(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
5 July 2007 (05.07.2007)

PCT

(10) International Publication Number
WO 2007/076449 A2

(51) International Patent Classification:
C02F 3/00 (2006.01)

(21) International Application Number:
PCT/US2006/062506

(22) International Filing Date:
21 December 2006 (21.12.2006)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

60/754,053	27 December 2005 (27.12.2005)	US
11/614,700	21 December 2006 (21.12.2006)	US

(71) Applicant *(for all designated States except US)*: **BIO-PROCESS TECHNOLOGIES LTD.** [US/US]; 207 HIGH POINT AVENUE, Suite 7, Portsmouth, RI 02871 (US).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: **HALEY III, John, W.** [US/US]; 276 Angell Street, Providence, RI 02906 (US).

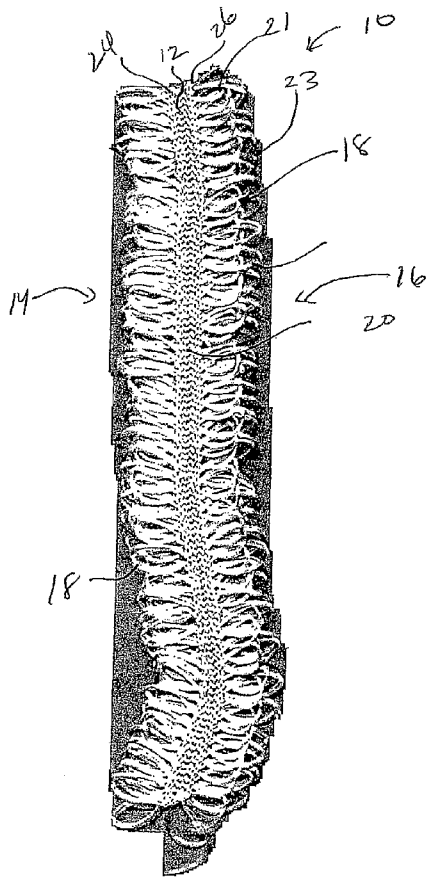
(74) Agent: **RING, Thomas, J.**; WILDMAN, HARROLD, ALLEN & DIXON LLP, 225 W. Wacker Drive, Chicago, IL 60606 (US).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM,

[Continued on next page]

(54) Title: BIOMEDIA APPARATUS AND METHOD OF USE



(57) Abstract: A biomedia apparatus comprising an elongated central core and a plurality of loops positioned along the central core adapted to collect organisms from water. The biomedia apparatus may further comprise at least one reinforcing member associated with the central core. In one embodiment, the biomedia apparatus is utilized in a trickle tower to treat wastewater. In another embodiment, the biomedia apparatus is utilized outside a power plant to minimize spat that is drawn into the plant through water intake valves.

WO 2007/076449 A2

ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *without international search report and to be republished upon receipt of that report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

BIOMEDIA APPARATUS AND METHOD OF USE

Cross Reference To Related Application

[0001] This application claims the priority of United States Provisional Application Serial NO. 60/754,053 filed December 27, 2005.

Field Of The Invention

[0002] This invention is directed to a biomedia apparatus, and more particularly to a looped cord biomedia apparatus useful in the treatment of wastewater.

Summary Of The Invention

[0003] The present invention relates to a biomedia apparatus and methods for using same.

[0004] In one embodiment, the biomedia apparatus of the present invention comprises an elongated central core, at least one reinforcing member associated with the central core and a plurality of loops positioned along a length of the central core .

[0005] In another embodiment, the biomedia apparatus of the present invention comprises an elongated central core, wherein a width of the central core is no greater than about 10.0 millimeters and a plurality of loops positioned along the central core.

[0006] In yet another embodiment, the biomedia apparatus comprises an elongated central core and a plurality of loops positioned along the central core for collecting organisms from water, wherein the apparatus is adapted to hold about 150.0 to about 300.0 pounds of collected organisms per foot.

[0007] In an embodiment of the method of the present invention, the method comprises the steps of providing a biomedia apparatus comprising an elongated central core, at least one reinforcing member associated with the central core and a plurality of loops positioned along the central core, providing water comprising at least one organism and collecting the at least one organism from the water with the biomedia apparatus.

