

## Basic Knowledge

# Biological Water Treatment



## Microorganisms clean wastewater

The aim of biological wastewater treatment is the elimination of organic, biodegradable materials. This elimination is carried out by microorganisms which use organic substances as a source of food. This biodegradation also causes a conversion of materials to take place. This is a significant advantage that biological processes have over other methods. In adsorption, for example, it is simply a matter of displacing the substances to be removed from the wastewater onto the adsorbent (mass transport). Biodegradation may occur under either aerobic or anaerobic conditions. A number of methods are available in order to bring the wastewater to be treated into contact with the microorganisms (biomass). Regardless of whether the degradation is carried out aerobically or anaerobically, a distinction is made between the following two principles:

### Suspended biomass

The biomass is present in the form of small flocs (activated sludge). The activated sludge is suspended in the wastewater.

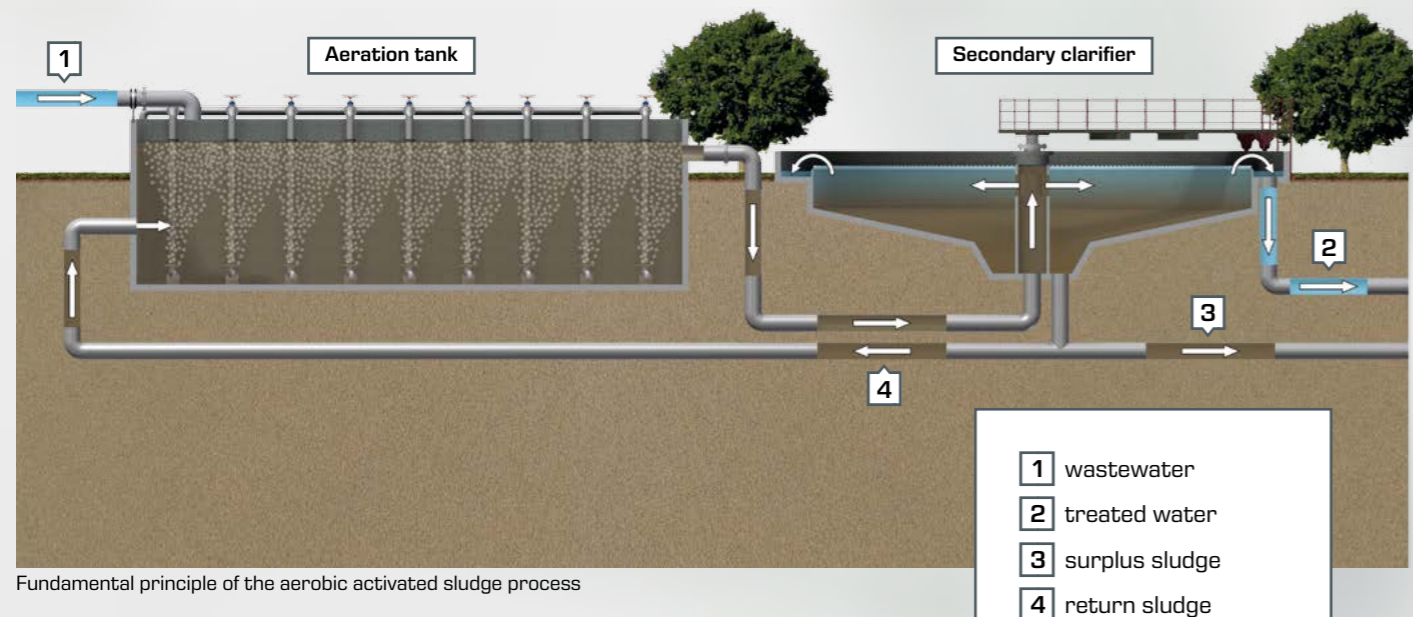
### Sessile biomass

The biomass is fixed on surfaces of solid bodies as a biofilm. The wastewater runs away over the biofilm as a thin film.

