

HORIZONTAL DRAINAGE MATERIAL WITH IMPROVED DRAINAGE EFFICIENCY

CROSS REFERENCE TO RELATED APPLICATION

The present application claims priority to Korean Patent Application No. 10-2023-0091807, filed July 14, 2023, the entire contents of which is incorporated herein for all purposes by this reference.

BACKGROUND OF THE INVENTION

Field of the Invention

The present disclosure relates to a horizontal drainage material with improved drainage efficiency, which enables soft ground treatment in a short time and has no risk of deterioration in drainage efficiency by quickly draining excess pore water as the material prevents clogging and does not cause a poor drainage problem due to loss of pore water.

Description of the Related Art

In general, in parks, playgrounds, golf courses, railway roadbeds and soft ground, for smooth drainage, circular bundle pipes and plate-type bundle pipes are buried in the ground after excavation is carried out to a predetermined depth from the ground surface so that rainwater or groundwater flowing in

from the ground surface or below the ground surface is drained.

In relation to such bundles of pipes, recently, Korean Patent No. 10-1303628 proposes round shape bundle drainage pipes with felt and felt packing, capable of preventing blockage and ensuring stable drainage since the entire pipe bundle is tightly wrapped with non-woven fabric to prevent soil or impurities from entering the pipes when buried in the ground.

However, bundle pipes such as those proposed in Korean Patent No. 10-1303628 usually contain PVC materials that cause environmental pollution problems, which makes subsequent removal of the pipes mandatory, generate environmental hormones during disposal, and have poor drainage performance.

In order to solve the above problems, a plastic board drain(PBD) method to discharge excess pore water through multiple vertical drains for discharging excess pore water contained in the soil of soft ground in the vertical direction and eco-friendly horizontal drains for discharging the excess pore water drained through the vertical drains has been proposed as Korean Patent Application Publication No. 10-2012-0126480.

However, in the case of Korean Patent Application Publication No. 10-2012-0126480, when foreign substances such as soil flows into the eco-friendly horizontal drains and a flow path of the eco-friendly horizontal drains is blocked, the pore water cannot be drained through the flow path, and thus

the efficiency of pore water drainage is still poor, which is problematic.

Documents of Related Art

(Patent Document 0001) Korean Patent No. 10-1303628

(Patent Document 0002) Korean Patent Application
Publication No. 10-2012-0126480

SUMMARY OF THE INVENTION

Accordingly, the present disclosure has been made keeping in mind the above problems occurring in the related art, and the present disclosure is intended to provide a horizontal drainage material with improved drainage efficiency, which enables soft ground treatment in a short time and has no risk of deterioration in drainage efficiency by quickly draining excess pore water as the material prevents clogging and does not cause a poor drainage problem due to loss of pore water.

In order to achieve the above objective, according to an embodiment of the present disclosure, there is provided a horizontal drainage material with improved drainage efficiency. The horizontal drainage material may include: a core for a horizontal drainage material including: a plurality of drainage groove parts provided at regular intervals from a first side to a second side; a plurality of horizontal connection plate parts,

each of which extends horizontally between upper ends of adjacent drainage groove parts among the plurality of drainage groove parts and connects the adjacent drainage groove parts to each other; and a support wall configured to protrude upward from a middle of a bottom surface of each of the drainage groove parts and have a height lower than a height of each of the horizontal connection plate parts, and a filter part including: a filter body in which the core for a horizontal drainage material is accommodated; and a wing member provided on one side of an upper portion of the filter body or on one side and the other side of the upper portion of the filter body.

At this time, the each of the drainage groove parts may be formed by: a first side wall and a second side wall extending vertically while being spaced apart from each other at a predetermined distance; and a bottom plate extending horizontally between a bottom of the first side wall and a bottom of the second side wall, and the support wall may protrude upward from a middle of the bottom plate of the each of the drainage groove parts.

In addition, a lower portion of the each of the drainage groove parts may be formed in an upwardly convex arch shape, and a lower portion of the each of the horizontal connection plate parts may be formed in a downwardly convex arch shape.

Furthermore, an auxiliary drainage groove may be provided in the horizontal connection plate parts to connect the

adjacent drainage groove parts to each other so that the adjacent drainage groove parts are communicated.

At this time, the auxiliary drainage groove may be sloped obliquely.

In addition, the auxiliary drainage groove formed in the each of the horizontal connection plate parts may be located in an oblique direction.

Furthermore, an auxiliary groove may be provided on an upper portion of the support wall, the auxiliary groove being located in an oblique direction along with the auxiliary drainage groove of the horizontal connection plate parts.

