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Fibre-reinforced support layer for turf

The invention relates to a support layer for turf, which has reinforcing fibres of plastic, whereby these reinforcing fibres are essentially non-biodegradable under the ambient conditions when used as a support layer in the soil. In addition, the invention also relates to a method for treating a support layer for turf. Such a support layer is known from WO2012159145A1.

Many popular sports, such as football, hockey or equestrian sports, are preferably played on turf. The intensive use of natural turf for such sports quickly leads to wear and tear of the turf. This wear can go so far that the turf can no longer be used for sporting activities. Longer maintenance and regeneration phases are then required for the turf, during which no sport can be played there. However, longer downtimes, caused by the wear and tear of the turf, are undesirable for operators of sports fields.

One approach to counteracting this problem is the use of artificial turf, which is made up of synthetic materials and therefore does not bond as quickly. However, even modern artificial turf does not behave in the same way as natural turf in most sports. Artificial turf is therefore unpopular with athletes in many cases.

Another alternative for improving the wear resistance of turf surfaces is the use of hybrid turf. Hybrid turf combines the advantages of a natural turf surface with the advantages of reinforcement by synthetic materials. With such hybrid turf, a synthetic fibre-reinforced support layer is first applied to the existing subsoil. The synthetic fibres in this support layer have the task of improving the shear strength of the layer through cross-linking. Mechanical loads during the performance of the sports are thus better absorbed and distributed than with a soil that is not reinforced with fibres. Natural turf is then laid on this support layer. The reinforcing fibres of the support layer can also run into the natural turf, which also provides the turf layer with additional stability. Such a hybrid turf or its support layer also has a finite service life and must be renewed or replaced after a few years.

When disposing of used hybrid turf, the fact that the synthetic fibres are inseparably mixed with the mineral and organic components of the turf and support layer creates a problem. This is why large quantities of material are removed every year during the renewal of hybrid turf surfaces, which in addition to natural material also contain a large proportion of plastics. Such plastic-containing material cannot be disseminated into the environment and must therefore be dumped or disposed of in a cumbersome and costly manner.

The object of this invention is therefore to simplify the disposal of used hybrid turf support layers.

The object of the invention is achieved by a support layer with the characteristics of claim 1. A support layer according to the invention contains reinforcing fibres made of a plastic which is essentially not biodegradable under the environmental conditions when used as a support layer in soil or otherwise decomposed under conditions of normal use of the hybrid turf (e.g. temperatures, moisture/water content, radiation, in particular UV radiation). This means that the reinforcing fibres do not change their properties during use in the support layer of a hybrid turf, or do so only to a very limited extent. This ensures that these reinforcing fibres reliably perform their task of mechanically supporting and strengthening the support layer over a period of several years, as their mechanical properties remain essentially constant. The reinforcing fibres of an inventive support layer have an activation threshold above which these fibres are essentially completely biodegradable and disappear from the support layer. This activation threshold, at which a degradability of the reinforcing fibres occurs, can be a result of various physical effects. For example, a specific temperature can constitute this activation threshold. However, a specific air humidity or concentration of water or other liquids in the vicinity of the reinforcing fibres can also constitute this activation threshold. In addition, other physical effects (such as irradiation with radiation of a specific wavelength, for example UV radiation) are also part of the invention as activation thresholds for the biodegradability of the reinforcing fibres of a support layer.

Activation initiates biological degradation, in particular decomposition of the molecules of the plastic and then, under certain circumstances, further biological degradation or other decomposition or transformation of the plastic. The activation threshold is usually described by a chemical or physical parameter.

Furthermore, it is possible for the activation threshold to be constituted by a combination of two or more physical and/or chemical effects. For example, the activation threshold may consist of a combination of a specific temperature with a specific water content in the vicinity of the reinforcing fibres. The exceeding of such a combined activation threshold, constituted by a temperature and a water content, first leads to an absorption of water into the reinforcing fibres. This absorption of water causes the molecules of the plastic of which the reinforcing fibres are made to split. The further decomposition of the cleavage products then takes place by other mechanisms. In this respect, further decomposition can take place through saprobionts, for example. These are organisms that feed on dead material and break it down, transform and crush it.

