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(71) Demandeur/Applicant:
STRATEGIC ENVIRONMENTAL TECHNOLOGIES LTD., GB

(72) Inventeur/Inventor:
LORD, GARFIELD R., TC

(74) Agent: ROBIC

(54) Titre : APPAREIL DE CULTURE DE BACTERIES POUR REACTEUR BIOLOGIQUE A CHAMBRES MULTIPLES UTILISE A LA SORTIE D'UN BASSIN DE SEDIMENTATION OU D'UN APPAREIL D'EXTRACTION DES SOLIDES

(54) Title: BACTERIA GROWTH APPARATUS FOR USE IN MULTI CHAMBER BIOLOGICAL REACTOR USED AFTER A SETTLING TANK OR SOLIDS REMOVAL APPARATUS

BACTERIA GROWTH APPARATUS FOR USE IN MULTI CHAMBER BIOLOGICAL REACTOR USED AFTER A SETTLING TANK OR SOLIDS REMOVAL APPARATUS

FIELD OF THE INVENTION

The present invention broadly relates to an apparatus for increasing bacterial growth thereon used in a multi-chamber reactor (or clarifier) used after a settling tank such as a domestic multi chamber septic tank or a solids removal apparatus such as a screen, a filter, screw or other type of press, and the like.

BACKGROUND OF THE INVENTION

Several filter apparatuses are well known to this day. For instance North American Filter Corporation has developed a filter known by the trademark Waterloo Biofilter, which comprises an open cell foam wherein little blocks are cut in the dimension of 3 inches by 3 inches. The gray water is poured over the top and floats down as air is blown up through the bottom. By keeping the media wet, the bacteria grow inside the foam. However, such a system is expensive to maintain, as it constantly needs air blowing to generate aerobic bacteria in the foam and a mechanical pump is needed to circulate the grey water over the foam.

Other filtering/purifying apparatuses that are well known to this day include the following: leaching field attached to septic tanks, biodisks (rotating disks), multimedia sand filters, fluidized beds (sand suspended in water), Zenon Zeeweed® filters, ECO FLOW® (peat moss) and plastic spheres, balls, stars, honeycombs, etc.

SUMMARY OF THE INVENTION

A first object of the present invention relates to an apparatus for increasing attached growth bacteria in an aerobic or anaerobic chamber of a multi chamber biological clarifier attached to a settling tank such as a septic tank.

A second object of the invention relates to a process for purifying water from a residential or community septic tank.

The first object of the present invention is achieved with a water treatment apparatus, for the treatment of the gray water effluent of a domestic nature by replacing a leaching field or bed (also called "weeping bed"), wherein:

- the apparatus comprises a multi chamber container, the chambers being separated by baffles so that air can access the first chamber and provide aerobic biological treatment while the next chamber is deprived of air or oxygen so as to provide anaerobic treatment and subsequent chambers are alternately aerated and deprived of air or oxygen; alternatively air can be turned on and off at varying intervals in each chamber of the reactor to promote the growth of both aerobic and anaerobic bacteria in the same chambers or reactors

- each chamber is filled with a loose bundle of non toxic thin and narrow strips of extruded virgin or recycled polymer, that allows for the free circulation of the grey water through the attached growth bacteria (either nitrosominous or nitrobacters) completing the natural nitrogen cycle treatment or process in a controlled environment;

- the polymer strips serve to vastly increase the area on which bacteria can attach themselves and grow in the reaction chambers, thereby providing for faster and more efficient treatment;

- minimal maintenance is required, what residue from bacterial action has accumulated can be pumped out every five years or so through one or more of the container's covers;

- size of the container and its polymer strip bundle filled chambers can be varied to allow for different retention times and meet specific goals for effluent discharge;

- treated effluent is decontaminated to a quality level that meets national and local requirements for water being discharged either into the ground or for irrigation use.

An advantage of such a clarifier system is that it replaces a leaching field or bed and is sized according to the amount of gray water produced by the septic tank or community effluent discharge as well as it's specific b.o.d. Water thus treated is decontaminated to a quality level that easily allows for its discharge either into the ground or surface discharge for irrigation.

Another advantage of the clarifier system comes in the fact that it is now possible to create in a minimum volume a very large surface area for bacteria growth. Indeed, because attached growth bacteria need a surface to attach to and to grow the greater the surface area one can create in the smallest volume is preferable.

Furthermore, the overall cost to produce such media is greatly reduced.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a schematic representation of the BIO-NEST according to a preferred embodiment of the invention.

Figure 2 shows the various stages of decontamination of effluent, first the separation of the solids from the grey water, next the remediation of the grey water by the BIO-NEST in the bio reactor.

