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(54) Title: HYDROPHILIC POLYOLEFIN MATERIALS AND METHOD FOR PRODUCING THE SAME

(54) Bezeichnung: HYDROPHILE POLYOLEFINMATERIALIEN UND VERFAHREN ZU DEREN HERSTELLUNG

(57) **Abstract:** The invention relates to polyolefin materials, especially fibres and/or filaments and/or nonwovens and/or nonwoven products, produced from at least one polyolefin and a melt additive containing a fatty acid ester. According to the invention, a subsequent activation of the fatty acid ester in the melt additive is carried out on the surface of the polyolefin material by applying a formulation containing a silicon compound and a quaternary ammonium compound.

(57) **Zusammenfassung:** Die Erfindung bezieht sich auf Polyolefinmaterialien, insbesondere Fasern und/oder Filamente und/oder Vliese und/oder Vliesprodukte, hergestellt aus mindestens einem Polyolefin und einem Schmelzadditiv, enthaltend einen Fettsäureester, wobei eine nachträgliche Aktivierung des im Schmelzadditiv vorhandenen Fettsäureesters auf der Oberfläche des Polyolefinmaterials durch Aufbringen einer Formulierung, die eine Silikonverbindung und eine quartenäre Ammoniumverbindung enthält, erfolgt.

Hydrophilic Polyolefin Materials and Method for Producing the Same

The present invention pertains to hydrophilic polyolefin materials, especially fibres and/or filaments and/or nonwovens and/or nonwoven products, produced from a mixture of at least one polyolefin and at least one melt additive containing a fatty acid ester, in which the polyolefin materials show a subsequent activation of the fatty acid ester contained in the melt additive on the surface of the polyolefin material.

Polyolefins, especially polyethylene, polypropylene and their copolymers, are established materials for producing nonwoven fabrics.

Typical applications in which nonwoven fabrics made of polyolefins are used are hygiene products (baby and feminine hygiene, as well as incontinence products) and filter materials. If, for example, nonwovens are used as a top sheet in baby diapers, they must be permeable to body fluids such as urine. Due to the pronounced hydrophobic character of the polyolefins, this then requires hydrophilic functionality, which is preferably supplied as a subsequent topical treatment. This process uses aqueous baths containing amphiphilic, surface-active substances, preferably cationic (quaternary ammonium salts), anionic (sulfates, phosphates) or non-ionic (ethoxylates, esters, alcohols, silicones) components and/or formulations made of these substances.

A formulation for permanently hydrophilising polyolefin fibres, filaments and textiles manufactured from the same using quaternary ammonium compounds is known from US Patent 6,008,145.

According to US 963,929 and DE 19645380, non-ionic surfactants are used in conjunction with cationically modified polydimethylsiloxane.

US 6,028,016 describes a formulation and method for providing nonwoven fabrics with stable hydrophilic functionality, in which the formulation has a viscosity modifier for specific adjustment of the viscosity of surface-active substances not typically usable, by applying an alkylated polyglycol in conjunction with surface-active substances, such as mixtures of modified castor oil and sorbitan monooleate.

Another method for hydrophilic functionalisation of polyolefin or polyester fibres is described in DE 19851688, in which a mixture of polyolefin or polyester and a compound containing at least one substance from the class of ethoxylated sugar esters is disclosed. In US 6,211,101 stable hydrophilic fibres and nonwoven fabrics produced from these are described, which are preferably to be used in medical and hygiene applications and in which the agent for functionalizing the fibres consists of an amphoionic, surface-active betaine and a dicarboxylic acid ester produced from high molecular weight hydroxy fatty acid esters.

In practice, however, topical treatment of nonwoven fabrics has shown the following disadvantages:

1. In use, the surface-active substances are leached out by urine and other body fluids, causing a gradual loss of the hydrophilic characteristics.