This decomposition can take place within the organisms, or through enzymes that the organisms release to the outside. Saprobionts are typical organisms in composting processes. Saprobionts in the form of thermophilic bacteria and fungi have proven to be particularly beneficial for the biological degradation of reinforcing fibres in accordance with the invention. Such thermophilic organisms are particularly active at elevated temperatures, e.g. between 45 and 80 °C. A complete biological degradation of the reinforcing fibres is not limited to a degradation by thermophilic organisms. Other microorganisms, such as those found or used during composting, are also suitable for this purpose. It is clear that a biological degradation, as described, is naturally also caused by the exceeding of an activation threshold, which is defined only by a temperature parameter or only by another physical or chemical parameter.

Ultimately, only organic and mineral material remains after biological degradation, which can be unhesitatingly applied or distributed in the environment. An inventive support layer thus offers the very advantageous combination of a high-quality stabilising function when used in hybrid sports turf together with a significantly simplified and improved disposal after use in hybrid turf.

Particularly advantageous is the selection or setting of an activation threshold for the reinforcing fibres, which is never reached if possible when used in the support layer of a hybrid turf in use. This ensures that no biological degradation of the reinforcing fibres takes place during use in hybrid turf. During the disposal of a used support layer, care is then taken to ensure that the activation threshold is deliberately and clearly exceeded, so that the desired biological degradation of the reinforcing fibres can then take place. After a specific period of time under conditions beyond the activation threshold, the support layer will no longer have any plastic content and can be disposed of or reused at will.

It is advantageously provided that the activation threshold is set at a temperature higher than 50 °C, 55 °C, 60 °C, 65 °C or 70 °C. According to the invention, the activation threshold, from which a biological degradation of the reinforcing fibres occurs, is constituted by a temperature higher than 50 °C. This activation threshold can then be as high as 55 °C, for example. There are suitable plastics, such as polylactides (PLA), which absorb water molecules to a considerable extent from this temperature, which in turn lead to the decomposition and thus the biological degradation of the plastics. In addition to an exceeding of the activation threshold constituted in this regard by a temperature, it should also be ensured that a sufficient amount of water is available to achieve good biological degradation of the reinforcing fibres. It is naturally possible to use different plastics as material for the reinforcing fibres, wherein the activation threshold can also be constituted by higher temperatures. One way to reach or exceed the activation threshold is to place a used, removed support layer in a composting facility. Temperatures higher than 60 °C are often used in industrial composting facilities, since germs are effectively killed from this temperature onwards. The conditions in such a composting facility are therefore also ideal for the degradation of the reinforcing fibres in an inventive support layer. The temperature prevailing in the composting facility is well beyond the activation threshold for biological degradation of the reinforcing fibres and thus ensures safe and rapid degradation of the fibres. In addition, an activation threshold can also be constituted by lower temperatures, for example in the range of 40 °C or 45 °C. The activation threshold depends on the material of which the reinforcing fibres are made and on the mechanisms or organisms to be used for degradation or decomposition. Advantageously, such activation thresholds are suitable for use in areas that cannot be reached during normal use as a support layer for a turf.

In addition, it is also advantageously provided that the reinforcing fibres are resistant against UV radiation or water when used as a support layer in the soil. In this embodiment, the reinforcing fibres are designed in such a way that they are resistant against the environmental conditions prevailing during their use in the support layer. This includes the fact that the reinforcing fibres are resistant against UV radiation, which is contained in sunlight. This is particularly advantageous when parts of the reinforcing fibres protrude from the soil. If the reinforcing fibres are completely surrounded or enclosed in the soil and thus normally no UV radiation hits the fibres, this property can be dispensed with and UV light can be used for activation, for example. This resistance to UV radiation can be achieved, for example, by using a UV-resistant plastic that can be activated by adding pigments or by coating less resistant plastics with a UV-absorbing coating. In this respect, it is also possible to colour the reinforcing fibres green in order to make them inconspicuous within the natural turf. Furthermore, the reinforcing fibres are designed in such a way that they are impervious to water. Since turf surfaces must be watered regularly to achieve good growth of natural turf, the reinforcing fibres are designed so that they do not absorb water in hybrid turf under normal conditions of use. This prevents unwanted decomposition or swelling with associated changes in the mechanical properties of the fibres.

