan containing fibers.

[0021] The ratio of the alginate fibers and/or chitosan containing fibers in the nonwoven fabric may not exceed 20 % by weight with reference to the total weight of the nonwoven fabric.

[0022] The nonwoven fabric may have a surface weight of about 35 g/m² to 100 g/m².

[0023] The nonwoven fabric may be produced by spun-

lacing/hydroentanglement and may be manufactured with a substantially plain or corrugated surface, which may be perforated or not.

[0024] Another matter of the invention is a multilayer nonwoven fabric having at least two differing layers, which stick together without chemical bonding as provided by adhesives, for example. At least one first layer is an inventive nonwoven fabric comprising the PLA fibers and the further fibers of the at least second fiber type, which is eucalyptus fiber. At least one second layer, which is an inner or lower layer, comprises no PLA fibers but said further fibers of the at least second fiber type, which is eucalyptus fiber. The first layer or one of the first layers is a surface layer of the multilayer nonwoven fabric and may provide an application surface of the multilayer nonwoven fabric, i. e. the surface contacting skin, for example. With the cross-shaped PLA fibers in this surface layer, moisture can be removed from the surface into the core of the nonwoven fabric and retained by the eucalyptus fibers - or inversely moisture stored in the inner of the fabric by the eucalyptus fibers may be provided at the surface, depending on the type of destined application of the nonwoven fabric.

[0025] If applicable, the multilayer nonwoven fabric may have at each surface first layers, with at least one second layer in between. Both, the first and second layer may comprise further fibers of the third fiber type. Optionally, more than two differing layers are possible, too. An additional first layer which is not a surface layer could comprise PLA fibers and further fibers of the at least second fiber type in an alternate ratio or PLA fibers in combination with fibers of the third fiber type, for example.

[0026] Each layer may have a thickness of about 1 to 3 mm.

[0027] Another subject matter of the invention is an article made of an inventive nonwoven fabric or an inventive multilayer nonwoven fabric. The article may be a disposable garment, a cosmetic or hygiene product, or a diaper.

[0028] For producing an inventive nonwoven fabric containing PLA fibers a method according to the invention comprises the steps of providing the PLA fibers with a cross-shaped profile by extrusion and providing further fibers of at least a second fiber type, wherein the second fiber type is eucalyptus fiber. The next step is forming a precursor web with the PLA fibers and the further fibers followed by bonding the fibers together by spunlacing / hydroentangling of the precursor web for obtaining the nonwoven fabric. "Web" should not be understood as a product being made by weaving but rather as a textile panel.

[0029] During extrusion of the PLA-fibers micro-engravings may be generated on the PLA fibers' surface with the micro-engravings extending along the PLA fibers' length direction. The micro-engravings are generated by means of an adapted extrusion die with four branches for forming the cross-shaped profile and respective micro-protusions, leading to the micro-engravings. After

the melted PLA is extruded into the fiber with definite cross-shaped profile and micro-engravings, the PLA fiber may be cooled, drawn to reach the final denier, crimped (thermosetting) and finally cut in staple fibers.

[0030] The hydrophilicity of the fibers used in the invention supports hydroentanglement, since the hydrophilic fibers show an enhanced wettability and therefore engagement with the water jets resulting in a higher degree of entanglement. Prior to hydroentanglement in the formation of the precursor web, hydrophilicity facilitates uniform fiber dispersion in wet-laid fabrics.

[0031] A further step, if applicable, may be providing further fibers of a third fiber type which is alginate fiber and/or chitosan containing fiber in forming the precursor web.

[0032] A method for producing an inventive multilayer nonwoven fabric comprises the above steps of producing a nonwoven fabric containing PLA fibers, wherein the forming step of the precursor web comprises the forming of a multilayer structure with at least two layers, wherein at least a first layer, which is an inventive layer comprising PLA fiber and further fibers of the at least second fiber type, is arranged as a surface layer, and wherein a second layer, which is arranged as a lower or inner layer comprises no PLA fibers, but further fibers of the at least second fiber type.