2. The leached-out surface-active substances impair absorption and fluid distribution processes in hygiene products.

3. The distribution of surface-active substances on the nonwoven often occurs unevenly.

So-called processing aids are often used as a melt additive to

improve the processing characteristics of polyolefins. Here, for example, fatty acid derivatives with polar groups are often used as "external lubricants" (Ullmann's Encyclopedia of Industrial Chemistry, VCH Weinheim, 5th Ed., Vol. A20, p. 479)

However, the use of such melt additives for specifically hydrophilising of polyolefin nonwovens is less widespread. Due to phase incompatibility, migration of hydrophilic groups to the surface of the fibre takes place. The migration takes place during the spinning process in the polymer melt, but also in the semi-crystalline fibres after spinning.

US 5,439,734 describes the use of hydrophilic melt additives for nonwoven fabrics with stable wettability, consisting of a polyolefin and hydrophilic additives, which include fatty acids esterified with dihydroxylated polyethylene glycols.

Furthermore, wettable fibres and threads consisting of polymers blended with wetting agents are known from US 5,969,026; here the polymers selected are polyolefins, polyesters and polyamides, and the active substance essentially consists of a glyceride.

US 5,240,985, US 5,272,196, US 5,281,438, US 5,328,951 and US 5,464,691 disclose amphiphilic additives for the modification of polyolefins, in which the amphiphilic compounds consist of an A-B-A combination of a hydrophilic group in the centre, such as polyethylene glycol, connected to two flanking groups which are chosen from the classes of fatty acids or long-chain alcohols.

Furthermore, US 5,696,191 and US 5,641,822 make known surface-migrating, extrudable thermoplastic mixtures consisting of at least one polyolefin and one additive, in which the additive is a polysiloxane graft copolymer with polyalkene oxide side chains. Extrusion of the mixture produces wettable nonwoven fabrics, which continue to demonstrate the corresponding properties even after two years. Likewise known from US

20020019184 are polymers with improved hydrophilicity, which are produced by addition of an appropriate quantity of an additive consisting of fatty acids esterified with polyethylene glycol.

US 20010008965 describes multicomponent fibres, in which the first component consists of a hydrophobic polypropylene the second component of a blend of a hydrophobic polypropylene and a hydrophilic melt additive, in which the second component is positioned on the surface of the fibres.

WO9842767A1, WO9842776A1 and WO9842898A1 disclose a process for production of a polyolefin mixture with improved compatibility with adhesives and/or coatings. The mixture consists of a polyolefin, a migrating amphiphile and a transition metal.

The patents US 20020002242A1 and WO0158987A2 describe a possibility for increasing the surface energy of polymeric substrates by the use of new amphiphilic block copolymers, in which the block copolymers, consisting of linear hydrophobic polymers or oligomers and a static, highly branched polymer or oligomer, completely or partially functionalised with lipophilic end groups.

US 5,582,904 describes a method and a product deriving therefrom, in which hydrophobic polyolefin nonwoven materials are equipped with hydrophilic characteristics. For this, a necessary amount of an alkoxylated fatty amine is added to the polymer melt, optionally combined with up to 60 weight percent of a primary fatty acid amide.

Further known from WO 0071789 are polypropylene fibres and structures that can be manufactured from them, in which a fatty acid monoglyceride can be added to the polypropylene as a melt additive as well as further additives consisting hydrophilicity enhancers and antimicrobial substances.

Finally, in WO 0242530 fibres, filaments and nonwoven

materials are disclosed, which consist of a melt blend of a polyolefin and an additive, in which the additive is a chemical substance composed of an alkyl chain and a hydrophilic oligomer. The nonwoven materials produced show stable wettability preferably with respect to body fluids.

The nonwovens for hygiene applications, which were hydrophilised with melt additives, are especially distinguished by the high permanence of the hydrophilic groups on the fibre surface. However, in many cases the degree of hydrophilicity achieved through melt additives is too low to satisfy the requirements of the hygiene industry.

This is where the invention comes in.

It is the task of the invention to provide hydrophilic polyolefin materials, especially fibres and/or filaments and/or nonwovens and/or nonwoven products, which specifically and permanently exhibit the required level of hydrophilicity for the polyolefin materials and/or persistence of hydrophilic properties and spontaneous wettability of the polyolefin material surface (initial wetting).