It is also provided that the reinforcing fibres will consist of a material belonging to the group of polylactides (PLA) or polyhydroxyalkanoates, in particular polyhydroxybutyric acid (PHB) or polyvinyl alcohols (PVA). The reinforcing fibres of the support layer are formed from a material that is biodegradable beyond the activation threshold. For this reason, various biocompatible plastics can be used as materials for the reinforcing fibres. Materials from the group of polylactides (PLA) are particularly suitable. Polylactides are synthetic polymers that belong to the group of polyesters. Polylactides are composed of interconnected lactic acid molecules. Polylactides can be used to produce thermoplastics that can be produced in almost any shape using standard processing methods (injection moulding, extrusion, etc.). The reinforcing fibres can thus be produced in different lengths, diameters and shapes from PLA. The good mechanical properties, with a high tensile strength, a high elastic modulus and a low elongation at break, are particularly favourable for reinforcing fibres made of PLA. These properties, largely due to the large molecular mass, provide effective support and cross-linking of the support layer. In addition, PLA is water-repellent under the environmental conditions prevailing in hybrid turf. Thus, any influence of the reinforcing fibres on the water balance of the support layer is excluded. At the same time, there is no danger that the fibres will swell due to water absorption and change their mechanical properties, or decompose in the soil. Below the activation threshold, the properties of PLA reinforcing fibres remain stable over a long period of time and are virtually free of rot. Naturally, the reinforcing fibres can also consist of a suitable biocompatible material, for example the groups of polyhydroxyalkanoates, in particular polyhydroxybutyric acid (PHB) or the polyvinyl alcohols (PVA). In addition, other biodegradable plastics that are biodegradable under defined conditions are also part of the invention.

It is advantageously provided that the support layer contains quartz sand and/or natural sand and/or lava and/or topsoil and/or peat and/or natural cork in addition to the reinforcing fibres. The reinforcing fibres serve to strengthen and improve the shear strength of the support layer. The higher the shear strength, the higher the possible usage intensity of the hybrid turf and the lower the maintenance effort and regeneration time required.

In addition to the reinforcing fibres, the support layer contains various other materials that provide the other required properties of the support layer. For example, the support layer must be well permeable to water in order to avoid flooding of the hybrid turf in heavy rain. Drainage systems for draining off water are therefore often installed within the support layer. The support layer also has the task of ensuring that the hybrid turf remains level, even under regular load. In a possible embodiment of the invention, the support layer contains quartz sand and/or natural sand as the largest component. The amount of these sands is usually 60 - 80 percent by volume. Grain sizes between 0.02 mm and 4 mm have proven to be particularly favourable.

Lava can also be a component of the support layer. Lava is usually added to the support layer in an amount of 0 - 18 percent by volume (volume percent).

An interval is given for the amount of the lava, which is described by an upper and lower limit. In this respect, the following values are provided as upper limits, for example: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22 or 25 % by volume. For example, the following values apply as lower limits: 0.5, 1, 1.5, 2, 4, 6, 8, 10 or 12 % by volume. The disclosure of this application includes the quantity of all intervals, which consists of all possible, technically correct combinations of the above-mentioned upper and lower limits.

Here, too, lava grain sizes between 0.02 mm and 4 mm have proven to be particularly favourable.

An interval is indicated for the grain size of the lava, which is described by an upper and lower limit. In this respect, the following values are provided as upper limits, for example: 1, 1.5, 2, 2.5, 3, 3.5, 4, 5 or 6 mm. The following values apply as lower limits, for example: 0.02, 0.05, 0.1, 0.15, 0.2, 0.3, 0.4, 0.5, 0.7, 0.85, 1, 1.3, 1.5, 1.7, 2, 2.5, 3 or 4 mm. The disclosure of this application includes the quantity of all intervals, which consists of all possible, technically correct combinations of the above-mentioned upper and lower limits.

A further component of the support layer, in particular 5 - 20 % by volume, is the topsoil.

An interval is specified for the amount of the topsoil, which is described by an upper and lower limit. In this respect, the following values are provided as upper limits, for example: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 25, 28 or 30 % by volume. The following values apply as lower limits, for example: 0.5, 1, 1.5, 2, 4, 6, 8, 10 or 12 % by volume. The disclosure of this application includes the quantity of all intervals, which consists of all possible, technically correct combinations of the above-mentioned upper and lower limits.

Suitable topsoil for a support layer is defined in the DIN 18300 standard as soil class 1 soil as topsoil or matrix and, in addition to inorganic material, also contains humus and soil life. Flowing soil types are also suitable, as they are classified as soil group 2 in the DIN 18915 standard.

Another suitable component of the support layer is peat, ideally in an amount of 3 - 11 % by volume (volume %). In this respect, experience has shown that raised bog peat or fine white peat can be used well.

An interval is indicated for the amount of peat, which is described by an upper and lower limit. In this respect, the following values are provided as upper limits, for example: 2, 4, 6, 8, 10, 11, 12 or 13 % by volume. The following values apply as lower limits, for example: 0.5, 1, 1.5, 2, 4, 6 or 8 % by volume. The disclosure of this application includes the quantity of all intervals, which consists of all possible, technically correct combinations of the above-mentioned upper and lower limits.

