(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 1 978 156 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
08.10.2008 Bulletin 2008/41

(51) Int Cl.:
E01C 13/08 *(2006.01)*

(21) Application number: **07105637.8**

(22) Date of filing: **04.04.2007**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC MT NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK RS

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(54) **Artificial turf**

(57) The present invention is related to an artificial turf comprising at least one layer (3) that comprises an amount of a leachable component, characterized in that the turf further comprises an active material (7) which is able to adsorb, break down or transform said leachable component, when the component is dissolved in water, and when said water subsequently comes into contact with said active material.

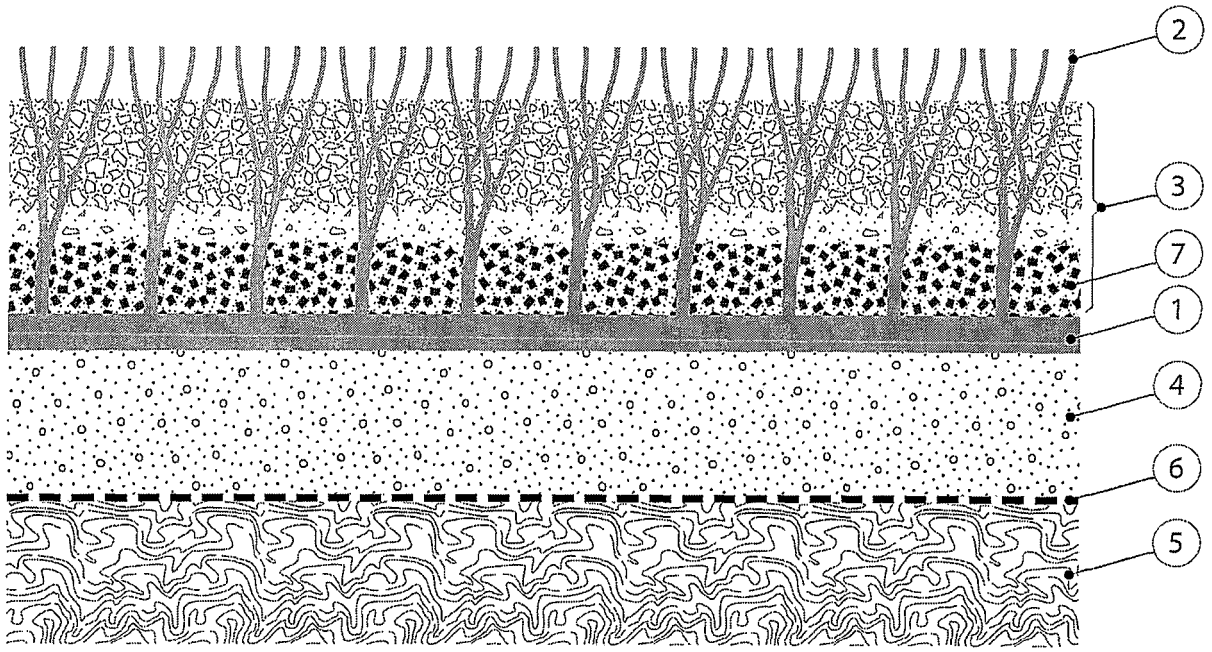

FIG. 1

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Description

Field of the Invention

[0001] The present invention is related to an artificial or synthetic turf, in particular for use as a surface for sports activities.

State of the Art

[0002] Artificial turfs are often used to cover courts or playgrounds on which sports activities such as tennis, baseball, soccer and the like are played. The synthetic turf has been developed in order to reduce the expense of maintaining sporting areas, and to increase the durability of the turf surface, especially where professional sports are involved.

[0003] Artificial turfs are generally constructed from synthetic and/or natural materials that are combined in one or more layers covering the surface underneath. Generally, artificial turfs include a carpet-like pile fabric with a flexible backing lying on a compacted substrate, such as crushed stone or other stabilized base material. The pile fabric has rows of upstanding synthetic ribbons representing grass blades, and extending upwardly from the top surface of the backing.