[0033] Embodiments of the invention and some of the advantaged associated with these and further embodiments become apparent by the following detailed description with reference to the accompanying figures. Subjects or parts thereof, which essentially are the same or similar, may be denoted with the same reference numeral. Figures are just schematic illustrations of an embodiment of the invention and show:

Fig.1 a perspective view of a cross-shaped PLA fiber,
Fig.2 a cross-sectional side view of a multilayer nonwoven fabric.

[0034] The invention refers to nonwoven fabrics comprising PLA fibers, which have a cross-shaped profile as illustrated by fiber 1 in Fig. 9. The four lobes of the cruciform shape define four grooves respectively, which enhance humidity transport along the fiber, indicated by arrow L. Micro-engravings 1° on the surface of the fiber support migration of the liquid along the fiber length. The second fiber type which is comprised in an inventive nonwoven fabric is eucalyptus fiber. The eucalyptus fiber is an environmentally friendly fiber made from eucalyptus wood pulp. Production of eucalyptus fibers comprises sustainable agriculture with significant less water consumption than cotton. The eucalyptus fibers exhibit superior softness combined with odor resistance, i. e. in utilization no smell is developed over a long time. Further benefit is bacteriostaticity of the fabric, which is inherent to both, the PLA fibers and the eucalyptus fibers.

[0035] The ratio of the PLA fibers in the nonwoven fabric is at least 20 % by weight and up to 50 % by weight

with reference to the total weight of the nonwoven fabric. In one embodiment, a nonwoven fabric comprises the two fiber types only, so the remaining ratio of 80 to 50 % by weight consists of eucalyptus fibers.

[0036] In a further embodiment a nonwoven fabric may comprise not only PLA and eucalyptus fibers, but further fibers of a third fiber type. This third fiber type may be alginate fibers or chitosan containing fibers, which both are excellent in biodegradability, biocompatibility, and humidity absorption, and show bacteriostatic effect as well. An example for chitosan containing fibers is known under the name Crabyon, which is a composite fiber of chitosan and cellulose.

[0037] The ratio of the third fibers in the nonwoven fabric is not exceeding 20 % by weight with reference to the total weight of the nonwoven fabric. So with 20 to 50 % by weight PLA fibers, the remainder is at least 60 to 30 % by weight eucalyptus fibers.

[0038] The nonwoven fabric has a surface weight of about 35 g/m² to 100 g/m². The surface weight may be adjusted suitably depending on the intended use of the nonwoven fabric in an article like a disposable garment, cosmetic product (tissues or wipes) or hygiene product (sanitary towel), or a diaper, i. e. articles with contact to the human skin. However, it may not be excluded that an inventive nonwoven fabric may be used for other applications as for producing seed mats (with the seeds incorporated in the fabric, which will be degraded after being covered with soil) or cleaning wipes with enhanced biodegradability.

[0039] For producing an inventive nonwoven fabric PLA fibers with a cross-shaped profile are provided by extrusion. According a preferred embodiment, micro-engravings extending along the fibers' length may be generated on the fibers' surface during extrusion. Prior to forming a precursor web, the further fibers which are eucalyptus fibers (and optionally alginate fibers and/or chitosan containing fibers) are provided. "Web" should not be understood as a product being made by weaving but rather as a textile panel. The formation of the precursor web may be air-laid, wet-laid, spun-bond or melt-blown, for example.

[0040] The bonding of the fibers for obtaining the nonwoven fabric is carried out mechanically without adhesives or binders by spunlacing / hydroentangling of the precursor web.

[0041] Chosen process parameters in respect of web forming and fiber bonding depend among others on the target surface weight of the finished product. In processing, the surface may be perforated or left plain depending on the intended use. For filtering purposes the surface may be perforated whereas for commodity plain surfaces may be preferred.

[0042] In a preferred embodiment a nonwoven fabric according to the invention has a multilayer structure with at least two layers sticking together without chemical or mechanical bonding. An example of a multilayer nonwoven fabric with two layers is depicted in Fig. 2. It is noted

that this example shall not be understood to restrict the scope of the invention. A multilayer nonwoven fabric according to the invention may comprise three or more layers, in which every layer may be different from the others in respect of fiber composition, fiber lengths, fiber direction, or layer thickness, for example. On the other hand, it is absolutely possible that some layers match each other or may have corresponding compositions, but differ in another parameter like layer thickness. The order of layers may be symmetric in respect to a center layer of the fabric, or asymmetric.