With respect to the invention, this task is solved by Claims 1 to 13, by hydrophilic polyolefin materials, especially fibres and/or filaments and/or nonwovens and/or nonwoven products consisting of an mixture of at least one polyolefin and a melt additive containing a fatty acid ester with the general formula

$$R\text{-}CO\text{-}O\text{-}CH_2\text{-}CH_2\text{-}O\text{-}R'$$

in which R is a straight-chain or branched alkyl group with 23 to 35 carbon atoms, and in which

$$R' = H,\ -CH_3,\ -C_2H_5,\ -C_3H_7,\ -C_4H_9$$

in which the hydrophilic groups of the fatty acid ester show a subsequent activation of the fibre surface of the polyolefin materials by application of small quantities of a surface-

active substance.

The mixture, consisting of a polyolefin and a melt additive containing a fatty acid ester, is extruded using known methods and techniques to manufacture the polyolefin materials. Afterward, fibres and/or filaments are produced in a typical process and from these in turn nonwovens and/or nonwoven products are subsequently manufactured, after which, in accordance with the invention, a surface-active substance is applied, an aqueous preparation which effects a subsequent activation of the fatty acid ester on the surface of the polyolefin material.

Preferably the polyolefin is selected from a group consisting of homopolymers, copolymers, random copolymers and/or block copolymers of the ethylene and/or propylene. However, copolymers with higher alkenes, in particular also butylene, hexene and/or octene, are possible. The following polymers have proven especially suitable:

poly(ethylene) such as HDPE (high density polyethylene), LDPE (low density polyethylene), VLDPE (very low density polyethylene), LLDPE (linear low density polyethylene), MDPE (medium density polyethylene) , UHMPE (ultra high molecular polyethylene), XLPE (crosslinked polyethylene), HPPE (high pressure polyethylene), poly(propylene) such as isotactic polypropylene; syndiotactic polypropylene; polypropylene manufactured by metallocene-catalysis, impact modified polypropylene, random copolymers based on ethylene, propylene and higher 1-olefins, block copolymers based on ethylene, and propylene; EPM (poly[ethylene-co-propylene]); EPDM (poly[ethylene-co-propylene-co-diene]).

Further suited are graft copolymers as well as polymer blends, i.e. mixtures of polymers, which contain among other things the aforementioned polymers, such as polymer blends based on polyethylene and polypropylene.

Furthermore preferred are copolymers of ethylene and/or propylene with higher olefins and/or diolefins.

Particularly preferred as a polyolefin is a homopolymer of ethylene or propylene. In a preferred embodiment of the invention, the mixture has 0.5 to 10 weight percent, more preferably 0.5 to 3 weight percent, and even more preferably 1 to 2.5 weight percent of the melt additive. Furthermore, the mixture can have in particular 0.05 to 2 weight percent, preferably 0.1 to 0.5 weight percent of titanium dioxide. Preferred mixtures have 96 to 99 weight percent of homopolypropylene and/or homopolyethylene, 0 to 1 weight percent titanium dioxide and 1 to 3 weight percent melt additive. Mixtures of this type could be used without difficulty to produce a polyolefin material such as a spun nonwoven, doing so in fact in a temperature range of 190 to 310°C despite the high temperatures prevailing in the thermoplastic melt. To produce the thermoplastic melts, the inventive mixture can first be combined in the unmelted state and subsequently melted, but the melt additive and any further additives such as titanium dioxide can be added via side-feeds in an extruder for the polyolefin melt.

The invention furthermore involves hydrophilic polyolefin materials such as, for example, fibres and/or filaments and/or nonwovens and/or nonwoven products, which also contain bicomponent fibres. For example, a core-mantle structure can be created in the manufacture of fibres and/or filaments. According to one embodiment, only the mantle of the polyolefin material has a melt additive.

The core does not contain melt additive. Another embodiment consists of a homopolypropylene core, but a mantle of homopolyethylene, which contains the melt additive. Such structures make it possible to provide the melt additive only in those areas where it is necessary to develop its hydrophilic character. In addition to a core-mantle structure,

a fibre and/or filament cross-section can also exhibit other multicomponent distributions. These can be, for example, segment structures, half-moon structures, non-round geometries or other structures.