Brief Description Of The Drawings

[0008] Certain embodiments of the presently claimed invention are illustrated by the accompanying figures. It should be understood that the figures are not necessarily to scale and that details not necessary for an understanding of the invention or which render other details difficult to perceive may be omitted. It should be understood, of course, that the invention is not necessarily limited to the particular embodiments illustrated herein.

[0009] Fig. 1 is a perspective front view of a looped cord biomedia according to the presently claimed invention; and

[0010] Fig. 2 is a back view of the looped cord biomedia shown in Fig. 1.

Detailed Description

[0011] As used herein, biomedia means any material or substance used in connection with the treatment of water. The present invention is directed to a looped cord biomedia, which comprises an elongated central core and a plurality of loops positioned along the central core. As used herein, elongated means having a greater vertical dimension than horizontal dimension. In one embodiment, the present invention further comprises a reinforcing member associated with the central core. The biomedia of the present invention may be used in a trickle tower or various other applications involving the treatment of water.

[0012] Referring now to Fig. 1, one embodiment of the looped cord biomedia **10** of the present invention is shown. The biomedia of Fig. 1 comprises an elongated central core **12** including a first side **14** and a second side **16**, a plurality of loops **18** extending laterally from each of the first and second sides **14** and **16** and a reinforcing member **20** associated with the central core. The biomedia **10** also includes a front portion **21** and a back portion **23**.

[0013] The central core **12** may be constructed in various ways and of various materials. In one embodiment, the central core **12** is knitted. The knitted portion of the core **12** may comprise a few (*e.g.*, four to six), lengthwise rows of stitches **22**. The core **12** may be formed from yarn-like materials. Suitable yarn-like material may include, for example, polyester, polyamide, polyvinylidene chloride,

polypropylene and other materials known to those of skill in the art. The yarn-like material may be of continuous filament construction, or a spun staple yarn. The lateral width *l* of the central core **12** is relatively narrow and is subject to variation. In certain embodiments, the lateral width *l* is no greater than about 10.0 mm, is typically between about 3.0 mm and about 8.0 mm or between about 4.0 mm and about 6.0 mm.

[0014] As shown in Fig. 1, the plurality of loops **18** extend laterally from the first and second sides **14** and **16** of the central core **12**. As can be seen, the plurality of loops are designed to collect various types of organisms from water. The plurality of loops offer flexibility in shape to accommodate growing colonies of organisms. At the same time, the plurality of loops **18** permit air circulation so that, when the biomedia is employed in a trickle tower, the growing colonies of organisms can consume sufficient oxygen to survive long enough to eliminate toxins from the wastewater.

[0015] The plurality of loops **18** are typically constructed of the same material as the central core **12**, and may also include variable lateral widths *l'*. The lateral width *l'* of each of the plurality of loops **18** may be within the range of between about 10.0 mm and about 15.0 mm. If the loops are too big, they may become saturated with organisms, which could fall off or preclude the capture of additional organisms.

[0016] As can be seen, the lateral extent of the core **12** is rather insignificant vis-à-vis the overall lateral extent of each of the plurality of loops. That is, the central core **12** occupies between about 1/7 to 1/5 of the overall lateral width of the biomedia apparatus. In fact, the central core **12** is barely perceptible when viewing the back portion **23** of the biomedia apparatus **10**. As seen in Fig. 2, the central core appears nearly totally hidden from view by the laterally extending plurality of loops **18**.

[0017] The central core **12** may optionally be strengthened through use of the reinforcing member **20**, which typically extends along and interconnects with the central core. As used herein, the term reinforcing member means any material or substance added to the central core that is made of a material different than that of the central core. The material of the reinforcing member **20** typically has a higher tensile

strength than that of the central core **12** and may have a range of break strengths between about 50.0 pounds and about 15,00 pounds. Thus, the reinforcing member **20** may be constructed of various materials, including high strength synthetic filament, tape and stainless steel wire or other wire. Two particularly useful materials are Kevlar® and Tensylon®.

[0018] According to another aspect of the invention, a method for making the biomedia apparatus is provided. The method comprises the steps of knitting the yarn-like material to form the central core **12**, and pulling the plurality of loops **18** therefrom, such that the loops are positioned along the central core **12**. Knitting machines available from Comez SpA of Italy may be employed for this purpose. In addition, one or more reinforcing members **20** may be added to the central core **12** in various ways.