[0004] The most recent artificial turfs make use of various formulations for granular resilient fill that is placed between the upstanding ribbons on the upper surface of the backing and/or incorporated in another layer of the artificial soil, to simulate the presence of soil. Most systems involve some use of sand or crushed slag particles, together with a resilient foam backing or rubber particles to provide resilience. A suitable form of rubber-like particles which is commercially available is what is called "crumb rubber" which is granulated or ground rubber tires.

[0005] One of the disadvantages of the granulated rubber is that it can contain leachable chemical compounds (in particular Zn) that can enter the environment when brought into contact with liquid. Preliminary results show for example that granulated rubber can contain up to 200 mg/kg dm (mg per kg of dry matter) leachable Zn (Liquid/Solid ratio L/S 10) as determined by the EN12457-4. In the EU-landfill directive, the acceptance criteria for Zn for inert waste is 4 mg/kg dm (L/S 10), while the acceptance criteria for Zn for non-dangerous waste is 50 mg/kg dm (L/S 10) (determined by EN12457). In addition, rubber can contain other leachable chemical compounds that can affect the environment.

[0006] Other materials than "granulated rubber" can be used in artifical turfs and can contain leachable amounts of chemicals that might have an impact on the environment.

Aims of the Invention

[0007] The present invention aims to provide an artificial turf structure, which presents a solution to problems of existing structures, for the prevention of soil pollution.

Summary of the Invention

[0008] The invention is related to an artificial turf such a described in the appended claims, wherein an active material is provided, preferably in the form of active particles, e.g. grains or fibres. The active particles are biologically or chemically active, in the sense that they react with contaminants present in the artificial turf, after said contaminants have dissolved in rainwater or groundwater passing through the artificial turf, to thereby bind these contaminants and prevent the contaminants from entering the soil. Depending on the nature of the contaminants and the active material, contaminants break down or chemically transform through contact with the active material, or the contaminants adopt a less soluble form through said contact. The contaminant may thus precipitate onto, or be adsorbed onto the active material.

[0009] According to one embodiment, a separate layer consisting of or comprising active particles is provided, and located underneath a layer of the artifical turf which comprises leachable compounds (contaminants). The active layer may be located directly underneath the layer comprising contaminants, or may be separated therefrom by other layers of the turf (e.g. a resilient layer). Alternatively, the active particles can be incorporated, i.e. evenly dispersed into a layer of the artificial turf, said layer comprising leachable compounds.

[0010] The active material can be a mineral, such as an aluminium silicate or an oxide. As an aluminium silicate, a clay mineral can, be used, e.g. glauconite. According to one embodiment, at least one layer comprises glauconite in a concentration between 2% and 70% (W/W), preferably between 20% and 60% (W/W).

[0011] Alternatively, the active material can be an organic material. It can be a natural organic material, e.g. a compost type of organic matter, comprising a concentration of between 5% and 15% organic carbon (W/W). The compost type of organic matter may further comprise humic and fulvic acids.

[0012] According to a preferred embodiment, the artificial turf comprises a flexible mat with upstanding ribbons, with a layer of sand or a layer comprising granulated rubber in between said ribbons. The active particles are incorporated

in said layer of sand or granulated rubber, or in a resilient layer lying directly underneath said flexible mat, or in a drainage layer lying directly underneath said resilient layer. Alternatively, the active particles may be incorporated in a separate layer lying underneath the drainage layer.

[0013] The artificial turf of the invention preferably comprises one or more geotextiles substantially parallel to the surface of the turf, said membranes being placed in order to retain the reacted contaminants (e.g. adsorbed onto active particles) in a defined zone, during the lifetime of the artificial turf.

[0014] When the layer comprising the active material is separate from the layer comprising the contaminant, said layer comprising active material preferably has a thickness of max. 20cm, more preferably between 5 and 10 cm.