A preferred embodiment of the invention for subsequent activation on the polyolefin material fibre surface of the fatty acid ester contained in the melt additive is a formulation in the form of an aqueous preparation, which in accordance with the invention contains a cationically modified silicone compound and a quaternary ammonium compound, which is a quaternised ester of fatty acids and triethanolamine. In this process, the formulation in the form of an aqueous preparation is preferably physically applied on the fibre surface of the polyolefin material.

In an embodiment of the invention, the mixture from which the hydrophilic polyolefin materials is produced has 0.01 to 0.5 weight percent, preferably 0.05 to 0.15 weight percent of the formulation for activation on the fibre surface of the fatty acid ester contained in the melt additive.

The invention furthermore involves a fibre and/or a filament and/or a nonwoven and/or nonwoven products made from the inventive polyolefin material.

The inventive polyolefin materials, especially fibres and/or filaments and/or nonwovens and/or nonwoven products, produced from a mixture of at least one polyolefin and at least one melt additive containing a fatty acid ester, in which the polyolefin materials show a subsequent activation on the fibre surface of the fatty acid ester contained in the melt additive, can be used not only in a so-called "top sheet" but also as the so-called "acquisition layer". Due to their permanent hydrophilic properties, polyolefin materials of this type can be used not only in hygiene and/or medical articles, but also in cases where fast fluid uptake is important. This is the case with filtering, for example.

Thus a filter sheet can have the inventive hydrophilic polyolefin materials in the form of nonwovens, in which the liquid is transported to a further underlying layer. However, particles in the liquid can be retained by the nonwoven material. The fast fluid uptake prevents build-up of fluid in front of the nonwoven.

According to one embodiment, the inventive polyolefin material shows penetration times (repeated strike-through times) according to EDANA test method ERT 154.0-00 of less than 5 seconds.

Moreover, the polyolefin material, in the determination of the run-off weight according to EDANA test method ERT 152.0-99 (repeated run-off), preferably shows a run-off weight of less than 25 weight percent of the test fluid with reference to the quantity of fluid applied.

These and further advantageous embodiments and extensions of the present invention will be explained in further detail based on the examples below. The characteristics presented therein can, together with those described above, lead to additional extensions, which however are not elaborated here. Specifically shown are:

Fig. 1 a section from a hygiene product;

Fig. 2 a section from an oil absorption filter;

Fig. 3 a section from a fluid absorbing product.

Fig. 1 shows a section from a hygiene product 1. The hygiene product 1 has a top layer 2, a distribution layer 3 and a core 4. The top layer 2 is made of a nonwoven fabric produced from the inventive hydrophilic polyolefin materials. The hydrophilic nonwoven made of the inventive hydrophilic polyolefin materials absorbs liquid and passes it on to the distribution layer 3. From the distribution layer 3, the liquid can be further passed on to the core 4. The liquid is

stored in the core 4. In addition to the hydrophilic character of the top layer 2, the distribution layer 3 can also be produced from the inventive hydrophilic polyolefin materials and consequently be strongly hydrophilic. However, the distribution layer 3 can also be made of another thermoplastic material. For example, the top layer 2 can be a spunlaid nonwoven and the distribution layer 3 a melt-blown nonwoven. Preferably the distribution layer 3 is more hydrophilic than the top layer 2, preferably by at least 10%, even better by at least 20%. This achieves a drawing effect from the surface of the top layer 2 to the distribution layer 3.

Fig. 2 shows a section from an oil filter 5. The oil filter 5 has an absorption layer 6. On one hand, the absorption layer 6 takes up oil which comes in contact with it. On the other hand, the absorption layer 6 also serves as a filter for particles contained in the oil, which are not supposed to be transported further. The absorption layer 6 in this example is associated with a further optional filtering layer 7. The filtering layer 7 is preferably finer-pored than the absorption layer 6. The absorption layer 6 serves as a pre-filter for the filtering layer 7. The oil filter 5 can, for example, be intended for continuous use, but it can also be used only as needed. The absorption layer 6 is formed by a nonwoven produced from the inventive hydrophilic polyolefin materials. The underlying filtering layer 7, which can also have absorbent properties, can likewise be a nonwoven made of the inventive hydrophilic polyolefin materials. The absorption layer 6 can also be used alone as an oil-absorbent material. This can, for example, find application where oil leaking from machines or other equipment is to be collected.