Furthermore, a support layer of natural cork can be used, especially in a grain size between 0.5 mm and 20 mm, preferably between 3 mm and 7 mm.

An interval is specified for the grain size of the natural cork, which is described by an upper and lower limit. In this respect, the following values are provided as upper limits for example: 3, 5, 7, 10, 12, 15, 17 or 20 mm. The following values apply as lower limits, for example: 0.5, 1, 2, 3, 4, 5, 7, 10, 12 or 15 mm. The disclosure of this application includes the quantity of all intervals, which consists of all possible, technically correct combinations of the above-mentioned upper and lower limits.

Depending on the desired properties of the hybrid turf, the amount of natural cork can be in the range of 0 - 13 percent by volume (volume percent).

An interval is specified for the grain size of the natural cork, which is described by an upper and lower limit. In this respect, the following values are provided as upper limits, for example: 2, 4, 6, 8, 10, 12 or 13 % by volume. The following values apply as lower limits, for example: 0.5, 1, 1.5, 2, 4 or 6 % by volume. The disclosure of this application includes the quantity of all intervals, which consists of all possible, technically correct combinations of the above-mentioned upper and lower limits.

The components of a support layer listed here have proven to be particularly favourable in practice. Naturally, other and further components can also be contained in the support layer. In addition, grain sizes or volume fractions other than those mentioned or fractions of the components in a support layer are also part of the invention and are disclosed.

Furthermore, the thickness of the support layer should be between 30 mm and 300 mm, especially between 60 mm and 200 mm. The support layer can be of different thicknesses depending on the location and desired properties of the hybrid turf. In this respect, thicknesses between 60 mm and 200 mm have proven to be particularly favourable. Thicknesses between 30 mm and 300 mm are also suitable. In addition, however, thinner or thicker support layers are also covered by the invention. An interval is specified for the layer thickness, which is described by an upper and lower limit. In this respect, the following values are provided as upper limits for example: 150 mm, 200 mm, 250 mm and 300 mm. The following values apply as lower limits, for example: 30 mm, 45 mm, 75 mm, 60 mm and 90 mm. The disclosure of this application shall include the quantity of all intervals existing through all possible combinations of the above-mentioned upper and lower limits.

Furthermore, according to the invention, it is provided that the amount of reinforcing fibres in the support layer is between 0.1 and 4 % by weight. The amount of reinforcing fibres in the support layer is relevant for the shear strength of the support layer achieved. An amount of between 0.1 and 4 % by weight of the reinforcing fibres in the support layer has proved to be particularly favourable for shear strength.

An interval is given for the amount of reinforcement fibres, which is described by an upper and lower limit. In this respect, the following values are provided as upper limits for example: 2, 4, 6, 8 or 10 % by weight. The following values apply as lower limits, for example: 0.05, 0.1, 0.5, 1, 1.5, 2 and 4 % by weight. The disclosure of this application includes the quantity of all intervals, which consists of all possible, technically correct combinations of the above-mentioned upper and lower limits.

It is advantageously provided that the length of the reinforcing fibres is between 15 mm and 700 mm, in particular between 30 mm and 500 mm. The length of the reinforcing fibres also influences the shear strength of the support layer. When selecting a length for the reinforcing fibres, it is important how the fibres are introduced into the support layer. If the fibres are mixed with the support layer before the hybrid turf is applied, other fibre lengths can be optimal than if the reinforcing fibres are subsequently applied to a turf already laid or a support layer already laid. Particularly favourable results can be achieved with reinforcing fibres with a length between 30 mm and 500 mm. Good shear strength is also achieved in the range between 15 mm and 700 mm. In addition, however, larger or smaller lengths of reinforcing fibres are also part of the invention. An interval is specified for the length of the reinforcement fibres, which is described by an upper and lower limit. In this respect, the following values are provided as upper limits, for example: 90 mm, 100 mm, 150 mm, 250 mm, 300 mm, 350 mm, 400 mm, 450 mm, 500 mm, 550 mm, 600 mm, 650 mm and 700 mm. The following values apply as lower limits, for example: 15 mm, 30 mm, 45 mm, 60 mm, 75 mm and 100 mm. The disclosure of this application includes the quantity of all intervals, which consists of all possible, technically reasonable combinations of the above-mentioned upper and lower limits.