According to the present disclosure, by providing a wing member on the upper portion of a filter body of a filter part, the inflow of foreign substances such as soil into the interior of a core for a horizontal drainage material is blocked, so that the core for a horizontal drainage material can be easily prevented from being clogged. As a result, the problem of poor drainage due to loss of pore water does not occur and the problem of poor drainage is prevented in advance, thereby enabling rapid drainage of excess pore water and soft ground treatment in a short time.

Furthermore, according to the present disclosure, when any one of drainage groove parts located respectively in one direction and the other direction of a support wall at a height lower than a horizontal connection plate part is clogged due to

the inflow of foreign substances such as soil, the pore water overflows beyond the support wall and is drained through the other drainage groove part that is not clogged, and thus there is no risk of deteriorating the drainage efficiency of the drainage groove parts.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objectives, features, and other advantages of the present disclosure will be more clearly understood from the following detailed description when taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a perspective view schematically showing a horizontal drainage material with improved drainage efficiency according to an embodiment of the present disclosure;

FIG. 2 is an exploded perspective view schematically showing a state in which a vertical drainage material is separated from the horizontal drainage material of the present disclosure;

FIG. 3 is a partially enlarged front view schematically showing an overflow process of pore water;

FIG. 4 is a partially enlarged front view schematically showing a state in which the lower portion of a drainage groove part and a horizontal connection plate part are formed in an arch shape;

FIG. 5 is a perspective view schematically showing a state in which auxiliary drainage grooves are continuously formed in a diagonal direction in a plurality of horizontal connection plate parts;

FIG. 6 is a plan view schematically showing a state in which pore water is moved from one drainage groove part to another drainage groove part through the auxiliary drainage grooves;

FIG. 7 is a perspective view schematically showing a state in which the auxiliary drainage grooves are intermittently formed in a diagonal direction in the plurality of horizontal connection plate parts;

FIG. 8 is a perspective view schematically showing a state in which a plurality of support walls is formed at regular intervals in the drainage groove parts;

FIG. 9 is a perspective view schematically showing a state in which auxiliary grooves are formed in the support walls; and

FIGS. 10 and 11 are perspective views schematically showing a state in which a reinforcing wall is formed under the horizontal connection plate part.

DETAILED DESCRIPTION OF THE INVENTION

Hereinafter, preferred embodiments of the present disclosure will be described in detail with reference to the

accompanying drawings. The scope of the present disclosure is not limited to the following embodiments, and various modifications may be carried out by those skilled in the art within the scope of not departing from the technical gist of the present disclosure.

FIG. 1 is a perspective view schematically showing a horizontal drainage material with improved drainage efficiency according to an embodiment of the present disclosure; FIG. 2 is an exploded perspective view schematically showing a state in which a vertical drainage material is separated from the horizontal drainage material of the present disclosure; FIG. 3 is a partially enlarged front view schematically showing an overflow process of pore water.

As shown in FIGS. 1 to 3, a horizontal drainage material with improved drainage efficiency according to an embodiment of the present disclosure includes a core 10 for a horizontal drainage material and a filter part 20.

First, the core 10 for a horizontal drainage material is for discharging pore water contained in the soil of the soft ground in the horizontal direction.

The core 10 for a horizontal drainage material includes a plurality of drainage groove parts 110, a plurality of horizontal connection plate parts 120, and a support wall 130.

The drainage groove parts 110 are to be inserted in the ground of the soft ground to discharge the pore water of the

soft ground, and may be provided extending horizontally at a predetermined length in the front-rear direction of the soft ground.

In addition, the drainage groove parts 110 may be provided at regular intervals from one side of the soft ground to the other side.

As an example, each of the drainage groove parts 110 may be formed by a first side wall 111, a second side wall 112, and a bottom plate 113 as shown in FIG. 3.

The first side wall 111 and the second side wall 112 may be formed vertically extending at a predetermined length in the vertical direction of the soft ground while being spaced apart from each other at a predetermined distance.

The bottom plate 113 may be formed to extend horizontally between the bottom of the first side wall 111 and the bottom of the second side wall 112.

The drainage groove part 110 may be formed between the first side wall 111 and the second wall 112 so as to be located in the upward direction of the bottom plate 113, and the tops of the drainage groove part 110 may be opened.

The horizontal connection plate parts 120 are to improve the pore water discharge efficiency of the drainage groove parts 110 while maintaining the shape of the drainage groove parts 110 by connecting the drainage groove parts 110 to each other and by preventing the first side wall 111 and the second

side wall 112 from collapsing by earth pressure.