Fig. 3 shows the use of a nonwoven made from the inventive hydrophilic polyolefin materials for fluid uptake, in which a hydrophilic nonwoven 8 is contained in a product 9, arranged here between two further layers. The hydrophilic nonwoven 8 is able to absorb moisture in the product 9 and store it in

itself. The product 9 can, for example, be used to re-release the moisture stored in the hydrophilic nonwoven 8 as needed. Release can occur, for example, by heating the product 9.

The invention is to be explained in further detail below using examples.

Various polyolefin mixtures were produced and were used to produce polyolefin materials by the Lurgi-Docan spunlaid nonwoven process in the form of a nonwoven with a basic weight of 30g/m². Specifically, the nonwovens were produced from the following materials:

Reference

A spunlaid nonwoven made of 100 weight percent homopolypropylene (Basell, Moplen HP 460R), which has a standard base stabilisation for the extrusion process was used as a reference.

Mixture 1

Mixture 1 had 98 weight percent of the reference homopolypropylene as well an additional 2 weight percent of the melt additive $C_{25}H_{51}$-CO-O-CH_2-CH_2-O-CH_3.

Mixture 2

Mixture 2 had 97.6 weight percent of the reference homopolypropylene, 2 weight percent of the melt additive as specified in Mixture 1 and an additional 0.4 weight percent of a titanium dioxide master batch (Clariant, Remfin RCLAP, grain size 2.2 to 2.6 microns).

The reference and the Mixtures 1 and 2 were processed under identical processing conditions to make a spunlaid nonwoven.

The inventive activation of the fatty acid ester on the fibre surface of the nonwovens produced from Mixture 2 was carried out using a hand-held spray gun to apply a Formulation B, an aqueous preparation containing among other things a

cationically modified silicone compound and a quaternary ammonium compound, which is a quaternised ester of fatty acids and triethanolamine, to the nonwoven, with subsequent drying at room temperature for a period of 10 hours. For comparison, a nonwoven made from Mixture 2 was treated in the same way using a Formulation A; the mixtures had the following quantities of Formulations A and B:

- sample 8: 0.15 weight percent Formulation A
- sample 9: 0.05 weight percent Formulation B
- sample 10: 0.15 weight percent Formulation B

As can be seen in Table 2, the mixtures of samples 2 to 5 made of pure polypropylene nonwoven as a reference likewise contained various quantities of Formulation A and Formulation B.

Moreover, Sample 11 was treated with pure water. This was to investigate the activating effect of pure moisture without the use of Formulation A and/or Formulation B.

The hydrophilicity of the samples and permanence of the hydrophilic properties was determined by repeated strike-through time measurements in accordance with EDANA test method ERT 154.0.00 and/or repeated run-off measurements according to EDANA test method ERT 152.0-99 (Tables 2 and 3).

In addition to that, the leaching (wash-out) behaviour of the spunlaid nonwovens produced from Mixtures 1 and 2 was determined as per US 5,945,175 (Table 1).

Wash-out was determined by the following test method:

Before immersing the spunlaid nonwoven in water, its surface tension is measured according to DIN 53914. Samples are die-cut from the nonwoven material (approx. 2.5 x 22 cm and 0.17 g) and immersed in 80 ml of water for 30 minutes. Then the surface tension of the water is measured again.