Brief Description of the Drawings

[0015] Fig. 1 represents an artificial turf according to a first embodiment of the invention.

[0016] Fig. 2 represents an artificial turf according to a second embodiment of the invention.

[0017] Fig. 3 represents an artificial turf according to a third embodiment of the invention.

[0018] Fig. 4 shows results on tests performed on specific active materials.

Detailed Description of the Invention

[0019] Figure 1 shows a first embodiment of an artifical turf according to the invention. The term 'artificial turf' in this description is to be understood as including all the layers that are applied on top of the soil. The artificial turf of figure 1 therefore consists of layers 1, 3, 4 and 5. In this embodiment, the turf comprises a flexible sheet 1, to which are attached upstanding ribbons 2. A granulate material 3, e.g. crumb rubber is present between the upstanding ribbons. A resilient layer 4 is present underneath the flexible sheet, thereby determining the sport technical characteristics of the turf. The resilient layer may comprise any suitable material. It may comprise or consist of granulated rubber. A drainage layer 5, e.g. a quartz sand layer, is present underneath the resilient layer and separated therefrom by a geotextile 6.

[0020] The active particles 7 are incorporated into the crumb rubber layer present between the upstanding ribbons. The active particles may be dispersed evenly in said layer, or a higher concentration of active particles may be present in the lower half of the layer than in the in upper half (the latter case is illustrated in the drawing).

[0021] According to a second embodiment (fig. 2), the active particles are incorporated into the drainage layer 5. A geotextile 20 is then preferably present underneath the drainage layer 5.

[0022] According to a third embodiment, a separate layer 8 is present underneath the drainage layer 5, and separated therefrom by a geotextile 9. The active particles are dispersed in said separate layer 8. The separate layer 7 is itself separated from the soil underneath by a further geotextile 10.

[0023] The invention is not limited to the embodiments of figures 1 to 3. The active particles may be present in or underneath any layer that comprises leachable components, such as the Zn which is present in the crumb rubber layer. Also, an artificial turf of the invention does not need to comprise all the component layers shown in the drawings. For example, the resilient layer and/or the drainage layer can be omitted.

[0024] One or more geotextiles are preferably present, located such that the leachable components or their reaction products, once the leachable components have reacted with the active particles, remain within a confined area of the artificial turf. The geotextiles allow to remove the artificial turf or parts of the artificial turf after its lifetime, and thereby also remove the contaminants.

[0025] Active particles can be provided in bulk and mixed directly with one of the layers of the artificial turf, or they can be pre-mixed with sand or gravel before being added to the turf.

[0026] The concentration of active particles in a layer of the turf is dependent upon the amount of contaminants present and/or of the nature of the active particles. The amount of active particles should not adversely affect the characteristics of the layer into which they are incorporated.

[0027] Another important parameter is the average size of the active particles or fibres. Optimal operation of the active layer is obtained with small particles, preferably having a characteristic dimension lower than 100μm. This dimension can be the average diameter in the case of grain-like particles, or a characteristic length, e.g. in the case of fibres. These small particles ensure a maximum contact surface between the particles and the contaminant. Other considerations may have to be taken into account, such as resilience and other sport-related functionalities, especially in the case of active particles being incorporated in a layer which already has another function (e.g. drainage layer, resilient layer).

According to a first embodiment, at least 50% of the particles or fibres has a characteristic dimension of max. 100μm, e.g. grain-like particles with a diameter of max 100μm. This is preferably the case when a separate active layer is used, such as layer 8 in figure 3. According to two other embodiments, at least 70% and at least 80% respectively of the particles or fibres has a characteristic dimension of max. 100μm.

According to a second embodiment, at least 50% of the particles has a characteristic dimension between 100μm and 500μm. This may be the case when the active particles or fibres are incorporated in a drainage layer or in a resilient

layer. According to two other embodiments, at least 70% and at least 80% respectively of the particles or fibres has a characteristic dimension between 100μm and 500μm.