Each of the horizontal connection plate parts 120 is formed to extend horizontally between the upper end of the second side wall 112 of any one of the drainage groove parts 110 and the upper end of the first side wall 111 of another one of the drainage groove parts 110 adjacent to the any one of the drainage groove parts 110 so as to connect the adjacent drainage groove parts 110 to each other.

The support wall 130 prevents a portion of the filter part 20 located thereover from being indented into the drainage grooves 110 by earth pressure, thereby preventing the efficiency of pore water discharge by the drainage groove parts 110 from being lowered.

In addition, the support wall 130 prevents the drainage efficiency of the drainage groove parts 110 from deteriorating by allowing the pore water to overflow toward another adjacent drainage groove part 110 that is not clogged with foreign substances when any one of the drainage groove parts 110 is clogged due to the inflow of the foreign substances such as soil as shown in FIG. 3.

As an example, the support wall 130 may be formed extending in the front-rear direction along the drainage groove part 110 to protrude vertically at a predetermined length in the upward direction of the drainage groove part 110 from the middle portion of the upper part of the bottom plate 113 for

constituting the bottom surface of the drainage groove part 110.

For smooth overflow of pore water by means of the support wall 130, the vertical height of the support wall 130 may be lower than that of the horizontal connection plate part 120.

The lower portion of a filter body 210 located below the horizontal connection plate part 120 of the core 10 for a horizontal drainage material may protrude convexly toward the bottom of the horizontal connection plate part 120 by the earth pressure applied to the lower portion of the filter body 210 located below the horizontal connection plate part 120 of the core 10 for a horizontal drainage material (see the arrow in FIG. 3).

Due to this, the upper portion of the filter body 210 located over the drainage grooves 110 may maintain a horizontally stretched state while being located at a predetermined height from the upper portion of the support wall 130, thereby efficiently preventing the upper portion of the filter body 210 located over the drainage grooves 110 from descending onto the support wall 130 by earth pressure or the like.

Next, the filter part 20 is to prevent foreign substances such as soil from entering into the drainage groove parts 110 of the core 10 for a horizontal drainage material.

The filter part 20 may be made of various type of materials such as spunbonded nonwoven fabric, and the filter

part 20 that may be made of various type of materials such as spunbonded nonwoven fabric may be made of various materials such as polypropylene or polyester material.

The filter part 20 is largely composed of the filter body 210 and a wing member 220.

The core 10 for a horizontal drainage material is accommodated inside the filter body 210.

One side or the other side of the wing member 220 may be attached to the top of the filter body 20 in various ways such as fusion bonding using ultrasonic waves, hot melt, or the like, or adhesive bonding using a binder, or the like.

As an example, as shown in FIG. 1, two wing members 220 may be provided, each of which is provided on each side of the upper portion of the filter body 20, that is, on one side of the upper portion of the filter body 20 and on the other side of the upper portion of the filter body 20.

To this end, a second side of one of the wing members 220 may be bonded to one side of the upper portion of the filter body 20.

In addition, a first side of the other wing members 220 may be bonded to the other side of the upper portion of the filter body 20.

As shown in FIG. 2, an insertion hole 211 may be formed at one side of the upper portion of the filter body 20 located in a first direction of a joint portion P of the second side of

one of the wing members 220.

The insertion hole 211 may be formed in various shapes such as a slit cut to a predetermined length in the front-rear direction of the filter body 20.

A vertical drainage material 9 may be fastened to the insertion hole 211 while being inserted.

As another example, although not shown in the drawings, one wing member 220 may be provided on one side of the upper portion of the filter body 20.

To this end, a second side of the one wing member 220 may be bonded to the middle of the top of the filter body 210 or bonded to the top of the filter body 210 in an eccentric state.

In this way, by providing the wing member 220 on the top of the filter body 210 of the filter part 20, inflow of foreign substances such as soil into the core 10 for a horizontal drainage material may be blocked to prevent the core 10 for a horizontal drainage material from being clogged, and thus the problem of poor drainage due to loss of pore water does not occur and the problem of poor drainage is prevented in advance, thereby enabling rapid drainage of excess pore water and soft ground treatment in a short time.

FIG. 4 is a partially enlarged front view schematically showing a state in which the lower portion of a drainage groove part and a horizontal connection plate part are formed in an arch shape.

As shown in FIG. 4, it is preferable that the bottom plate 113 located in the lower portions of the drainage groove parts 110 is formed in an arch shape convex toward the top of the drainage groove parts 110.

In addition, as shown in FIG. 4, it is preferable that the horizontal connection plate parts 120 are formed in an arch shape concave downward.