[0043] For producing a multilayer nonwoven fabric the forming of the precursor web is carried out by laying the fibers in different compositions (and/or lengths, directions, thicknesses...), successively in layers. Depending on the intended order, a first layer is formed by laying PLA, fiber and eucalyptus fibers (and optionally further fibers). A second layer is formed on the first layer by laying eucalyptus fibers only, so that PLA fibers are only present in the first layer. Depending on the number of layers further laying processes follow up. After the precursor web is finished, fiber bonding takes place by spunlacing/hydroentanglement, so the layers of the multilayer nonwoven fabric are mechanically interlaced without any chemical or adhesives.

[0044] Fiber length etc. may not only differ in various layers, it is also possible that the length of differing fiber types differ within one layer. For example, in a nonwoven fabric (or in a first layer of a multilayer nonwoven fabric), the eucalyptus fibers could be short-cut (also referred to as chopped) and the PLA fibers could be long fibers. The short-cut fibers may be added to only one side of the nonwoven and may be randomly orientated distributed, thereby constructing a surface structure that creates an uneven surface as in Fig. 2, reducing the migration of fluids and improving the penetration of the fluids into the absorption core of the fabric. This could be referred to as "liquid stopper" effect, as the top layer of this example consist of small barriers.

[0045] The length of short-cut fibers may vary from 3 mm to 40 mm and may depend on the web forming process. Maximum fiber length for air laid process is about 12 mm and for wet laid processes about 40 mm. For dry laid processes fibers may be as long as 12 cm, whereas spunbond, meltblown and electrospun processes use continuous filaments.

[0046] In the non-limiting example of Fig. 2, the first layer 11 at the surface of the multilayer nonwoven fabric 10 comprises the PLA and eucalyptus fibers (and optionally further fibers of a third type) and the second layer 12, which is a lower layer here, comprises no PLA fibers but eucalyptus fibers (and optionally further fibers of a third type). The thickness of each layer is about 1 to 3 mm. The first layer 11 of the multilayer nonwoven fabric 10 is already a multilayer structure consisting of several sub-layers (for example five sub-layers, wherein each may have 7 g/m²). In each sub-layer, the orientation of long PLA fibers 1 is essentially parallel, since longer fib-

ers tend to lay down in the machine direction. The long fiber orientations of adjacent sub-layers are crossed, to create a criss-cross structure. The second layer 12 is a random fiber storage web. Both layers 11, 12 constitute the double layer mechanically interlaced carded web.

REFERENCES

[0047]

- 1 fiber
- 1' micro-engravings
- 10 multilayer nonwoven fabric
- 11 first layer
- 12 second layer
- L humidity transport

Claims

1. Nonwoven fabric comprising PLA fibers, **characterized in that** the PLA fibers have a cross-shaped profile and the nonwoven fabric comprises further fibers of at least a second fiber type, which is eucalyptus fiber.
2. Nonwoven fabric according to claim 1, wherein the PLA fibers have micro-engravings (1') on their surface with the micro-engravings (1') extending along the PLA fibers' length direction.
3. Nonwoven fabric according to claim 1 or 2, wherein the ratio of the PLA fibers in the nonwoven fabric is at least 20 % by weight and up to 50 % by weight with reference to the total weight of the nonwoven fabric.
4. Nonwoven fabric according to any one of claims 1 to 3, wherein the nonwoven fabric comprises further fibers of a third fiber type, which is alginate fiber and/or chitosan containing fiber.
5. Nonwoven fabric according to claim 4, wherein the ratio of the alginate fibers and/or chitosan containing fibers in the nonwoven fabric is not exceeding 20 % by weight with reference to the total weight of the nonwoven fabric.

6. Nonwoven fabric according to any one of claims 1 to 5, wherein the nonwoven fabric has a surface weight of about 35 g/m² to 100 g/m².