[0019] A first way in which the biomedia **10** may be strengthened is by adding one or more reinforcing members **20** to the weft of the core **12** during the knitting step. These reinforcing members **20** may be disposed in a substantially parallel relationship to the warp of the core **12** and stitched into the composite structure of the core **12**. As will be appreciated, the use of these reinforcing members allows the width of the central core **12** to be reduced relative to central cores of known biomedia, without significantly jeopardizing the tensile strength of the core.

[0020] In one embodiment, two reinforcing members **20** are employed, with one member disposed on each side of the core **12**. Referring again to Fig. 1, two reinforcing members **24** and **26**, in the form of outside wales, are shown.

[0021] A second way in which the biomedia **10** may be strengthened is through the introduction of the one or more reinforcing members **20** in a twisting operation subsequent to the knitting step. This method allows the parallel introduction of the tensioned reinforcing members into the central core **12**, with the central core **12** wrapping around these reinforcing members **20**.

[0022] In addition, both the first and second ways of incorporating reinforcing members **20** may be combined. Thus, one or more reinforcing members **20** may be laid into the central core **12** during the knitting process, and then one or more reinforcing members **20** may be introduced during the subsequent twisting step. These

reinforcing members **20** could be the same or different (*e.g.*, during knitting, Kevlar® could be used, and during twisting, stainless steel wire could be introduced).

[0023] According to yet another aspect of the present invention, methods for using the above-described biomedia apparatus **10** are provided. The biomedia apparatus **10** may be used in a trickle tower or outside power plants with water intakes.

[0024] When used in a trickle tower for treating wastewater, a plurality of the looped cord biomedia strands are suspended vertically in the trickle tower. As the wastewater trickles down the biomedia strands, microorganisms continuously grows on the strands, particularly in and around the loops.

[0025] The increasing weight of this biomass tends to cause the biomedia strands to want to stretch or "creep." If this occurs, the biomedia strands can sag and encroach upon their neighbors; as the biomedia grows, this closeness caused by sagging will allow the bacteria to grow together, and thus create "bridging" with consequential deterioration in the wastewater purification process. Owing to the narrow size of the central core **12**, however, the above-described biomedia constructions help mitigate this problem of "creep," as the individual biomedia within the trickle tower occupy relatively small lateral widths, allowing for additional space between each biomedia apparatus.

[0026] Further, the presence of the reinforcing members **20** can help provide a reduction of stretch in the wire and filamentary structures of the invention. Along these lines, the biomedia **10** of the inventors of the present invention believe that it can hold more pounds of weight per foot of biomedia than known structures. The inventors have found that a biomedia apparatus **10** according to the present invention can provide up to 300 pounds of weight per foot. This has the advantages of reducing the risk of the biomedia yielding or even breaking during use in a trickle tower, and enables the trickle tower to process a larger volume of wastewater before needing grooming to reduce growth of microorganisms.

[0027] In a modification, the Kevlar (trademark), Tensylon (trademark), wire, etc. can be introduced under tension without the twisting step. The now knitted structure is loaded into a trickle tower in such a way that the small

foundation areas are all located in the exact position relative to one another; this configuration allowing the maximum availability of air throughout the media structures.

[0028] In another embodiment, the biomedia **10** of the present invention may be used to treat water that enters the water intake valves of power plants. In many cases, the intake valves of power plants draw in the larval form of muscles (often referred to as spat) that typically grow in large bodies of water, like lakes. This spat eventually turns into full-grown muscles that can seriously damage the power plant's filtration systems. To counteract this problem, a frame of the biomedia **10** of the present invention may be submerged outside the water intake valves of power plants. Because the plurality of loops **18** can ensnare the spat before it enters the power plant, the numbers of muscles growing inside the target power plant is reduced, thereby helping to minimize the aforementioned damage to power plant filtration systems.

[0029] Variations, modifications and other implementations of what is described herein will occur to those of ordinary skill in the art without departing from the spirit and scope of the invention. Accordingly, the invention is in no way limited by the preceding illustrative description.