[0028] The active material can be a mineral, e.g. glauconite. One embodiment comprises a glauconite-rich layer of sand as the active layer, e.g. the drainage layer 5.

[0029] Tests have shown that such a layer allows to capture Zn from water that has percolated through a layer of granulated rubber and then passes through the glauconite-rich layer. In stead of a glauconite-rich layer, a layer, e.g. a sand layer, comprising a fraction of organic material (e.g. organic carbon present in compost) may be used, with the same result. A glauconite-rich active layer preferably comprises a concentration of glauconite between 2% and 70%, e.g. 56%. An active layer comprising a fraction of organic material preferably may comprise a concentration of organic carbon of 5-15%, e.g. 9.6% TOC (total organic carbon).

[0030] Figure 4 shows a graph based on so-called column tests, wherein a layer of granulated rubber is brought into contact with a layer comprising active material (glauconite or compost), in a tube in the laboratory. Water is then percolated through the tube, so that the water passes first through the rubber and then through the active material. The graph in figure 4 shows the concentration of Zn in the water after it has flown through the column, as a function of the Liquid/Solid ratio (L/S), which indicates the amount of liquid percolated through the column. The result is shown in three cases : an active layer comprising glauconite (♦), an active layer comprising compost (▲), and a non-active layer of quartz sand (■). It is clear that the active layers are very capable of retaining the Zn.

[0031] Further tests and simulations have been performed to determine the optimum thickness of an active layer. When the active material is incorporated into a layer of the artificial turf that is already present (e.g. resilient layer), this thickness is usually determined beforehand on the basis of other criteria (e.g. the resilient layer will need to have a thickness determined mainly by the sports characteristics of the turf). If a separate layer is added to the turf, the thickness of that layer can be designed to obtain optimal performance in terms of contaminant adsorption or reaction. Tests and simulations have been performed in the case of an active layer comprising glauconite and compost respectively. According to the preferred embodiment shown in figure 3, of an artificial turf of the invention comprising a separate layer 8 comprising one or the other of these two materials (glauconite or compost), the thickness of said separate layer is between 5 and 10 cm, for a layer 3 of granulated rubber of 10cm thick, which is a good average of the thickness of the granulated rubber layer. Therefore, the invention is related to an artificial turf with a separate layer comprising active particles, said layer having a thickness between 5 and 10 cm.

[0032] Table 1 shows an example of the particle size distribution in the case of a glauconite-rich layer, and in the case of a compost-rich layer.

Table 1.

	ASG/05193		ASG/05214	
	Glauconite layer		compost layer	
	Weight (gram)	%	Weight (gram)	
> 2000 μm 1000 - 2000	0	**0**	13,94	**2,65**
μm 500 - 1000	15,05	**1,39**	16,74	**3,18**
μm 100 - 500	196,9	**18,24**	11,91	**2,26**
μm	842,45	**78,04**	434,73	**82,51**
< 100 μm	25,12	**2,33**	49,53	**9,4**

Claims

1. An artificial turf comprising at least one layer that comprises an amount of a leachable component, **characterized in that** the turf further comprises an active material (7) which is able to adsorb, break down or transform said leachable component, when the component is dissolved in water, and when said water subsequently comes into contact with said active material.

2. The artificial turf according to claim 1, wherein said active material is in the form of particles (7) of said active material.

3. The artificial turf according to claim 1 or 2, wherein said active material is incorporated into said layer comprising a leachable component.

4. The artificial turf according to claim 1 or 2, wherein said active material is incorporated in a layer (4,5,8) which is

separate from and located underneath said layer comprising a leachable component.

5. The artificial turf according to claim 4, wherein the separate layer comprising active material has a thickness of maximum 20cm.