7. Multilayer nonwoven fabric having at least two differing layers of nonwoven fabrics, **characterized in that** at least one first layer is a nonwoven fabric according to any one of claims 1 to 6, wherein the at least one first layer is a surface layer of the multilayer nonwoven fabric, and at least one second layer, which is an inner or lower layer, comprises no PLA fibers but the further fibers of the at least second fiber type, which is eucalyptus fiber, wherein the at least two layers of the multilayer nonwoven fabric stick together without chemical bonding.

8. Multilayer nonwoven fabric according to claim 7, wherein each layer has a thickness of about 1 to 3 mm.

9. Nonwoven fabric article **characterized in that** the article is made of a nonwoven fabric according to any one of claims 1 to 6 or is made of a multilayer nonwoven fabric according to claim 7 or 8, wherein the article is a disposable garment, cosmetic or hygiene product, or a diaper.

10. Method for producing a nonwoven fabric containing PLA fibers according to any one of claims 1 to 6, comprising the steps of

- providing the PLA fibers with a cross-shaped profile by extrusion,
- providing further fibers of at least a second fiber type, wherein the second fiber type is eucalyptus fiber,
- forming a precursor web with the PLA fibers and the further fibers,
- bonding the fibers together by spunlacing / hydroentangling of the precursor web for obtaining the nonwoven fabric.

11. Method according to claim 10, wherein during the extrusion step of the PLA fibers with a cross-shaped profile micro-engravings (1') are generated on the PLA fibers' surface with the micro-engravings (1') extending along the PLA fibers' length direction.

12. Method according to claim 10 or 11, comprising the step

- providing further fibers of a third fiber type

which is alginate fiber and/or chitosan containing fiber in forming the precursor web.

13. Method for producing a multilayer nonwoven fabric according to claims 7 or 8, comprising the steps of

- producing a nonwoven fabric containing PLA fibers with a method according to any one of claims 10 to 12, wherein

in the forming step of the precursor web a multilayer structure is formed with at least two layers, wherein at least one first layer, which is arranged to result in a surface layer, comprises the PLA fiber and further fibers of the at least second fiber type, and at least one second layer, which is arranged as inner or lower layer, comprises no PLA fibers, but further fibers of the at least second fiber type.

Patentansprüche

1. Vliesstoff, der PLA-Fasern aufweist, **dadurch gekennzeichnet, dass** die PLA-Fasern ein kreuzförmiges Querschnittsprofil haben und der Vliesstoff ferner Fasern zumindest eines zweiten Fasertyps aufweist, der Eukalyptusfaser ist.

2. Vliesstoff nach Anspruch 1, wobei die PLA-Fasern Mikroeinkerbungen (1') an ihrer Oberfläche haben, wobei sich die Mikroeinkerbungen (1') entlang der Längsrichtung der PLA-Faser erstrecken.

3. Vliesstoff nach Anspruch 1 oder 2, wobei der Anteil der PLA-Fasern in dem Vliesstoff zumindest 20 Gewichtsprozent und bis zu 50 Gewichtsprozent in Bezug auf das Gesamtgewicht des Vliesstoffes beträgt.

4. Vliesstoff nach irgendeinem der Ansprüche 1 bis 3, wobei der Vliesstoff ferner Fasern eines dritten Fasertyps aufweist, der eine Alginatfaser und/oder eine chitosanhaltige Faser ist.

5. Vliesstoff nach Anspruch 4, wobei der Anteil der Alginatfasern und/oder chitosanhaltigen Fasern in dem Vliesstoff 20 Gewichtsprozent in Bezug auf das Gesamtgewicht des Vliesstoffes nicht überschreitet.

6. Vliesstoff nach irgendeinem der Ansprüche 1 bis 5, wobei

der Vliesstoff ein Oberflächengewicht von etwa 35 g/m² bis 100 g/m² aufweist.

