1776 Mentor Avenue; Suite 400A
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SUPERBIOMEDIA – TECHNOLOGY SHEET

Water Warriors has developed a new biomedia, SuperBiomedia for improving the performance of currently operating bioreactors. In activated sludge systems, it offers all the benefits of fixed-biofilm systems, without any of the disadvantages of fixed media.

The use of biomedia in bioreactors and activated sludge treatment of wastewater has been documented to result in a stable process which responds well to influent fluctuations, and achieved improved treatment, in a small footprint. The primary goal of the treatment process is reduction of Biological Oxygen Demand (BOD) and nutrients in the wastewater, before the wastewater is discharged into the environment, such as the ground, creek, river or ocean. In the 1980s and 1990s, integration of this media began with conventional activated sludge plants, resulting in the development of **I**ntegrated **F**ixed Film **A**ctivated **S**ludge (IFAS) plants.

Benefits

The main benefits of using media in an activated sludge plant or bioreactor are:

- Uses existing facility layout and equipment, economically improving performance of the plant;
- Operator friendly, reducing process performance variations;
- High rate of BOD removal at high suspended growth food-to-mass (F/M) ratios in activated sludge systems;
- Higher effective biomass within the system, which allowed biomass concentrations to be well above the 2,500 mg/L limit for conventional activated sludge plants, thereby increasing treatment rates of BOD;
- Enhanced nitrification/denitrification, especially during cold weather conditions, due to excess biomass present and presence of anoxic conditions within the interior of the biofilms;
- Resistant to organic and hydraulic shock loads, since the biomass was immobilized on the submerged media, it could not easily washout of the system, when the hydraulic load increased, and biofilms were less susceptible to influent BOD shocks;
- Improved process stability due to increase in bacterial population and stability of biofilms on the media, which enables the process to handle influent fluctuations;
- Improved **S**ludge **V**olume **I**ndex (SVI), which results in a more concentrated sludge in the clarifier, thereby improving the process operation;
- Reduced sludge production due to higher sludge retention times (SRT), due to the immobilization of biomass on the media, which did not leave the system; this significantly reduced the sludge handling, drying and landfilling that most plants had to use for sludge disposal;
- No changes to standard operating procedures; and
- Economically meets regulatory specific effluent discharge requirements

There are two kinds of submerged medias:

1. Suspended media – Sponge, extruded
2. Fixed media – web/rope, caged

Fixed media need to be installed, while suspended media are simply added to the activated sludge basin, and a screen is added to prevent the media from leaving with the treated water.

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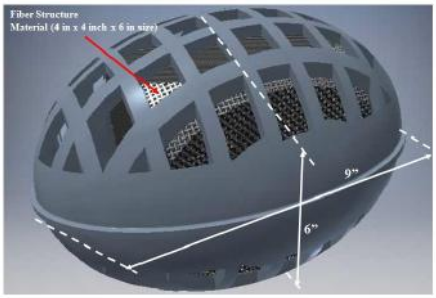
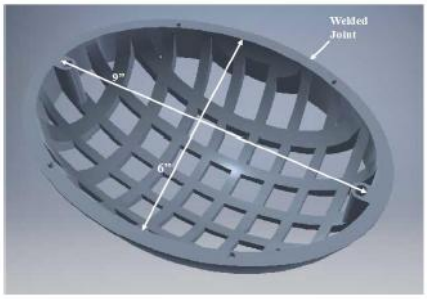
Major disadvantages with fixed media, which are also advantages of suspended media are:

- Fixed media need to be installed, which increases cost;
- Fixed media gets clogged, due to biomass growth
- Liquid by-passing occurs around fixed media
- Fixed media cannot be easily cleaned, without draining the basin

SuperBiomedia has a unique design consisting of the following:
A plastic, high impact resistant, high surface area plastic extruded media, which surrounds a high surface area open-cell foam . This media has bacterial population adhering to the plastic surface, which is very open to prevent clogging, with an anoxic, de-nitrifying zone within the open cell foam piece. The media characteristics are as follows:





Dimension:	6 in x 9 in.
Void fraction	92%
Density (polypro)	62.1 – 62.5 lb/ft3
Number of pieces	7/ft^3
Geometric surface area or (656 m^2/m^3)	200 ft^2/ft^3

Water Warriors' SuperBiomedia is capable of BOD, COD, TKN and Phosphorus removal simultaneously from the wastewater. It is fairly large and easy to contain within the bioreactor.