6. The artificial turf according to claim 4, wherein the separate layer has a thickness between 5cm and 10 cm.

7. The artificial turf according to any one of the preceding claims, wherein said active material is a mineral.

8. The artificial turf according to claim 7, wherein said mineral is an aluminium silicate or an oxide.

9. The artificial turf according to claim 8, wherein the mineral is an aluminium silicate and wherein said aluminium silicate is a clay mineral.

10. The artificial turf according to claim 9, wherein said clay mineral is glauconite.

11. The artificial turf according to claim 10 wherein at least one layer comprises glauconite in a concentration between 2% and 70% (W/W).

12. The artificial turf according to any one of claims 1 to 6, wherein said active material is an organic material.

13. The artificial turf according to claim 12, wherein the organic material is a natural organic material.

14. The artificial turf according to claim 13, wherein the active material is a compost type of organic matter comprising a concentration of between 5% and 15% organic carbon (W/W).

15. The artificial turf according to any one of the claims 2-14, wherein the layer(s) comprising active particles comprise (s) at least 50% of particles with a characteristic dimension of max. 100μm.

16. The artificial turf according to any one of the claims 2-14, wherein the layer(s) comprising active particles comprise (s) at least 50% of particles with a characteristic dimension between 100μm and 500μm.

17. The artificial turf according to any one of the preceding claims, wherein said turf comprises a flexible sheet (1), to which are connected upstanding ribbons (2), and a granulate material (3) filling up the spaces between said ribbons, and wherein the active material is either incorported in said granulate material or incorporated in a layer located underneath said flexible sheet.

18. The artificial turf according to claim 17, further comprising a resilient layer (4) and/or a drainage layer (5), located underneath the flexible sheet (1) .

19. The artificial turf according to any one of the preceding claims, further comprising one or more geotextiles (6, 9, 10, 20) .