7. Mehrlagiger Vliesstoff, der zumindest zwei unterschiedliche Lagen aus Vliesstoffen aufweist, **dadurch gekennzeichnet, dass** zumindest eine erste Lage ein Vliesstoff gemäß irgendeinem der Ansprüche 1 bis 6 ist, wobei die zumindest eine erste Lage eine Oberflächenlage des mehrlagigen Vliesstoffes ist, und zumindest eine zweite Lage, die eine innere oder untere Lage ist, keine PLA-Fasern, sondern die weiteren Fasern des zumindest zweiten Fasertyps aufweist, der Eukalyptusfaser ist, wobei die zumindest zwei Lagen des mehrlagigen Vliesstoffes ohne chemische Anbindung zusammen halten. 5 10 15
8. Mehrlagiger Vliesstoff nach Anspruch 7, wobei jede Lage eine Dicke von etwa 1 bis 3 mm hat. 20
9. Vliesstoff-Artikel, **dadurch gekennzeichnet, dass** der Artikel aus einem Vliesstoff gemäß irgendeinem der Ansprüche 1 bis 6 oder aus einem mehrlagigen Vliesstoff gemäß Anspruch 7 oder 8 gefertigt ist, wobei der Artikel ein Wegwerfbekleidungsstück, ein Kosmetik- oder Hygieneprodukt oder eine Windel ist. 25
10. Verfahren zur Herstellung eines PLA-faserhaltigen Vliesstoffes nach irgendeinem der Ansprüche 1 bis 6, aufweisend die Schritte 30
 - Bereitstellen der PLA-Fasern mit kreuzförmigen Querschnittsprofil durch Extrusion, 35
 - Bereitstellen weiterer Fasern zumindest eines zweiten Fasertyps, wobei der zweite Fasertyp Eukalyptusfaser ist,
 - Bilden einer Vorläuferstoffbahn mit den PLA-Fasern und den weiteren Fasern, 40
 - Binden der Fasern mittels Spunlacing/Hydroentangling der Vorläuferstoffbahn, um den Vliesstoff zu erhalten. 45
11. Verfahren nach Anspruch 10, wobei während des Extrusionsschrittes der PLA-Fasern mit kreuzförmigem Querschnittsprofil Mikroeinkerbungen (1') auf der Oberfläche der PLA-Fasern erzeugt werden, wobei sich die Mikroeinkerbungen (1') entlang der Längsrichtung der PLA-Fasern erstrecken. 50
12. Verfahren nach Anspruch 10 oder 11, aufweisend den Schritt 55
 - Bereitstellen weiterer Fasern eines dritten Fasertyps, der Alginatfaser und/oder chitosanhal-

tige Faser ist, zum Bilden der Vorläuferstoffbahn.

13. Verfahren zur Herstellung eines mehrlagigen Vliesstoffes nach Ansprüchen 7 oder 8, aufweisend die Schritte

- Herstellen eines Vliesstoffes, der PLA-Fasern enthält, mit einem Verfahren gemäß irgendeinem der Ansprüche 10 bis 12, wobei

in dem Schritt zum Bilden der Vorläuferstoffbahn eine Mehrlagenstruktur mit zumindest zwei Lagen gebildet wird, wobei zumindest eine erste Lage, die derart angeordnet wird, dass sie eine Oberflächenlage bildet, die PLA-Fasern und weitere Fasern des zumindest zweiten Fasertyps aufweist, und zumindest eine zweite Lage, die als innere oder untere Lage angeordnet wird, keine PLA-Fasern, sondern weitere Fasern des zumindest zweiten Fasertyps aufweist.

Revendications

1. Tissu non-tissé comprenant des fibres PLA, **caractérisé en ce que** les fibres PLA ont un profilé cruciforme et le tissu non-tissé comprend des fibres supplémentaires d'au moins un deuxième type de fibres, qui est de la fibre d'eucalyptus. 45
2. Tissu non-tissé selon la revendication 1, dans lequel les fibres PLA ont des micro-gravures (1') sur leur surface, avec les micro-gravures (1') s'étendant le long de la direction en longueur des fibres PLA. 50
3. Tissu non-tissé selon la revendication 1 ou 2, dans lequel le rapport des fibres PLA dans le tissu non-tissé est au moins de 20 % en poids et jusqu'à 50 % en poids en référence au poids total du tissu non-tissé. 55
4. Tissu non-tissé selon l'une quelconque des revendications 1 à 3, dans lequel le tissu non-tissé comprend des fibres supplémentaires d'un troisième type de fibres qui est de la fibre d'alginate et/ou de la fibre contenant du chitosane. 60
5. Tissu non-tissé selon la revendication 4, dans lequel le rapport des fibres d'alginate et/ou des fibres contenant du chitosane dans le tissu non-tissé ne dépasse pas 20 % en poids en référence au poids total du tissu non-tissé. 65