Figures 3a to 3d show the three types of BIO-NEST and each can be interchanged in the bio reactor. The BIO-NEST (figure 3a) is illustrated as it is first produced from virgin or recycled polymer, the BIO-NEST Plus (figure 3b) is the BIO-NEST after plasma etching, and figure 3d shows a polymer blended with a porous material prior to its production and then plasma etched to expose the surfaces of the porous material trapped in the polymer to obtain the BIO-NEST Ultra (figure 3c).

DETAILED DESCRIPTION OF THE INVENTION

The apparatus of the present invention comprises a non-toxic (virgin or recycled) polymer that is extruded in thin strips of various lengths and gathered in a loose bundle. The loose conformation of the polymer strips is important in that allows unhindered grey water circulation. Furthermore, this conformation allows the apparatus to fit within each of the multiple chambers of an aerobic and anaerobic clarifier that is fed with a residential or community domestic effluent (or any waste water source high in b.o.d.) from a settling tank or multi chambered septic tank. Moreover, the conformation of the polymer increases the surface area on which attached growth bacteria can proliferate and thus increase the efficiency and the treatment capacity of the clarifier.

The apparatus of the present invention known under the trademark BIO-NEST is basically a plastic media that can be made of any type of plastic that is not bioacidal in its nature unlike polyvinyl chloride. It should be a plastic that is compatible to bacteria growth rather than a plastic that may disintegrate in time and leach toxic chemical that would kill the bacteria, for instance chloride in polyvinyl chloride.

Preferably, the plastic that is used in the apparatus of the present invention may be selected from the group consisting of high-density polyethylene, polypropylene or any other plastic that can be heated, extruded, molded and made in a way that will allow them to be loosely packed together. The plastic should not compress or collapse or disintegrate over time and stop the flow of the water (such as peat moss).

In a preferred embodiment of the present invention and as shown in Figure 3a, such apparatus may be made by extrusion, molded, machined or cast.

Preferably, for a domestic application, the apparatus should comprise three cubic meters of the extruded plastic bundled up. The extruded plastic should be as small and as thin as possible all the while rigid. The rigidity is provided by the nature of the plastic used. It is important not to extrude the plastic too thin since it will become like sheet of polyethylene that will collapse together and won't allow proper passage of the grey water there between the strips.

Therefore, the plastic is preferably extruded 0.2 mm thick by 0.2 mm to 3.0 mm wide.

After being extruded, these strips are put into an irregular form either by putting them through a gear or spinning them or blowing them as they are growing so that they will adopt an irregular form, as shown in Figure 1. This is mainly to prevent them touching together and compact together, because it is as mentioned before important that the water flows through without restriction carrying through the pollutants in the grey water that the bacteria will remove .

In a second embodiment of the present invention and as shown in Figure 3b, the apparatus has superior adhesive qualities. In this embodiment, the adhesive qualities are improved thanks to a new technology that allows

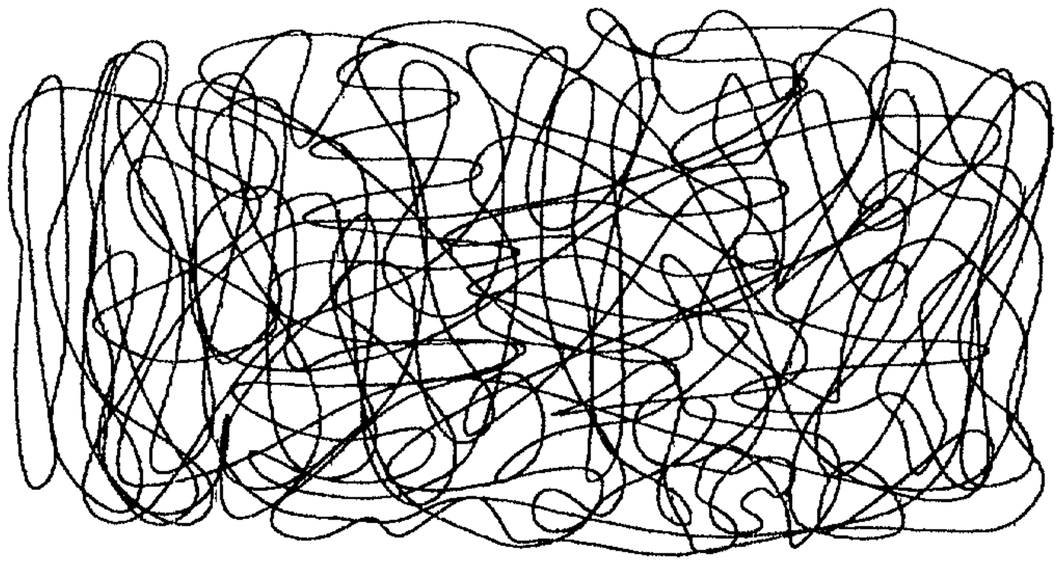
processing of the plastic strip that will in turn increase its adhesive properties. This technology is called Plasma Etch Technology. This technology uses a gas in a vacuum with a high frequency RF or microwave. The surface of any plastic media can be etched to create a much larger surface area for the bacteria to attach to. This will include all synthetic media that are presently being used to support bacteria growth as well as BIO-NEST mentioned earlier.