Competitive medias, and there are several, basically consist of plastic, extruded shapes, typically about ½ in or 10 mm in nominal size. Problems with this type of biomedia area: limited surface area, limited de-nitrification capability, no phosphorus removal, difficulty in retaining the media, and typically requiring screens, high volume content (60-70% by volume) and significantly higher costs. Since there are a large number of small pieces in the water, additional coarse bubble aeration is needed to move the media within the water.

The following table shows a comparison of the Water Warriors Biomedia with the conventional plastic media:

SUPERBIOMEDIA	COMPETITION
Plastic structure with foam	Extruded plastic pieces
Size: 6 in x 9 in oval shape	Less than 0.5 inch (~1 cm)
Area: 200 – 244 ft^2/ft^3 (656 -800 m^2/m^3) 7 pieces/ft^3	107 – 274 ft^2/ft^3 (350 – 900 m^2/m^3)
Biomedia moves due to normal aeration (fine bubble – coarse bubbles)	Coarse bubble aeration required to move the media
De-Nitrification Capability: Very Effective	Limited
Phosphorus Removal: Very Effective	Non-Existent
Biomedia Volume %: 20-30%	40 – 70%
Increase in Plant Capacity: 40 – 60%	20 – 30%
Cost: $58 - $66/ft^3 of media	> $80/ft^3
Improved Sludge Volume Index (SVI): Yes	No
Reduced Sludge Production: Yes	Limited reduction

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Biological Treatment Systems					
Attributes	Water Warriors SuperBiomedia	Activated Sludge	Engineered Plastic Fixed Film	Moving Bed Bioreactor (MBBR)	Membrane Bioreactor (MBR)
BOD Removal Efficiency	**High Rate of BOD removal due to increased biomass concentrations on porous foam material**	Medium	Medium to high	Medium to high	High
Space Requirement	**Smaller Reactor volume due to higher active biomass concentrations**	Large	Medium	Medium	Small
Sludge Generation	**Significantly lower sludge generation due to large sludge retention time**	High	Low to medium	Medium	Low
Capital Costs	**Moderate, since no equipment cost and facility change**	Low but dependent on land availability	Moderate	Moderate	High
Operating Costs	**Lower operating cost and lower waste sludge handling**	High	Medium	Medium	High
Maintenance Costs	**None, since SuperBiomedia does not have to be replaced**	Low	Low	Moderate	High

Application for Trickling Filters

Trickling filter is an ***attached growth process*** i.e. process in which microorganisms responsible for treatment are attached to an inert packing material. Packing material used in attached growth processes include rock, gravel, slag, sand, redwood, and a wide range of plastic and other synthetic materials.

The greater the surface area of plastic media, the greater the ability of the Trickling Filter to accomplish nitrification at higher volumetric loadings relative to rock media. SuperBiomedia filter media provides significantly more area for bacteria growth and therefore provide more bacteria "workmen." The media also provides better gas transfer due to the greater draft and higher void fraction, and less plugging. One of the greatest benefits of SuperBiomedia filter media is that they are light and can be constructed to greater depths. This increases the hydraulic load capacity and improves mass transfer. Rock filters, on the other hand, often have poor ventilation, particularly when water and air temperatures are similar or identical.

Another advantage of SuperBiomedia is the use of high surface area foam inside the plastic football-shape cage, which also provides higher water residence time, due to increased tortuosity of the foam material. The trickling filter water has to flow through a tortuous path inside the foam material, which increases not only contact with the high surface area biofilms but also increases water residence time within the filter material.

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