6. Tissu non-tissé selon l'une quelconque des revendications 1 à 5, dans lequel le tissu non-tissé présente un poids de surface d'environ 35 g/m² à 100 g/m². 5
7. Tissu non-tissé multicouches présentant au moins deux couches différentes de tissus non-tissés, **caractérisé en ce** qu'au moins une première couche est un tissu non-tissé selon l'une quelconque des revendications 1 à 6, dans lequel l'au moins une première couche est une couche de surface du tissu non-tissé multicouches, et au moins une seconde couche qui est une couche intérieure ou inférieure, ne comprend pas de fibres PLA mais les fibres supplémentaires de l'au moins un deuxième type de fibres, qui est de la fibre d'eucalyptus, dans lequel les au moins deux couches du tissu non-tissé multicouches collent ensemble sans liaison chimique. 10 15 20
8. Tissu non-tissé multicouches selon la revendication 7, dans lequel chaque couche présente une épaisseur d'environ 1 à 3 mm. 25
9. Article en tissu non-tissé, **caractérisé en ce** que l'article est fait d'un tissu non-tissé selon l'une quelconque des revendications 1 à 6 ou est fait d'un tissu non-tissé multicouches selon la revendication 7 ou 8, dans lequel l'article est un vêtement jetable, un produit de cosmétique ou d'hygiène, ou une couche-culotte. 30 35
10. Procédé de production d'un tissu non-tissé contenant des fibres PLA selon l'une quelconque des revendications 1 à 6, comprenant les étapes de 40
- doter les fibres PLA d'un profilé cruciforme par extrusion, 45
 - doter des fibres supplémentaires d'au moins un deuxième type de fibres, dans lequel le deuxième type de fibre est de la fibre d'eucalyptus, 50
 - former un noyau précurseur avec les fibres PLA et les fibres supplémentaires,
 - lier les fibres ensemble par hydroliage/liage par jet d'eau du noyau précurseur pour obtenir le tissu non-tissé. 55
11. Procédé selon la revendication 10, dans lequel durant l'étape d'extrusion des fibres PLA avec un profilé cruciforme, des micro-gravures (1') sont générées sur la surface des fibres PLA, avec les micro-gravures (1') s'étendant le long de la direction en longueur des fibres PLA.
12. Procédé selon la revendication 10 ou 11, comprenant l'étape
- de doter des fibres supplémentaire d'un troisième type de fibres qui est de la fibre d'alginate et/ou de la fibre contenant du chitosane dans la formation du noyau précurseur.
13. Procédé de production d'un tissu non-tissé multicouches selon les revendications 7 ou 8, comprenant les étapes de
- production d'un tissu non-tissé contenant des fibres PLA avec un procédé selon l'une quelconque des revendications 10 à 12, dans lequel
- dans l'étape de formation du noyau précurseur, une structure multicouches est formée avec au moins deux couches, dans lequel au moins une première couche, qui est agencée pour résulter en une couche de surface, comprend la fibre PLA et des fibres supplémentaires de l'au moins un second type de fibres, et au moins une seconde couche, qui est agencée en tant que couche intérieure ou inférieure, ne comprend pas de fibres PLA mais les fibres supplémentaires de l'au moins un deuxième type de fibres.