Table 1

Surface tension (mN/m)	Mixture 1	Mixture 2
Before the test	72.5	72.5
After the test	65.5	66.8

Polyolefins with subsequent hydrophilic functionalisation typically lower the surface tension after the wash-out test significantly below 60 mN/m. As the test results for Mixture 1 and Mixture 2 show, the surface tension remains nearly constant with the nonwovens produced according to the invention. From this it can be concluded that the melt additive does not wash out. Mixtures 1 and 2 as well as additional inventive mixtures enable nonwovens with stable hydrophilic characteristics to be manufactured. The melt additive in particular is added in such a quantity that water after the wash-out test shows less than a 15% change in its original surface tension. Preferably the change in the surface tension of the water is in a range below of 2%. An advantageous surface tension of the water after wash-out testing of the nonwoven is in a range between 60 mN/m and 70 mN/m.

The penetration time (repeated strike-through time) according to EDANA ERT 154.0.00 is given in Table 2.

The reference nonwoven showed typical hydrophobic properties for polyolefins. The synthetic urine (0.9% NaCl solution) used was not able to penetrate the nonwoven. Therefore in each case, the test was discontinued after more than 60 seconds. In contrast, each of the nonwovens produced with the melt additive according to Mixtures 1 and 2 showed penetration times below 4 seconds. As can be seen in Table 2, the times for the nonwoven made from Mixture 1 were somewhat below those of the nonwoven made from Mixture 2. While the nonwoven from Mixture 1 showed a slight reduction of the hydrophilic

properties of the nonwoven after the first run, the hydrophilic properties of the nonwoven from Mixture 2 increased in further runs.

As can be seen from the times in Table 2, the nonwoven functionalised with the melt additive is not only able to ensure fast penetration of the artificial urine applied in the first run. More importantly, this property persists with multiple wetting. This is especially important for the use of such a nonwoven as a top layer in a diaper, sanitary napkin or incontinence product. With these, the product generally must not only absorb and distribute a single gush of liquid, but very often is required to repeat such an uptake and distribution of liquid. In order to increase the wearing comfort for the user of such an article of hygiene, it is advantageous for the nonwoven to have a penetration time below 4 seconds even after the third test run.

Table 2: Repeated strike-through time

Sample	1	2	3	4	5	6	7	8	9	10	11
	Reference	Reference	Reference	Reference	Reference	Mixture 1	Mixture 2	Mixture 2	Mixture 2	Mixture 2	Mixture 2
Activation	-	0.15 weight percent FA	0.05 weight percent FB	0.15 weight percent FB	0.3 weight percent FB	-	-	0.15 weight percent	0.05 weight percent FB	0.15 weight percent FB	Water
1st gush in s	>60	1.8	>30	2.5	2.1	2.3	3.8	1.6	1.8	1.7	2.0
2nd gush in s	>60	>30	>30	14.8	7.3	2.9	3.3	3.0	2.6	2.4	2.9
3rd gush in s	>60	>30	>30	12.4	7.8	2.8	2.9	3.3	2.7	2.5	2.9

FA = Formulation A
FB = Formulation B

It is known that fatty acid esters can be used as dispersing

media for inorganic fillers such as pigments. EP0605831A1 describes the corresponding addition of fatty acid esters to mixtures consisting of ethylene/olefin copolymers and inorganic fillers. However, as can be seen from the comparison of properties for the nonwoven materials made from Mixture 1 and Mixture 2, the melt additive does not work as a dispersing medium, but rather evidently exclusively as a hydrophilising agent on the surface of the fibre. Even with the addition of titanium dioxide (Mixture 2), low values for the repeated strike-through times are measured.

As expected, sample 1 showed the hydrophobic properties typical for polyolefins, which are characterised by long penetration times.

The application of Formulation A to the surface of the polyolefin material (nonwoven sample 8) in accordance with the invention led to a short-term improvement in the degree of hydrophilicity (lower strike-through and run-off values) of the nonwoven formulated with melt additive. However, the run-off values worsened with an increasing number of repetitions.

Nevertheless, the low quantity of Formulation A (0.05 weight percent for sample 8), which showed no hydrophilising effect on pure PP nonwoven (sample 2), in combination with a hydrophilising melt additive (sample 8) effected a significant improvement in the permanence of hydrophilicity.