In a preferred embodiment of the proposal, it is provided that the thickness of the reinforcing fibres shall be between 0.05 mm and 2 mm, in particular between 0.1 mm and 1 mm. The thickness of the reinforcing fibres also has an influence on the mechanical strength of the support layer and thus of the hybrid turf. Particularly favourable results have been achieved with a thickness of the reinforcing fibres between 0.1 mm and 1 mm. However, very good results were also obtained for the thickness of the reinforcing fibres in the range between 0.05 mm and 2 mm. In addition, greater or smaller thicknesses of the reinforcing fibres are also disclosed with the invention. An interval is given for the thickness of the reinforcing fibres, which is described by an upper and lower limit. In this respect, the following values are provided as upper limits, for example: 1 mm, 1.5 mm, 2 mm, 2.5 mm and 3 mm. The following values apply as lower limits, for example: 0.05 mm, 0.1 mm, 0.2 mm, 0.4 mm and 0.6 mm. The disclosure of this application includes the quantity of all intervals, which consists of all possible, technically reasonable combinations of the aforementioned upper and lower limits.

According to the invention, it is provided that the reinforcing fibres within the support layer are distributed disorderly in different directions and at least partially interlocked between the individual reinforcing fibres. In this embodiment of the invention, the reinforcing fibres within the support layer are distributed disorderly in different directions. This means that there is no preferred or deliberate direction in which the fibres run. Between the individual randomly distributed fibres there is at least a partial interlocking of the individual reinforcing fibres. The fibres touch each other, hook into each other or are partly wrapped around each other. This results in an interaction between the individual fibres, which corresponds to a kind of cross-linking. This cross-linking or interlocking ensures the desired improvement of the shear strength of the support layer. Thanks to the improved shear strength, the hybrid turf can be used much more intensively without wearing out and requires less regeneration time. Such a disorderly presence of reinforcing fibres in the support layer can be brought about, for example, by mixing the reinforcing fibres with the other components of the support layer before the support layer is applied to the soil. The support layer mixed with reinforcing fibres is then applied to the soil of the sports facility and laid as the top layer of the natural turf. The disorderly reinforcing fibres present in the support layer have proved to be particularly favourable for stabilising the root zone of the natural turf. Naturally, it is also part of the invention that reinforcing fibres are subsequently introduced into an already laid turf structure in a disorderly direction.

A combination of different arrangements of the reinforcing fibres within the support layer is also possible. For example, reinforcing fibres present in the support layer in a random order with an orderly layer of fibres can be used in combination to produce special properties of the hybrid turf.

It is advantageously provided that the reinforcing fibres are present in the support layer in a net-like or web-like manner. In this embodiment, reinforcing fibres are present in an orderly form in the support layer in a net-like or web-like form. Such an orderly form ensures a particularly good improvement in the shear strength of the support layer along the direction of the reinforcing fibres. In this connection, it is possible to arrange different net-like or web-like arrangements on top of each other, wherein the direction of the fibre courses is slightly offset to each other. This in turn allows excellent shear strengths to be produced in different directions. Reinforcing fibres of this kind, which are net-like or web-like, can be introduced into the support layer, for example, by first distributing a portion of the support layer on the soil, then placing the net-like reinforcing fibres on top of them and then filling up further support layer material. The reinforcing fibres, for example, are designed as rolls or sheets and are rolled out on a base. This layer-by-layer application of the support layer can naturally also be carried out with several layers of reinforcing fibres.

The object of the invention is also achieved by a process for treating a support layer according to one of the described embodiments, comprising the method steps: Activation of the reinforcing fibres, in particular composting of the support layer. A used support layer of a hybrid turf is treated with the aid of the inventive method. In this respect, the activation threshold of the reinforcing fibres is exceeded, which then results in a biodegradability of the reinforcing fibres. The reinforcing fibres, which were previously stable when used in hybrid turf, are now completely decomposed after activation, i.e. after the exceeding of the activation threshold, so that they are no longer present in the support layer after a certain time. Composting of the used support layer has proven to be particularly favourable for activation or for the exceeding of the activation threshold. In the case of industrial composting in particular, environmental conditions are present which can lead to the exceeding of the activation threshold and thus to the biological degradation of the reinforcing fibres in the support layer.

