

Aquaculture
Components for Water Treatment

engineering for a better world

GEA Heat Exchangers



Clean water with low energy costs

Water treatment in land-based aquaculture

GEA 2H Water Technologies is one of the leading manufacturers of plastic fills and tube settlers for water treatment. For biofilters in recirculating systems (RAS), as used in land-based aquaculture, GEA 2H Water Technologies supplies structured packings BIOdek®, random media and TUBEdek® tube settlers.

As in every aquarium, there is a biological purification stage in land-based aquaculture so that the fishes' excretion products do not accumulate in the pool and thus poison it. Various GEA 2H Water Technologies fills are used in this biofilter. In the main treatment stage structured packings BIOdek® and random media provide the surface for bacteria which, through biochemical reactions, convert the poisonous excretion products into harmless substances. The purified water is fed back into the system and, as such, the requirement for fresh water is reduced.

Solids are removed in the pre-cleaning and post-treatment of the water. Here the GEA 2H TUBEdek® tube settlers bring about effective sedimentation.

By choosing the correct process and the most suitable fill an optimum treatment of the water can be achieved. In addition, costs can be saved through the possibility of reducing energy consumption and incorporating smaller filter stages.

GEA 2H Water Technologies offers a broad range of different fills, and technical support and advice is available to help in the selection of these. GEA 2H has many years of experience in the treatment of waste water using all forms of biofilm processes and thus has the necessary skills required for the design of the bioreactors.



Nitrification
GEA 2H BIOdek® and Random Media

Fish need clean water. Bacteria settle on the GEA 2H BIOdek® fills and on the random media and use oxygen to convert the fishes‘ excretion products into harmless substances.

In the nitrification process ammonium, which is poisonous for the fish, is reduced down to a less dangerous nitrate. An active biofilm which is not too thick and a good supply of oxygen and nutrients to the bacteria determine how well the water is purified.

Three different processes may be considered for this cleaning stage, in which the bacteria must be supplied with oxygen: the trickling filter process, the moving bed process or the submerged fixed bed.

Trickling Filters:
For trickling filters GEA 2H Water Technologies uses structured packings BIOdek® from the KFP series. The water is particularly well purified in their intersecting channels and very low discharge concentrations of BOD and ammonium are achieved.

Submerged Fixed Bed:
In submerged fixed beds the preferred choice is for BIOdek® packings from the KVP series. In their vertical, closed channels the flowing water and the rising air bubbles create an optimal thickness for the biofilm and supply it with oxygen and substrate.

Moving Bed Reactors:
In aerated moving bed reactors random media of the BCC, BCN and BCP types are used. In this process it must be additionally ensured that there is an intensive movement of the random media in the water so that the surplus sludge may dissolve and blockages be thus avoided. This movement of the random media is created by the injection of oxygen or air into the biofilter.

The correct choice of the random media, in terms of its structure, the protected surface and its weight density, ensures that, on the one hand, a good cleaning standard is achieved and at the same time energy for the aeration is saved.

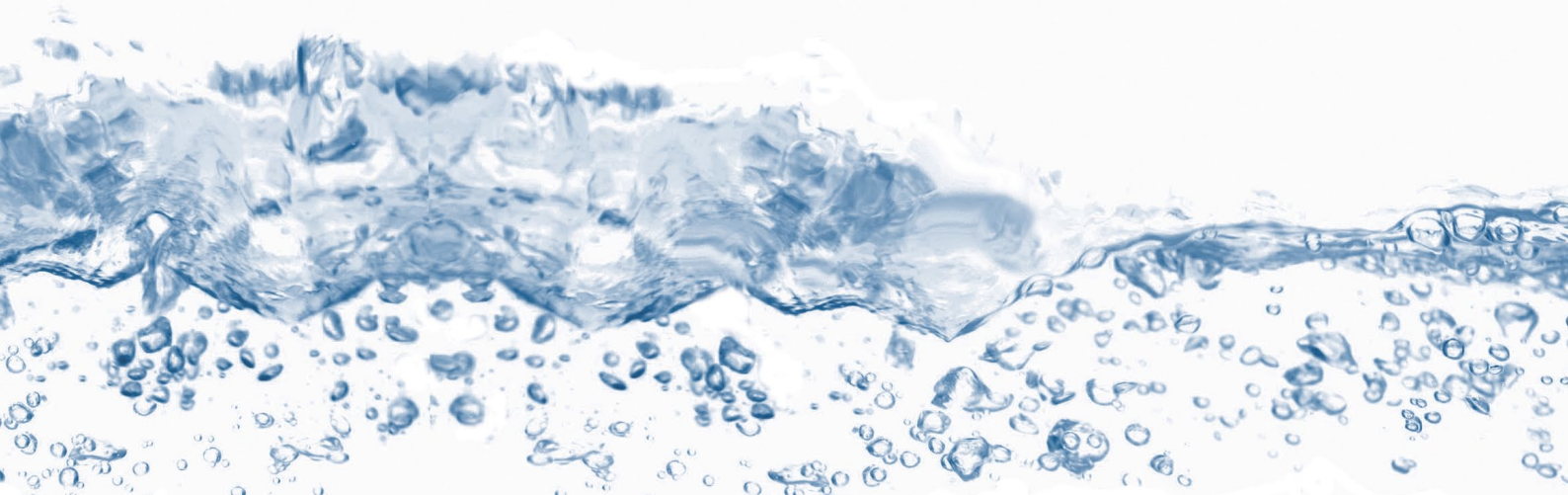
Advantages of the GEA 2H BIOdek® fills:
- Reliable biofilm process.
- Flexible sizes for adjustment to existing constructions.
- High aging resistance and thus a long service life.
- Very high mechanical stability and load bearing capacity.
- Easy cleaning.