WHAT IS CLAIMED IS:

1. A biomedia apparatus comprising:

an clongatcd ccntral corc;

at least one reinforcing member associated with the central core; and

a plurality of loops positioned along a length of the central core.

2. The biomedia apparatus of claim 1, wherein the central core is constructed of a yarn-like material.

3. The biomedia apparatus of claim 2, wherein the yarn-like material comprises at least one of a continuous filament and a spun staple yarn.

4. The biomedia apparatus of claim 2, wherein the at least one reinforcing member has a higher tensile strength than that of the yarn-like material.

5. The biomedia apparatus of claim 2, wherein the yarn-like material is selected from the group consisting of polyester, polyamide, polyvinylidene chloride and polypropylene.

6. The biomedia apparatus of claim 2, wherein the yarn-like material is of knitted construction and the at least one reinforcing member is stitched into the central core.

7. The biomedia apparatus of claim 1, wherein a width of the central core is no greater than about 5 millimeters.

8. Thc biomcdia apparatus of claim 1, whcrcin a width of thc ccntral corc is between about 1/7 to about 1/5 of the overall lateral width of the biomedia apparatus.

9. The biomedia apparatus of claim 1, wherein the at least one reinforcing member extends along and interconnects with the central core.

10. The biomedia apparatus of claim 1, wherein the at least one reinforcing member is at least partially knitted into the central core.

11. The biomedia apparatus of claim 1, wherein the at least one reinforcing member and the central core are twisted about one another.

12. The biomedia apparatus of claim 1, wherein the at least one reinforcing member is introduced into the central core under tension.

13. The biomedia apparatus of claim 1, wherein the at least one reinforcing member is constructed of a material selected from the group consisting of a high strength synthetic filament, tape and stainless steel wire.

14. A biomedia apparatus comprising:

an elongated central core, wherein a width of the central core is no greater than about 10.0 millimeters; and

a plurality of loops positioned along the central core.

15. The biomedia apparatus of claim 14, wherein the width dimension of the central core is between about 3.0 mm and about 8.0 mm.

16. The biomedia apparatus of claim 14, further comprising at least one reinforcing member.

17. A biomedia apparatus comprising:

an elongated central core; and

a plurality of loops positioned along the central core for collecting organisms from water, wherein the apparatus is adapted to hold about 150.0 to about 300.0 pounds of collected organisms per foot.

18. The apparatus of claim 17, further comprising a reinforcing member associated with the elongated core.

19. A method, comprising the steps of:

providing a biomedia apparatus comprising an elongated central core, at least one reinforcing member associated with the central core and a plurality of loops positioned along the central core;

providing water comprising at least one organism; and

collecting the at least one organism from the water with the biomedia apparatus.

20. The method of claim 19 further providing the central core constructed of a yarn-like material.

21. The method of claim 20 further providing the yarn-like material comprising at least one of a continuous filament and a spun staple yarn.

22. The method of claim 19 further comprising the step of positioning the biomedia apparatus into a trickle tower.

23. The method of claim 19 further comprising the step of positioning the biomedia apparatus submerged beneath the water.

24. The method of claim 21 further comprising the step of positioning the biomedia apparatus in a flow of water.

25. The method of claim 19, further comprising the step of providing another biomedia apparatus comprising an elongated central core, at least one reinforcing member associated with the central core and a plurality of loops positioned along the central core wherein the biomedia apparatus and the other biomedia apparatus are spaced apart.