It is advantageously provided that the activation, in particular composting, takes place at temperatures higher than 50 °C. In this embodiment of a method in accordance with the invention, the activation of the reinforcing fibres takes place at temperatures higher than 50 °C, 55 °C, 60 °C, 65 °C or 70 °C. These temperatures are particularly easy to achieve in industrial composting, where temperatures at or above this level are common. Due to this mobility of the activation temperatures in industrial composting facilities, possibilities for activation and thus for decomposition of the reinforcing fibres are easily and inexpensively accessible.

It is also provided that the support layer is removed from the soil before activation/composting. In this type of process, the support layer is first removed from the soil of the sports facility and then sent for activation or composting, where the reinforcing fibres are broken down. This has the advantage that the removed support layer can be immediately replaced by a new support layer for the construction of a new hybrid turf, thus avoiding any downtimes in the sports facilities.

It is advantageously provided that after activation/composting, the support layer is used as biomaterial/earth, in particular for the construction of a support layer according to one of the embodiments described above. In this embodiment of the method, the material of the used support layer is used for the construction of a new support layer after the reinforcing fibres have been removed. This has the advantage that the materials of the old support layer are already mixed in a favourable ratio and therefore little to no effort is required to mix a new support layer. New reinforcing fibres can then be added to the new support layer in the required quantity, shape and form, depending on the desired shear strength. In addition to using the material of the used support layer after the complete degradation of the reinforcing fibres for the new support layer, the treated material can also be used for other applications, for example in agriculture, horticulture or the like, since it is now free of plastics. Due to the complete freedom of the material from plastic residues, it can also be used in nature, for example to create biotopes or similar.

In this context, it is pointed out in particular that all features and characteristics described in relation to the device, but also procedures, are considered to be transferable analogously with regard to the formulation of the inventive method, applicable within the meaning of the invention and jointly disclosed. The same also applies in the opposite direction, which means that only features mentioned in relation to the procedure, i.e. structural features in accordance with the device, can also be taken into account and claimed within the scope of the device claims and are also part of the disclosure.

In the drawing, the invention is shown schematically, in particular in an embodiment. The drawings show the following:

Fig. 1 a three-dimensional, sectional view of a first embodiment of a support layer in a sports pitch;
Fig. 2 a three-dimensional, sectional view of a second embodiment of an inventive support layer in a sports pitch, and
Fig. 3 a three-dimensional, sectional view of a third version of a support layer in a sports pitch.

In the drawings, identical or corresponding elements are each marked with the same reference signs and are therefore not described again unless appropriate. The disclosures contained in the entire description can be applied accordingly to identical parts with the same references or component designations. The position data selected in the description, e.g. top, bottom, side, etc., are also related to the drawing directly described and depicted and are to be transferred to the new position in case of a position change. In addition, individual characteristics or combinations of characteristics from the different embodiments shown and described may represent independent, innovative or inventive solutions.

Fig. 1 shows a three-dimensional, sectional view of a first embodiment of a support layer in a sports pitch. The term sports pitch is understood here to mean the totality of all layers that form the subsoil for the practice of sports. A hybrid turf has proven to be particularly inexpensive as a sports pitch. A sports pitch formed by a hybrid turf contains artificial fibres in at least one of its layers and is otherwise naturally constructed. The basis of the sports pitch shown is a floor 4. A floor 4 is understood here as any subsoil that naturally predominates or is already present at the point where the sports pitch is to be laid. This floor 4 is levelled before the sports pitch is erected and, if necessary, pre-treated as required, e.g. compacted, so that it forms a good base for the subsequent support layer 1.

As shown in Fig. 1, support layer 1 is located on the soil 4. Above the support layer is the lawn 3. The turf 3 is usually formed by a natural lawn. However, it would also be possible to produce the sports pitch shown with a turf 3, wherein the turf 3 is formed by an artificial turf. The term turf 3 is therefore to be understood as the area in which the stalks of a natural or artificial turf protrude from support layer 1. The roots of a turf 3 formed by a natural turf are located, at least for the most part, within the support layer 1. The direct contact of the athletes with the sports pitch takes place in the area of turf 3. Essential for the function of the sports pitch shown and the support layer 1 are the reinforcing fibres

2, which are essentially vertical in the form of a support layer shown in Fig. 1. The ends of the reinforcing fibres 2 protrude from the support layer 1 upwards into or through the lawn. This protrusion of the reinforcing fibres 2 up to in or through the turf 3 provides additional consolidation and thus more intensive usability of the turf 3. Within support layer 1, reinforcing fibres 2 also provide reinforcement, resulting in improved shear strength of the entire sports pitch. In the design shown, the reinforcing fibres 2 were subsequently implanted from above into the support layer 1 after the application of support layer 1 and turf 3 on the soil 4. This can be done manually or with the aid of a device or machine. In the case shown, the reinforcing fibres were picked up by a tool approximately in the middle of their length and then pushed vertically through the lawn 3 to the support layer 1. Naturally, it is also possible to first push the reinforcing fibres 2 into the support layer and then apply the turf 3. In addition, the reinforcing fibres 2 can also be introduced into support layer 1 by other methods or with other aids in such a way that they run essentially in a vertical direction, as in the case shown.