Due to the arch-shaped drainage groove parts 110 and the arch-shaped horizontal connection plate parts 120, the upper portion of the filter body 210 located over the drainage groove parts 110 may be stretched horizontally and more tautly.

Accordingly, it is possible to more effectively prevent the upper portion of the filter body 210 located over the drainage groove parts 110 from descending onto the support wall 130 by earth pressure or the like.

FIG. 5 is a perspective view schematically showing a state in which auxiliary drainage grooves are continuously formed in a diagonal direction in a plurality of horizontal connection plate parts.

As shown in FIG. 5, an auxiliary drainage groove 121 for connecting the drainage groove parts 110 to each other so that the adjacent drainage groove parts 110 communicate with each other may be formed on top of the horizontal connection plate part 120.

A plurality of auxiliary drainage grooves 121 may be

formed at regular intervals in the front-rear direction of the horizontal connection plate parts 120 on at least one portion of the front, middle and rear portions of the horizontal connection plate parts 120.

FIG. 6 is a plan view schematically showing a state in which pore water is moved from one drainage groove part to another drainage groove part through the auxiliary drainage grooves.

As shown in FIG. 6, when the drainage groove part 110 in one direction of the horizontal connection plate part 120 is clogged by foreign substances A such as soil, pore water may pass through the auxiliary drainage groove 121 (see the arrow in FIG. 6) and be drained toward the drainage groove part 110 that is not clogged by the foreign substances A in the other direction of the horizontal connection plate part 120.

Next, although not shown in the drawings, the core 10 for a horizontal drainage material may be transported and stored in a roll-like state wound on the outer circumferential surface of a bobbin so as to be drawn out in the forward and backward directions of the bobbin.

During the process of winding the core 10 for a horizontal drainage material on the bobbin in a roll type, there is a high risk of damage to the core 10 for a horizontal drainage material as a folding phenomenon occurs in the portion of the horizontal connection plate part 120 in which the auxiliary

drainage groove 121 is formed.

To avoid such problems, it is preferable that the auxiliary drainage groove 121 be inclined in an oblique direction from one side of the horizontal connection plate part 120 to the other side, or inclined in an oblique direction from the other side of the horizontal connection plate part 210 to one side as shown in FIGS. 5 and 6.

In particular, in order to more easily prevent the occurrence of the folding phenomenon in the portions of the horizontal connection plate parts 120 in which the auxiliary drainage grooves 121 are formed, it is preferable that the auxiliary drainage grooves 121 are located in a diagonal direction (see the dotted line in FIG. 5).

FIG. 7 is a perspective view schematically showing a state in which the auxiliary drainage grooves are intermittently formed in a diagonal direction in the plurality of horizontal connection plate parts.

As an example, the auxiliary drainage groove 121 may be continuously formed in the diagonal direction on the horizontal connection plate parts 120 as shown in FIGS. 5 and 6, but as another example, the auxiliary drainage groove 121 may be formed intermittently in the diagonal direction on the horizontal connection plate parts 120 as shown in FIG. 7.

FIG. 8 is a perspective view schematically showing a state in which a plurality of support walls is formed at regular

intervals in the drainage groove parts.

As shown in FIG. 8, in order to greatly improve the bearing capacity of the horizontal connection plate parts 120 against earth pressure, it is preferable that the left-right width of the drainage groove part 110 from the first side wall 111 to the second side wall 112 is larger than the left-right width of the horizontal connection plate part 120 from one side to the other side thereof.

In addition, to further improve the pore water discharge efficiency of the drainage groove parts 110, two or more support walls 130 on the bottom surface of the drainage groove part 110 may be formed at regular intervals from one side to the other side of the drainage groove part 110.

By two or more support walls 130, each drainage groove part 110 may be partitioned into three or more.

FIG. 9 is a perspective view schematically showing a state in which auxiliary grooves are formed in the support walls.

As shown in FIG. 9, auxiliary grooves through which overflowed pore water can pass may be formed in the upper portions of the support walls 130 to further improve the pore water overflow guiding efficiency of the support walls 130.

One or more auxiliary grooves 131 may be formed in the front-rear direction of each support wall 130.

Even if the upper portion of the filter body 210 located over the drainage groove parts 110 descends onto the support

wall 130 by earth pressure and contacts the upper portion of the support wall 130, the pore water may easily pass over the support wall 130 through the auxiliary grooves 131.

In addition, it is more preferable that the auxiliary grooves 131 are located in an oblique direction together with the auxiliary drainage grooves 121 in order to prevent a folding phenomenon from occurring at the top of the support walls 130 in which the auxiliary groove 131 is formed during the process of winding the core 10 for a horizontal drainage material on the bobbin in a roll type.