Fig. 1

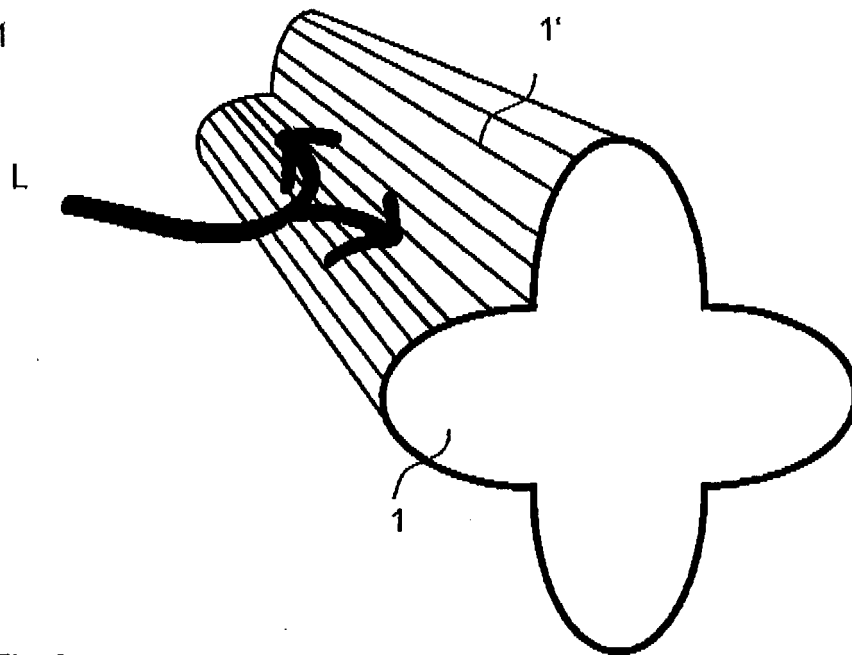
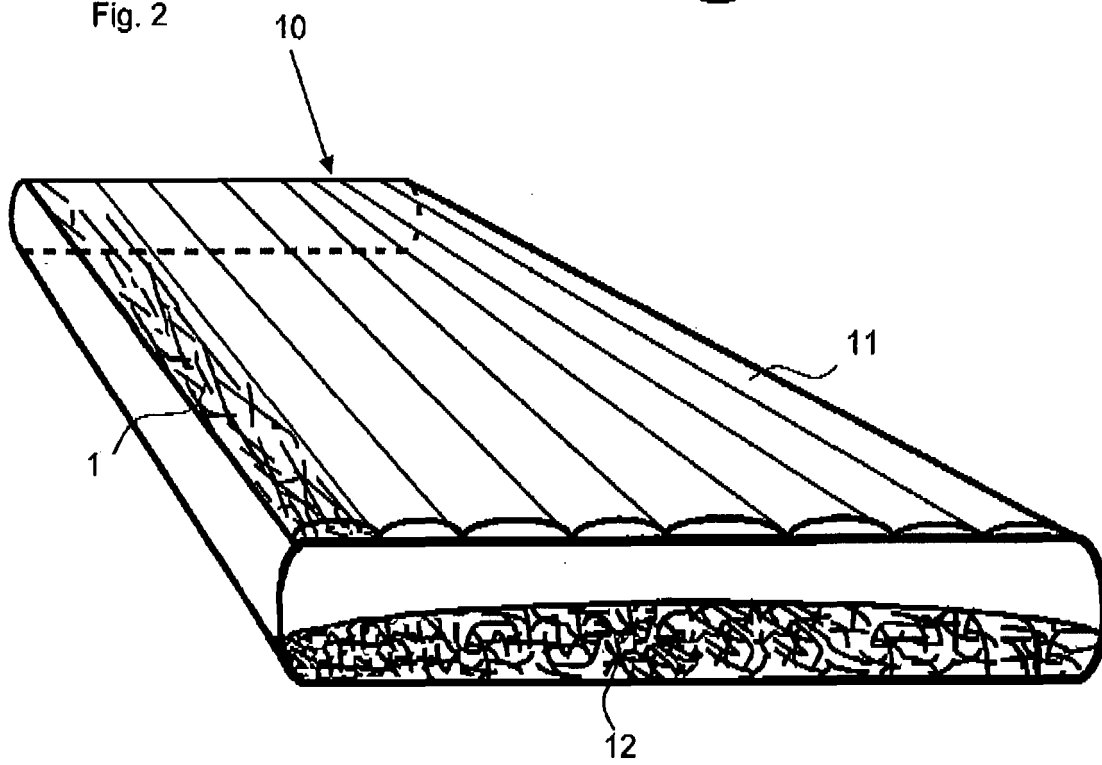


Fig. 2



REFERENCES CITED IN THE DESCRIPTION

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