Fig. 2 shows a three-dimensional, sectional view of a second version of an inventive support layer in a sports pitch. The structure of the sports pitch shown in Fig. 2 consists of the same layers as described in Fig. 1 above. The reinforcing fibres 2 are present disorderly in the form of support layer 1 shown in Fig. 2 and running in different directions. Due to the fact that the reinforcing fibres run disorderly here and along the fibre course of changing spatial directions, the reinforcing fibres 2 are cross-linked or interlocked with each other. It is precisely this interlocking between the individual reinforcing fibres 2 that ensures a strengthening of the support layer 1, which in turn leads to an increased shear strength of the support layer 1 and thus of the entire sports pitch. In addition, disorderly arranged reinforcing fibres 2 stabilize the root zone of the turf 3 and thus ensure increased wear resistance of the sports pitch. In the embodiment shown in Fig. 2, the ends of the reinforcing fibres 2 also jut out of the support layer 1 into or through the turf. This in turn results in increased wear resistance and better playability of turf 3, which is formed by both natural blades of grass and synthetic reinforcing fibres 2, often referred to as hybrid turf. For a more pleasing appearance, the reinforcing fibres 2 can be dyed green so that they can hardly be distinguished from the appearance of the natural blades of grass. The reinforcing fibres in the form of a support layer shown in Fig. 2 should be laid before the support layer 1 is laid. The reinforcing fibres 2 can be mixed evenly with the other materials of support layer 1 before the sports pitch is laid. This saves time when setting up the sports pitch at the sports facility. Naturally, it is also possible to apply or mix in reinforcing fibres 2 during the application of support layer 1 to soil

4. In addition, the reinforcing fibres 2 can also be inserted into the support layer 1 after the turf 3 has been applied. In addition, the embodiments of a support layer shown in Fig. 1 and Fig. 2 can also be combined with each other, so that both disorderly and orderly reinforcing fibres 2 are present in a support layer 1.

Fig. 3 shows a three-dimensional, sectional view of a third embodiment of a support layer in a sports pitch. In this embodiment of a support layer 1, shown in Fig. 3, the layer structure is also identical to Fig. 1 and Fig. 2. The reinforcing fibres 2 are available in the form shown in a kind of web or net. This means that the fibres are regularly arranged in a specific way. In the case shown, the fibres are essentially horizontal and either parallel to each other or at an angle of 90° to each other. This arrangement of the reinforcing fibres ensures particularly good consolidation of the support layer in the direction of the reinforcing fibres 2. As the reinforcing fibres 2 in the embodiment shown in Fig. 3 essentially run only in two horizontal directions twisted at 90° to each other, the strength of the support layer 1 is particularly high in these directions, but lower in other directions. Therefore, several webs or nets made of reinforcing fibres 2, which are twisted with respect to each other with respect to the fibre direction, can also be placed in the support layer 1. The support layer 1 is thus consolidated in further directions. The installation of a net or web of reinforcing fibres 2 can be carried out particularly favourably during the application of support layer 1 to soil 4. It is also possible to provide a net or web of reinforcing fibres 2 parallel to the net or web shown in Fig. 3, further such nets or webs of which a layer may also be provided at the boundary between support layer 1 and turf 3. A net or web made of reinforcing fibres 2 directly at the border of turf 3 reinforces the root zone of turf 3, which in turn increases the wear resistance of the sports pitch. The embodiment of a support layer 1 shown in Fig. 3 can also be combined with one or both embodiments shown in Fig. 1 and Fig. 2.

Patentkrav

1. Bærelag til græsplæne, som omfatter forstærkningsfibre (2) af plast, idet disse forstærkningsfibre (2) i alt væsentligt ikke er biologisk nedbrydelige under omgivelsesbetingelser når de anvendes som bærelag i jorden, **kendetegnet ved, at** i bærelaget (1) er forstærkningsfibrene (2) fordelt uordnet i forskellige retninger, og der er mindst en delvis sammenknytning af de enkelte forstærkningsfibre (2), idet mængden af forstærkningsfibrene (2) i bærelaget er mellem 0,1 og 4 vægtprocent, og disse forstærkningsfibre (2) har en aktiveringstærskel, over hvilken forstærkningsfibrene (2) i alt væsentligt er fuldstændigt biologisk nedbrydelige, idet aktiveringstærsklen er en temperatur over 50° C.