In the third embodiment of the present invention and as shown in Figures 3c and 3d, the apparatus comprises extruded polymer strips comprising a porous substance blended inside of the plastic. Such porous substance may be zeolyte or activated carbon or any other porous like material non toxic to bacterial growth. This porous substance is blended in such a way that it lies just below the surface of the plastic. Once the strips are extruded, the surface is etched off so as to create an opening on the surface to expose the porous substance and thereby creating a larger surface for bacteria growth. Therefore, any inert porous material that is heat resistant may be used in the context of the present invention. This porous material is not affected by heat if the plastic is molded, cast, machined or extruded. Furthermore, this porous material should not have holes that are so big that the plastic will impregnate it and the plastic can be etch off easily from the surface with plasma etching.

The plastic media mentioned above will be made either molded, cast, machined or extruded after being blended with a porous media such as activated carbon, any zeolyte or other porous material that could be mixed into the plastic before the molding or extrusion phase of manufacture. The porous media would be uniformly blended inside the plastic when completed. This blended media would then be machined or plasma etched as above, to etch the surface and exposed the porous media trapped inside the plastic and increase dramatically the surface area of the finished product.

Therefore, it can be appreciated that the apparatus of the present invention is used in the field of nitrification/denitrification namely in sewage treatment, aquaculture, aquariums and ponds, water processing and wastewater remediation.

Although the present invention has been explained hereinabove by way of a preferred embodiment thereof, it should be pointed out that any modification to this preferred embodiment within the scope of the present invention is not deemed to alter or change the nature and scope of the present invention.



Bio Nest

Figure 1

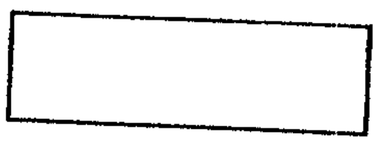
Figure 3a  Bio Nest

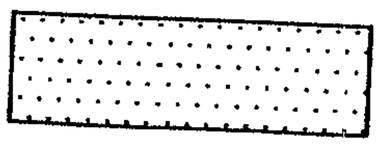
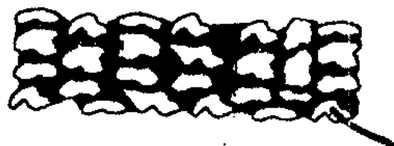
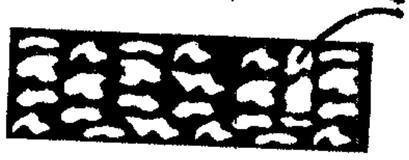
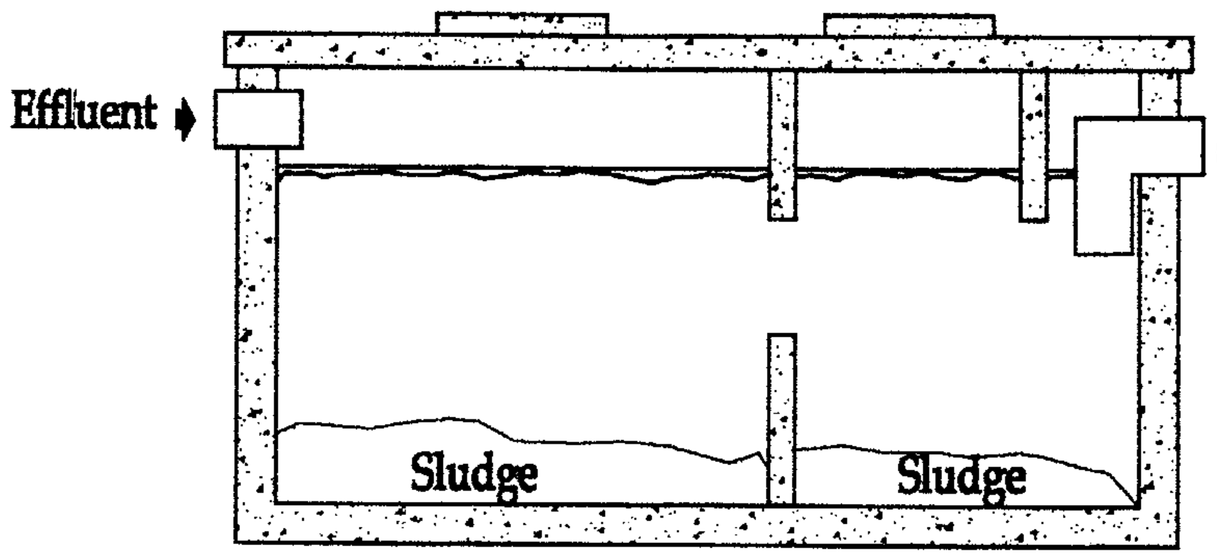
Figure 3b  Bio Nest Plus