Surprisingly, it was found that with application of small quantities of Formulation B (samples 9 - 10) to the fibre surface of the polyolefin material, the degree of hydrophilicity improved (lower strike-through and run-off values) as did the permanence of hydrophilic properties compared to a polyolefin material (nonwoven sample 7) modified with only a melt additive.

Formulation B, which contains a cationically modified silicone and a quaternary ammonium compound and which was applied

subsequently in low amounts, apparently serves as an activator.

Whereas samples 3-5 showed a considerable reduction in hydrophilicity after the second gush in the repeated strike-through and run-off measurements, which can be attributed to wash-out of Formulation B, samples 9 and 10 show an improvement in the permanence of hydrophilicity.

By activation of a nonwoven modified with a melt additive using low quantities of Formulation B, preferably 0.05 to 0.15 weight percent, inventive nonwovens corresponding to samples 9 and 10 are obtained, which are distinguished by good, stable hydrophilicity. This properties profile cannot be achieved with Formulation B alone and without the use of a melt additive. An application quantity of 0.3 weight percent of Formulation B on a pure PP nonwoven corresponding to sample 5 is too low to give the material hydrophilic properties and permanence of hydrophilicity comparable to the samples 8 and 9. A comparison of hydrophilicity as well as the permanence of hydrophilic properties in sample 11 and sample 7 shows that the treatment with pure water only has no significant activating effects.

Nonwovens produced by subsequent activation of the hydrophilic melt additive show clear advantages through improved hydrophilicity compared to a non-activated nonwoven, especially with spontaneous wetting of the dry nonwoven.

2003292204 27 Apr 2007

Table 3: Repeated run-off

Sample	1	2	3	4	5	6	7	8	9	10	11
	Reference	Reference	Reference	Reference	Reference	Mixture 1	Mixture 2	Mixture 2	Mixture 2	Mixture 2	Mixture 2
Activation	-	0.15 weight percent FA	0.05 weight percent FB	0.15 weight percent FB	0.3 weight percent FB	-	-	0.15 weight percent	0.05 weight percent FB	0.15 weight percent FB	Water
Run-off 1st gush in weight percent	100	11	93	55	20	-	15	1	16	15	42
Run-off 2nd gush in weight percent	100	51	93	65	47	-	13	2	7	4	17
Run-off 3rd gush in weight percent	100	80		73	73	-	48	24	11	5	51
Run-off 4th gush in weight percent	-	-	-	-	-	-	-	47	12	3	62
Run-off 5th gush in weight percent	-	-	-	-	-	-	-	44	11	12	60

FA = Formulation A
FB = Formulation B

It is to be understood that, if any prior art publication is referred to herein, such reference does not constitute an admission that the publication forms a part of the common general knowledge in the art, in Australia or any other country.

2003292204 27 Apr 2007

Claims

1. Hydrophilic polyolefin materials, produced from at least one polylefin and at least one melt additive containing a fatty acid ester with the general formula

$$R\text{-}CO\text{-}O\text{-}CH_2\text{-}CH_2\text{-}O\text{-}R',$$

in which R is a straight-chain or branched alkyl group with 23 to 35 carbon atoms, and in which

$$R' = H, -CH_3, -C_2H_5, -C_3H_7, -C_4H_9$$

characterised in that the polyolefin materials show a subsequent activation of the fatty acid ester contained in the melt additive on the surface of the polyolefin material when a surface-active substance in the form of a formulation containing a silicone compound and a quaternary ammonium compound is applied.

2. Polyolefin materials according to Claim 1, characterised in that the silicone compound is cationically modified.

3. Polyolefin material according to Claim 1 or 2, characterised in that the quaternary ammonium compound is a quaternised ester of fatty acids and triethanolamine.

4. Polyolefin material according to any one of Claims 1 to 3, characterised in that the formulation for subsequent activation of the fatty acid ester used on a fibre surface is an aqueous preparation.

5. Polyolefin material according to any one of Claims 1 to 4, characterised in that the formulation for subsequent activation of the fatty acid ester used on a fibre surface is physically attached to the surface.