Next, as shown in FIGS. 5 to 9, although the auxiliary drainage groove 121 may be formed on all of the upper portions of the horizontal connection plate parts 120, but preferably, when one horizontal connection plate part 120a is formed on one side of the core 10 for a horizontal drainage material and finished while one drainage groove part 110a is formed on the other side of the core 10 for a horizontal drainage material and finished, it is possible that the auxiliary drainage groove 121 is not formed on the upper portion of one horizontal connection plate part 120a formed on one side of the core 10 for a horizontal drainage material.

This is to prevent the pore water from draining toward the outside of one side of the core 10 for a horizontal drainage material through the auxiliary drainage groove 121 of the horizontal connection plate part 120a formed on one side of the

core 10 for a horizontal drainage material.

Alternatively, although not shown in the drawings, when one drainage groove part 110a is formed on one side of the core 10 for a horizontal drainage material and finished while one horizontal connection plate part 120a is formed on the other side of the core 10 for a horizontal drainage material and finished, it is possible that the auxiliary drainage groove 121 is not formed on the upper portion of one horizontal connection plate part 120a formed on the other side of the core 10 for a horizontal drainage material.

This also is to prevent the pore water from draining toward the outside of the other side of the core 10 for a horizontal drainage material through the auxiliary drainage groove 121 of the horizontal connection plate part 120a formed on the other side of the core 10 for a horizontal drainage material.

FIGS. 10 and 11 are perspective views schematically showing a state in which a reinforcing wall is formed under the horizontal connection plate part.

Next, as shown in FIGS. 10 and 11, it is preferable that a reinforcement wall 122 is provided in the lower middle portion of the horizontal connection plate part 120.

The reinforcement wall 122 is particularly to reinforce the upper portions of the support walls 130 in which the auxiliary grooves 131 are formed so that folding phenomenon

does not occur during the process of winding the core 10 for a horizontal drainage material on the bobbin in a roll type.

The reinforcement wall 122 may protrude vertically to a predetermined length in the lower direction of the horizontal connection plate part 120 and extend in a front-rear direction along the horizontal connection plate part 120 to a certain length.

By the reinforcement wall 122, the bearing capacity of the horizontal connection plate part 210 against earth pressure may also be greatly improved.

In addition, during the process of withdrawing the core 10 for a horizontal drainage material from the bobbin, as the reinforcement wall 122 bent along the curvature of the bobbin unfolds to its original state, the auxiliary drainage grooves 121 of the horizontal connection plate part 120 may be restored to their original state, the shape retention efficiency of the auxiliary drainage groove 121 may also be greatly improved.

In order to further improve the folding phenomenon prevention function by means of the reinforcement wall 122 and the shape maintenance efficiency function of the auxiliary drainage groove 121, it is preferable that the vertical length of the reinforcement wall 122 be larger than that of the auxiliary drainage groove 121.

WHAT IS CLAIMED IS:

1. A horizontal drainage material with improved drainage efficiency, the horizontal drainage material comprising:

a core for a horizontal drainage material comprising:

a plurality of drainage groove parts provided at regular intervals from a first side to a second side;

a plurality of horizontal connection plate parts, each of which extends horizontally between upper ends of adjacent drainage groove parts among the plurality of drainage groove parts and connects the adjacent drainage groove parts to each other; and

a support wall configured to protrude upward from a middle of a bottom surface of each of the drainage groove parts and have a height lower than a height of each of the horizontal connection plate parts, and

a filter part comprising:

a filter body in which the core for a horizontal drainage material is accommodated; and

a wing member provided on one side or opposite sides of an upper portion of the filter body;

wherein the each of the drainage groove parts is formed by: a first side wall and a second side wall extending vertically while being spaced apart from each other at a predetermined distance; and

a bottom plate extending horizontally between a bottom of the first side wall and a bottom of the second side wall, and

the support wall protrudes upward from a middle of the bottom plate of the each of the drainage groove parts;

wherein a lower portion of the each of the drainage groove parts is formed in an upwardly convex arch shape, and a lower portion of the each of the horizontal connection plate parts is formed in a downwardly convex arch shape.

2. The horizontal drainage material of claim 1, wherein an auxiliary drainage groove is provided in the horizontal connection plate parts to connect the adjacent drainage groove parts to each other so that the adjacent drainage groove parts are communicated.

3. The horizontal drainage material of claim 2, wherein the auxiliary drainage groove is sloped obliquely.