Advantages of the GEA 2H random media:
- Our extensive range offers a suitable product for all demands.
- Random media with a large specific surface area increase the efficiency of existing equipment and save costs through smaller reactors.



In addition to the structured packings, the appropriate supporting structures and the random media, GEA 2H Water Technologies also provides advice concerning the selection of the process and the design and process optimization of the biofilter.



Denitrification
GEA 2H BIOdek® and Random Media

Denitrification is a process which takes place without oxygen. Microorganisms remove the nitrate which is still present in the water. This purification stage is required if the nitrate content of the water is still too high after nitrification.

Very high recirculation rates lead to a high concentration of nitrate. Harmful nitrate concentrations can also be efficiently removed using microorganisms growing on GEA 2H fills. As surplus sludge is created in denitrification, its removal is a major factor in the selection of the process. Only submerged fixed bed and moving bed reactors are used for denitrification.

For the fixed bed we recommend GEA 2H BIOdek® fills of the KVP type which have a large surface area and can be rinsed thoroughly.

The floating bed for denitrification can, as for nitrification, be fitted with GEA 2H BCC, BCN or BCP random media.

Sedimentation
Pre- and post-treatment with TUBEdek® tube settlers

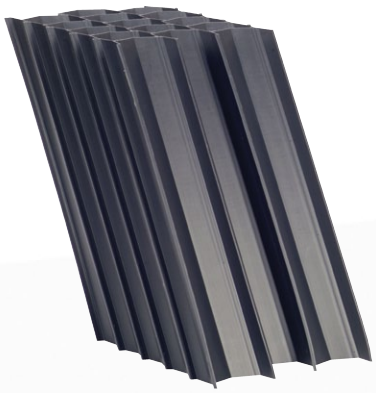
Larger volumes of solids which overload filters can be removed using GEA TUBEdek® tube settlers.

The removal of solids in recirculation systems generally takes place in filter stages, and consists, for example, of a flotation and a rotary drum filter.

The use of TUBEdek® tube settlers is particularly recommended in places where these filter stages very often have to be back-washed due to volumes of solids being too high. Their large number of sedimentation planes, located one above the other, enables smaller tanks to be constructed, thus lowering overall costs.

Advantages of the GEA 2H TUBEdek® tube settlers:

- High-quality materials, permitted for use in drinking water.
- Quick and simple assembly on-site.
- Efficient lamella design.
- High stability simplifies assembly, cleaning and maintenance of the equipment.
- Equidistant channel shape ensures complete separation.
- Optimum hydraulic values give a high level of effectiveness (low Reynolds numbers).
- The special support system prevents sludge deposits and turbulence.
- The sedimentation area can be expanded by up to 15 times.
- V-shaped channels let the separated sludge slide off more easily.





GEA 2H Water Technologies products in Recirculation Aquaculture Systems (RAS)

Treatment of the process water

Pre-treatment			Here GEA 2H components are used:
Mechanical treatment / removal of solids	by	Filtration Flotation Sedimentation	**TUBEdek®** Tube settlers
Aerobic water treatment			
Biological treatment / reduction of organic substances and nitrification	by	Submerged Fixed Bed Trickling Filter Moving Bed	Structured Packings: **BIOdek®** Cross-fluted fills **BIOdek®** Vertical flow fills **Random Media**
Anoxic water treatment			
Biological treatment / denitrification	by	Submerged Fixed Bed Moving Bed	
Final treatment			
Removal of solids and recirculation of the process water into the fish tanks	by	Sedimentation Filtration	**TUBEdek®** Tube settlers
CO_2-removal	by	Strippers	**BIOdek®** Vertical flow fills
Oxygenation, partly disinfection through UV / ozone and recirculation of the water into the system			

Application example of a biofilter with random media from GEA 2H Water Technologies



Fish tanks in a recirculation system



Random media in the biofilter
You can see how the random media move around, which is important for an even growth of biofilm and the removal of surplus sludge.

Excellence Passion Integrity Responsibility GEA-versity

GEA Group is a global mechanical engineering company with multi-billion euro sales and operations in more than 50 countries. Founded in 1881, the company is one of the largest providers of innovative equipment and process technology. GEA Group is listed in the STOXX Europe 600 Index.

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Binding specifications, especially pertaining to performance and suitability for specific applications, can only be made within the framework of concrete inquiries.

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GEA Heat Exchangers

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