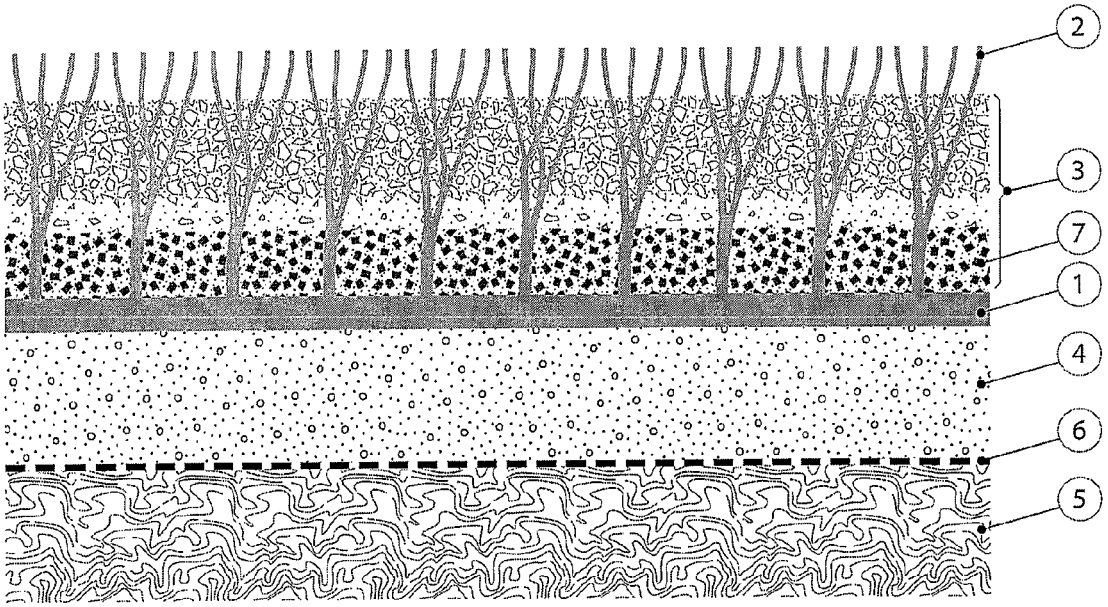

FIG. 1

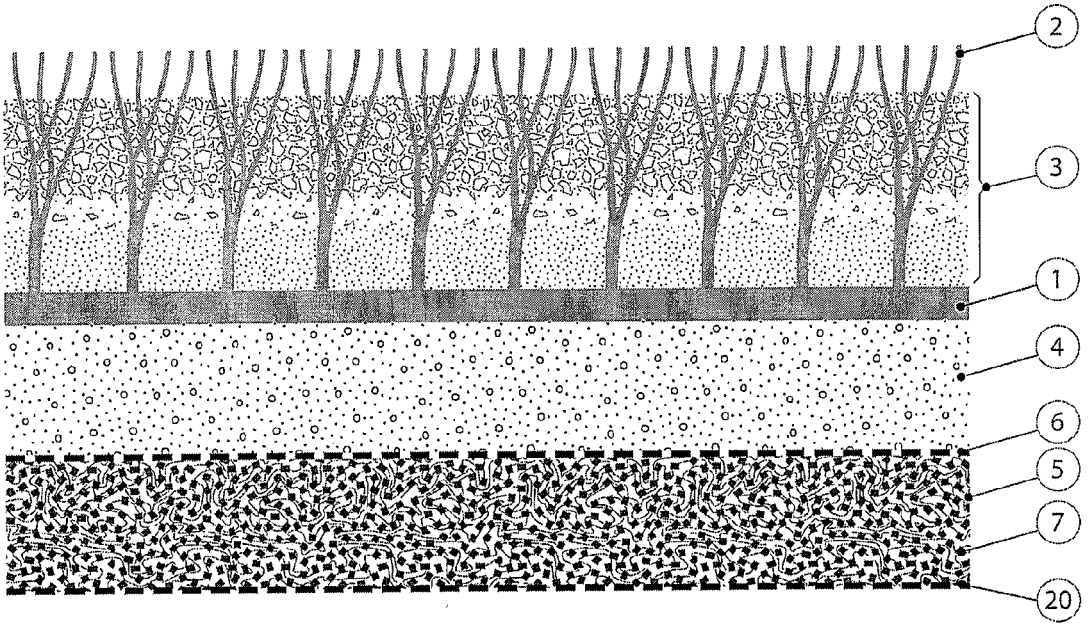

FIG. 2

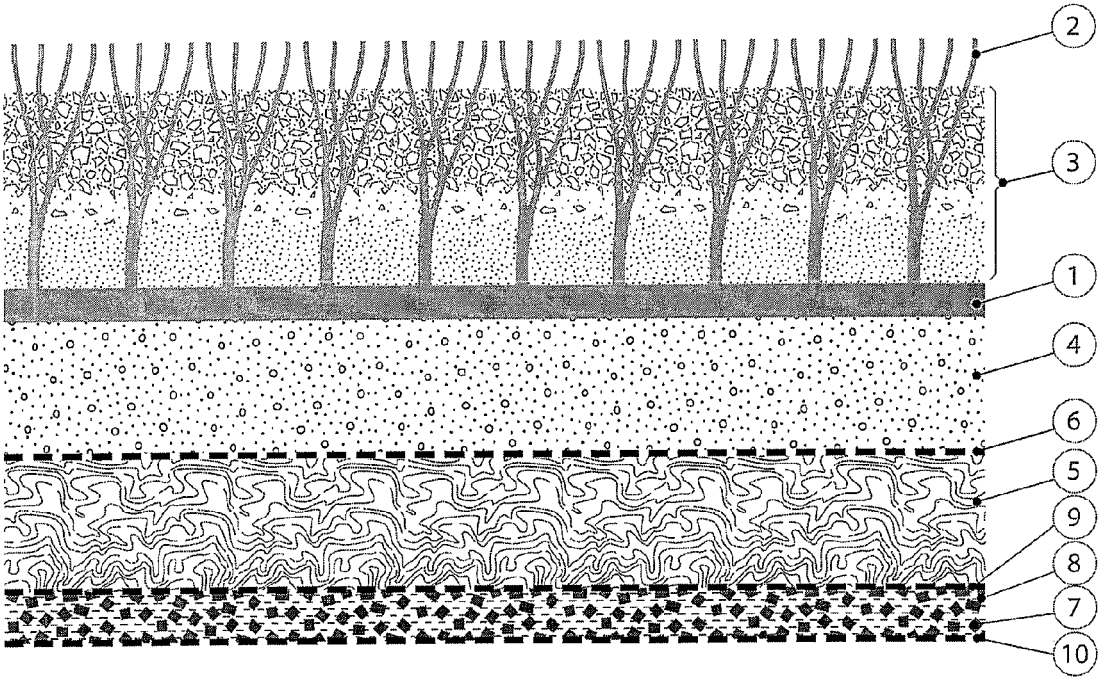

FIG. 3

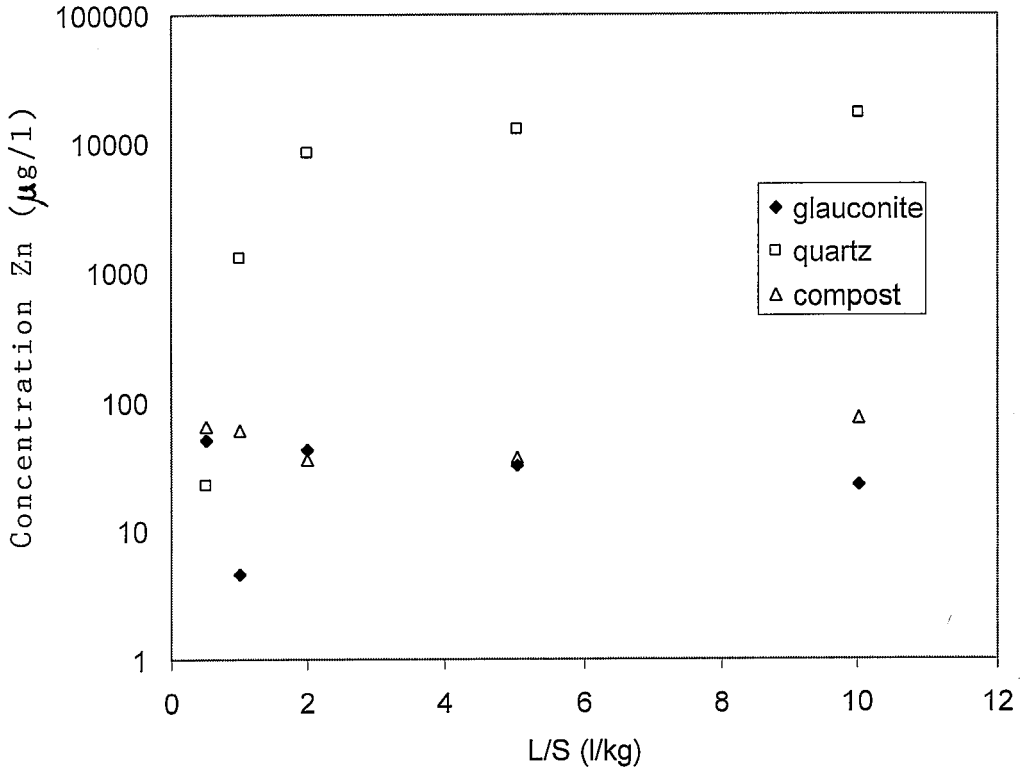
100000
10000
1000
100
10
1
Concentration Zn (µg/l)
0
2
4
6
8
10
12
L/S (l/kg)
glauconite
quartz
compost

FIG. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 07 10 5637

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	4 September 2007	FLORES HOKKANEN, P

CATEGORY OF CITED DOCUMENTS

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