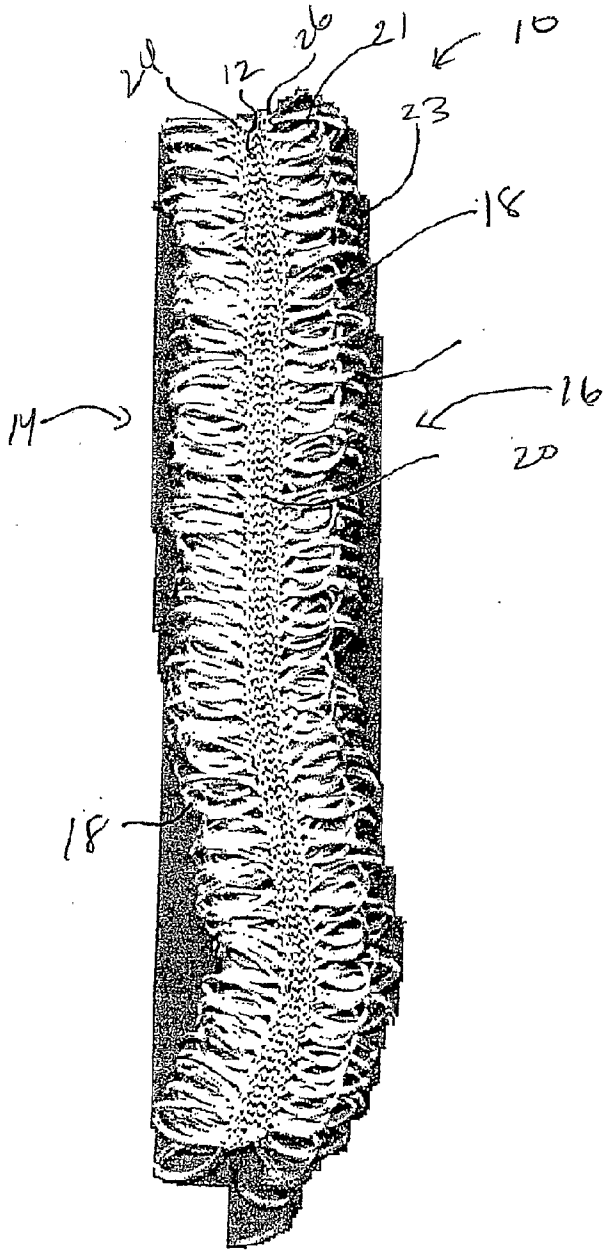


Fig. 1

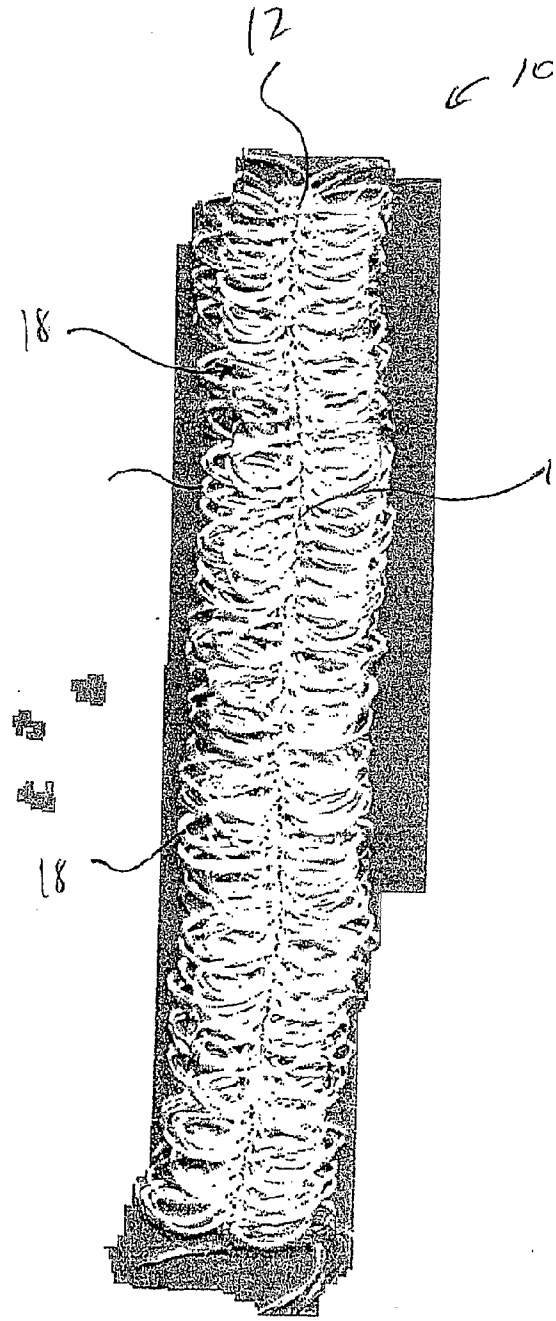


Fig. 2