2. Bærelag ifølge krav 1, **kendetegnet ved, at** forstærkningsfibrene (2) ved anvendelse som bærelag i jord blandt andet er stabile over for UV-stråling eller vand.

3. Bærelag ifølge et hvilket som helst af de foregående krav, **kendetegnet ved, at** forstærkningsfibrene (2) består af et materiale fra gruppen af polylactider (PLA) eller gruppen af polyhydroxyalkanoater, især en polyhydroxysmørsyre (PHB), eller gruppen af polyvinylalkoholer (PVA).

4. Bærelag ifølge et hvilket som helst af de foregående krav, **kendetegnet ved, at** bærelaget udover forstærkningsfibrene (2) også omfatter kvartssand og/eller natursand og/eller lava og/eller overjord og/eller tørv og/eller naturkork.

5. Bærelag ifølge et hvilket som helst af de foregående krav, **kendetegnet ved, at** bærelagets lagtykkelse er mellem 30 mm og 300 mm, især mellem 60 mm og 200 mm.

6. Bærelag ifølge et hvilket som helst af de foregående krav, **kendetegnet ved, at** længden af forstærkningsfibrene (2) er mellem 15 mm og 700 mm, især mellem 30 mm og 500 mm.

7. Bærelag ifølge et hvilket som helst af de foregående krav, **kendetegnet ved, at** tykkelsen af forstærkningsfibrene (2) er mellem 0,05 mm og 2 mm, især mellem 0,1 og 1 mm.

8. Fremgangsmåde til bearbejdning af et bærelag ifølge et hvilket som helst af de foregående krav, omfattende fremgangsmådetrinnene

- fjernelse af bærelaget (1) fra jorden (4),
- aktivering af forstærkningsfibrene (2), især kompostering af bærelaget (1),

idet aktiveringen, især komposteringen udføres ved en temperature som er højere end 50°C.

9. Fremgangsmåde ifølge krav 8, **kendetegnet ved, at** aktiveringen/komposteringen af bærelaget (1) anvendes som biomateriale/jord, især til konstruktionen af et bærelag (1) ifølge et hvilket som helst af kravene 1 til 7.

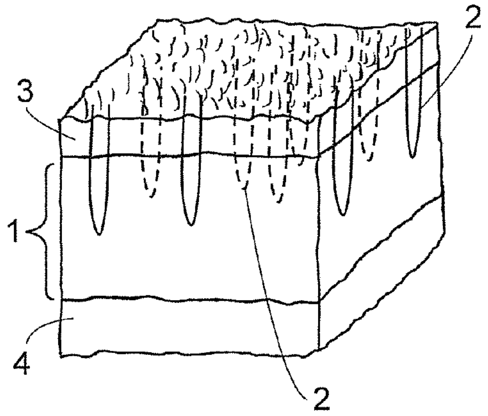

Fig. 1

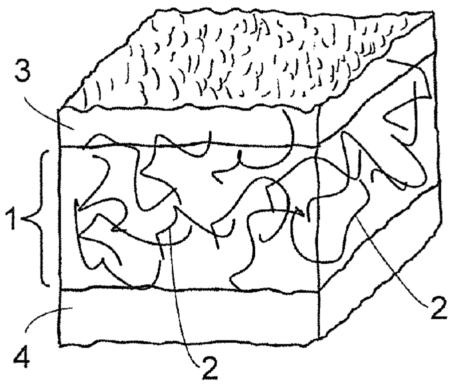

Fig. 2

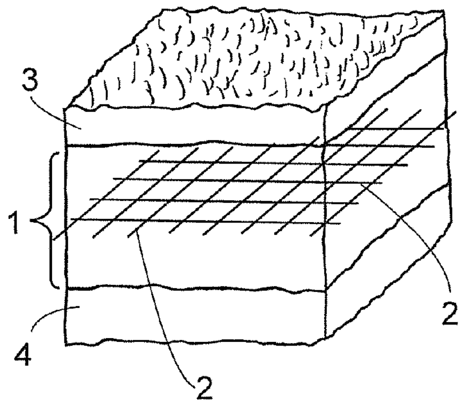

Fig. 3