6. Polyolefin material according to any one of Claims 1 to 5, characterised in that it contains 0.01 to 0.5 weight percent or 0.05 to 0.15 weight percent, of the formulation for

2003292204 27 Apr 2007

activation of the fatty acid ester used on a fibre surface.

7. Polyolefin material according to any one of Claims 1 to 6, characterised in that the polyolefin material is fibre and/or filament and/or nonwoven and/or nonwoven product.

8. Fibres produced from a polyolefin material according to any one of the Claims 1 to 7.

9. Filament produced from a polyolefin material according to any one of Claims 1 to 7.

10. A nonwoven produced from a polyolefin material according to any one of the Claims 1 to 7.

11. Use of a polyolefin material according to any one of Claims 1 to 7 to produce fibres and/or filaments and/or nonwovens and/or nonwoven products.

12. A nonwoven according to Claim 10, characterised in that it has a penetration time (repeated strike-through time measurements) of less than 5 seconds according to the EDANA test method ERT 154.0.00.

13. A nonwoven according to Claim 10, characterised in that during the determination of a run-off weight according to EDANA test method ERT 152.0-99 (repeated run-off) it exhibits a run-off weight of less than 25 weight percent of the test fluid with reference to an applied quantity of fluid.

14. Nonwoven products containing a nonwoven according to Claim 12 or 13.

15. A process for producing hydrophilic polyolefin materials, produced from at least one polyolefin and at least one melt additive containing a fatty acid ester, characterised in that the polyolefin materials show a subsequent activation

2003292204 27 Apr 2007

of the fatty acid ester contained in the melt additive on the surface of the polyolefin material when a surface-active substance in the form of a formulation containing a silicone compound and a quaternary ammonium compound is applied.

16. Process according to Claim 15, characterised in that the polyolefin material is a fibre and/or filament and/or nonwoven and/or nonwoven product.

17. Hydrophilic polyolefin materials, fibres, filaments or nonwovens produced from them, uses involving them, nonwoven products containing them or processes for producing them, substantially as herein described with reference to the examples and/or accompanying drawings.

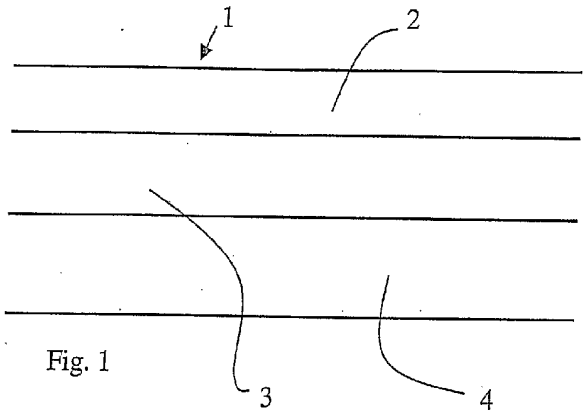

Fig. 1

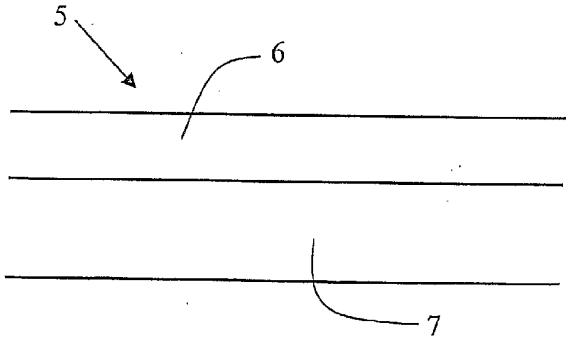

Fig. 2

2003292204 08 Jun 2005

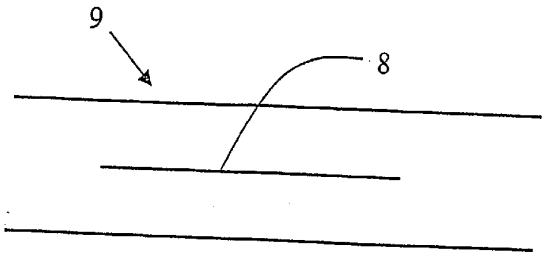

Fig. 3