Figure 3c  Bio Nest Ultra

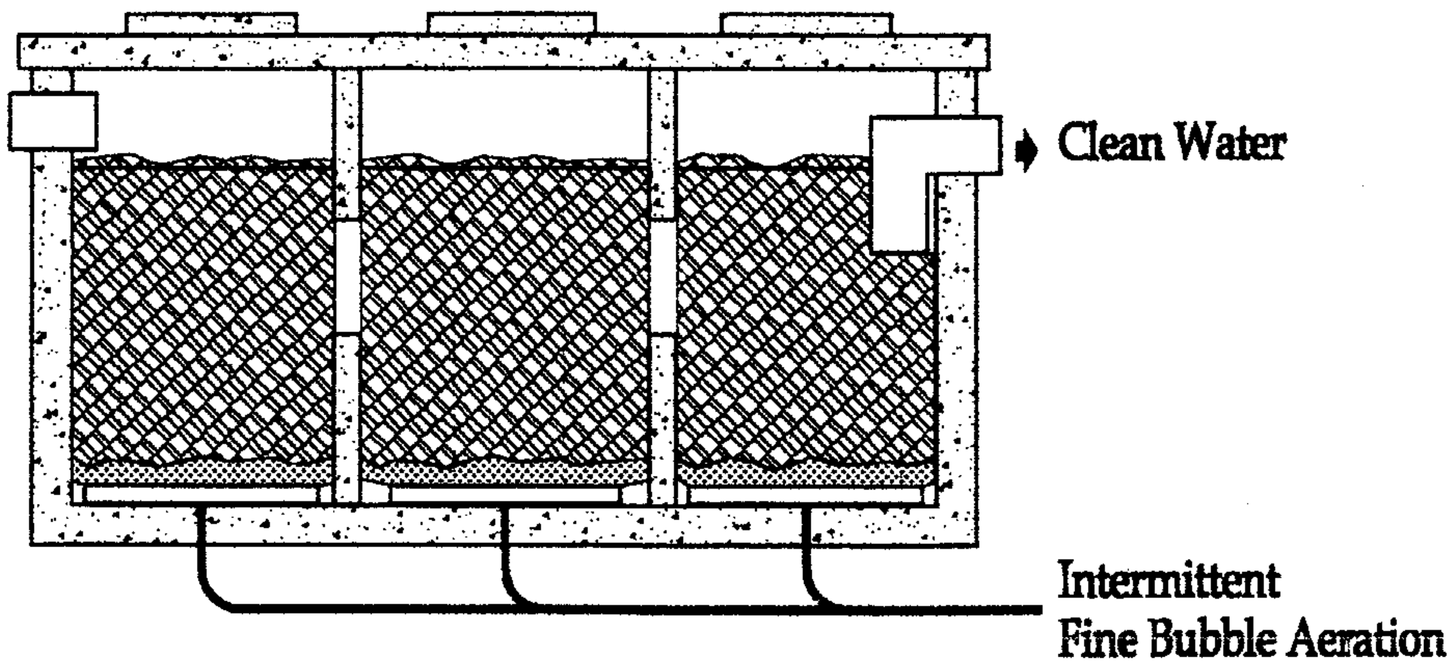
ZEOLYTE

Figure 3d  Bio Nest Ultra Pre-Etch

Settling Tank

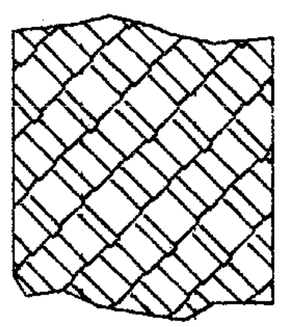


Bio Reactor



Settling Tank
For Solids Liquid Seperation
or
Filtration
or
Screw Press
or
Other Seperation Devices

Legend



Bio Nest
Bio Nest Plus
Bio Nest Ultra

Figure 2