

Biofilmfiltration

BFF Biological Film Filtration technology

Challenge

Today's demands for protection and preservation of water resources call for advanced wastewater treatment systems.

Using classical activated sludge systems nutrient removal can only be achieved in very large area demanding wastewater treatment plants - WWTP.

Natural filter-media like expanded clay with optimum surface properties for growth of biofilm and reasonable cost are applied.

Wastewater Treatment with Biological Film Filtration

Biofilmfiltration

The biological film up-flow filtration - **BFF** - can be used in its single stage design as an

- + additional treatment step for enhancing existing WWTPs or in its multistage design as
- + alternative replacing the conventional WWTP technology.

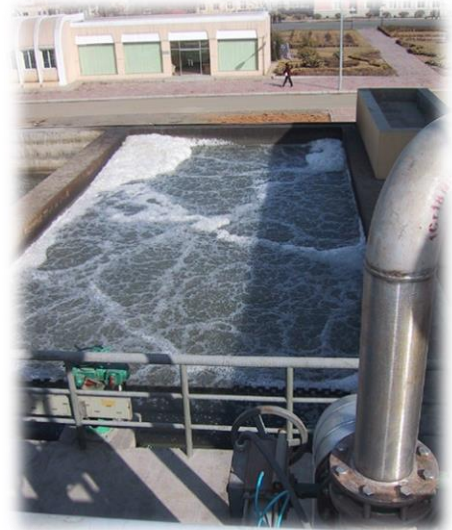
Process applications

- » SS removal
- » COD/BOD reduction
- » Nitrification/
Denitrification
- » Phosphorus removal
- » AOX elimination
- » Wastewater recycling



The general benefits of BFF technology are:

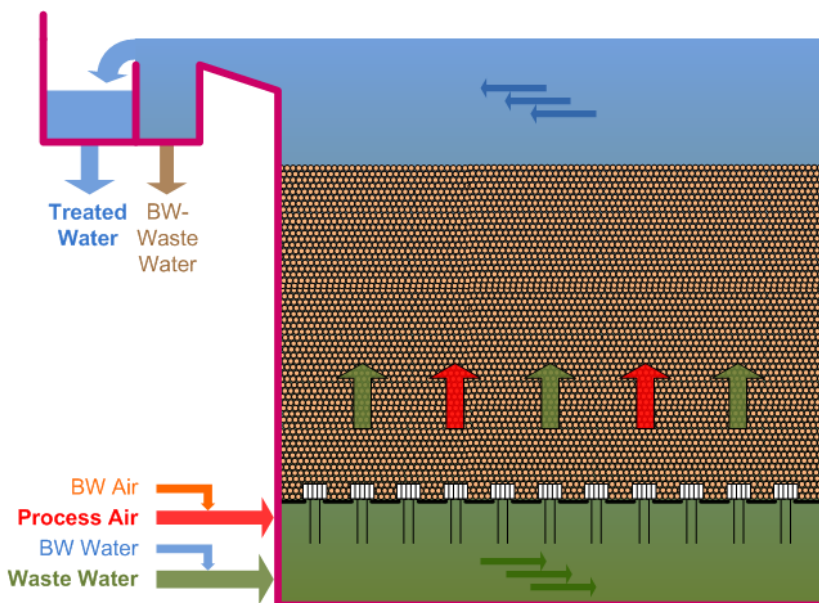
- ✓ High product water quality
- ✓ Very low area demand
- ✓ Fully covered, compact systems
- ✓ Simultaneous removal of biological and organic load as well as suspended solids
- ✓ High process stability and fully automated plants
- ✓ Well, adapted to cold water temperatures
- ✓ Low operation costs due to high O₂-transfer efficiency
- ✓ Low investment cost compared with achievable standards



Biofilter in operation

BFF Technology

In this technology, the microorganisms which are responsible for biological degradation of the pollutants, grow on a natural, granular filtration material where they form a so called “bio film”.



The BFF-concept works in up flow mode for both water and process air. This means that wastewater and process air, providing the necessary oxygen for the microorganisms are flowing in a co-current stream from the bottom to the top of the filter.

Raw wastewater is introduced underneath the nozzle floor into the filter. In aerated filters, process air is added in addition as oxygen source for degradation. Both water and air cross the nozzles installed in the nozzle floor, which have the function to evenly distribute both across the filter section. After crossing the nozzles, water and air flow through the pore volume of the filter media above.

This concept has several major advantages:

- » No clogging of the filter by entrapped air inside the pore volume
- » No clogging of the filter by entrapped N₂ gas (produced during denitrification) inside the pore volume
- » High O₂ transfer and highest O₂ concentrations where they are needed most, namely at the raw water influent
- » No compression of the filter media at increasing head loss inside the filter, as it is the case for floating media



Air injection

The injection of process air together with water is realised by specifically designed nozzle system, which is installed in the nozzle floor. These nozzles give very high O₂ transfer efficiencies.

Therefore, no additional process air distribution system is required.



Nozzle Floor

Biomass

Biomass produced during the process of biological degradation as suspended solids contained in the inflowing wastewater is accumulated in the filter bed in the course of time.

This biomass and the suspended solids have to be washed out regularly in order to maintain proper operation of the filters.

Therefore, the BFF system operates in two modes.

During the **filtration mode**, pollutants are removed by the filter and produce solids trapped inside the filter.

After the depletion of retention capacity, the filter passes into the **backwash mode** at regular time intervals, to remove accumulated solids.

Wastewater Recycling

Sewage treatment plant effluents can be used as irrigation water or process water for industrial applications if it is additionally treated.

BFF technology can here fore be used perfectly, as these plants usually are forced by regulation for additional BOD, COD and N removal as well as for removal of suspended solids.

BFF application

Abbreviation & term definition		
BFF		Biological film filter E+B Definition <i>Literature: Biological aerated filter, it would exclude the pre DN and post DN</i>
BFF C		aerated BFF to reduce the C a BOD, COD reduction without Nitrification
BFF CN	CN	aerated BFF to eliminating the rest of C and for the Nitrification
BFF N	N	aerated BFF for the Nitrification (the term is not used as always a rest of BOD has to be removed)
BFF pre DN	Pre DN	Anoxic BFF for the C- reduction and for the Denitrification, downstream of the BFF CN
BFF post DN	Post DN	Anoxic BFF for Denitrification, upstream of the BFF CN