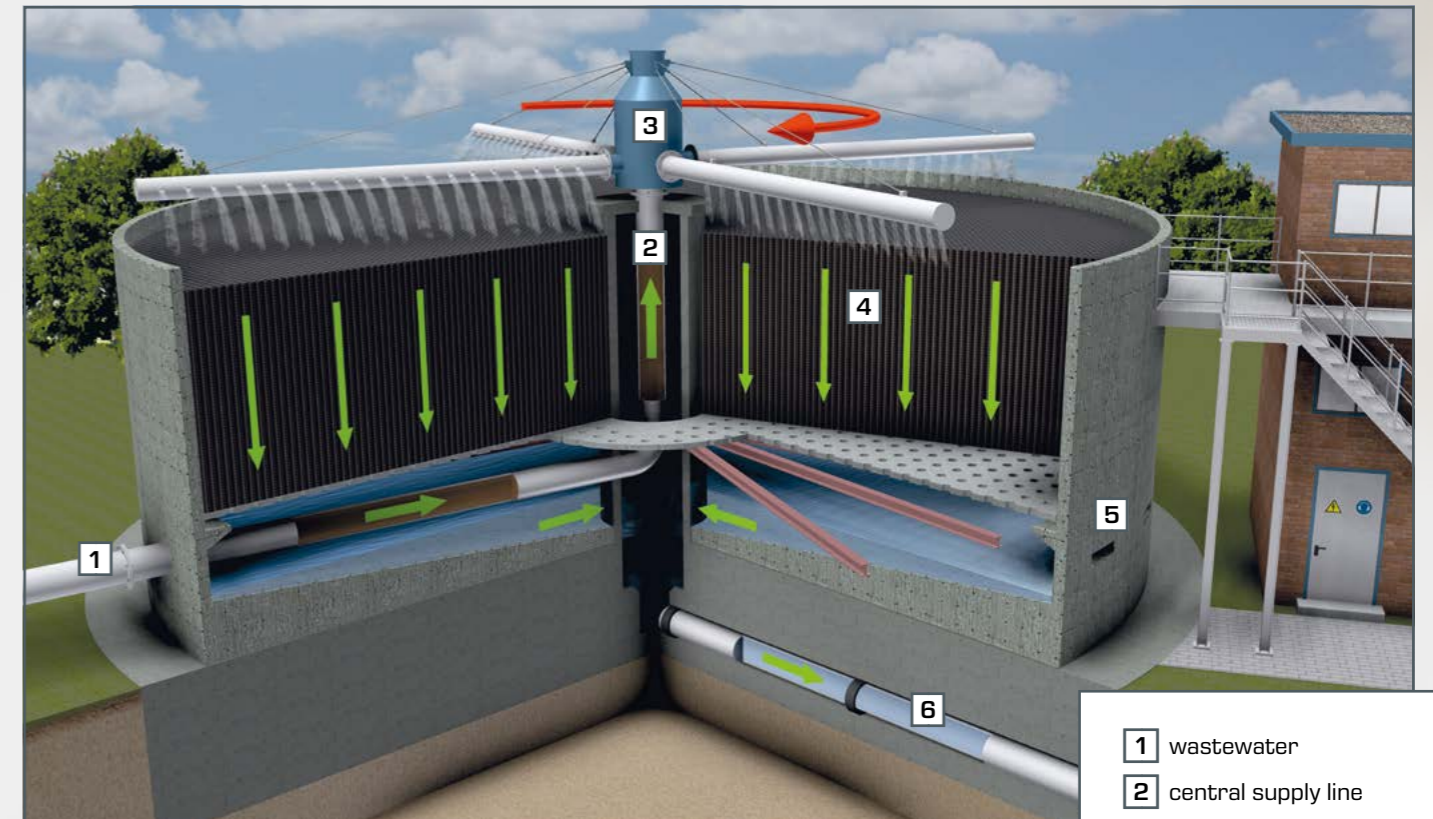
## Aerobic activated sludge process

The aerobic activated sludge process is the most widely used biological wastewater treatment process. The biomass is a suspended activated sludge in the aeration basin through which the wastewater flows continuously. The wastewater is also aerated here in order to supply the microorganisms with oxygen. Biomass (activated sludge) also continuously leaves

the aeration tank along with the wastewater flow. Therefore, the discharged activated sludge must be separated from the treated wastewater in a secondary clarifier (usually by sedimentation). Part of it is fed back into the aeration tank (return sludge). The non-recycled fraction is referred to as surplus sludge and is a waste product of this process.



Fundamental principle of the aerobic activated sludge process



Design and function of a trickling filter

- 1 wastewater
- 2 central supply line
- 3 rotary distributor
- 4 fixed bed with biofilm
- 5 aeration openings
- 6 treated water

## Trickling filters

Trickling filters are an aerobic biofilm process. In this process, a rotary sprinkler spreads the wastewater evenly over a fixed bed. The fixed bed consists of special support material on the surface of which a thin layer of microorganisms (biofilm) forms. While the wastewater trickles through the fixed bed, the microorganisms clean the wastewater by biological processes. Trickling filters usually have an open design and offer lateral openings below the fixed bed. This allows aeration by natural convection (chimney effect). Energy-intensive artificial aeration, such as that used in the activated sludge process, is not necessary.

## Anaerobic processes

Anaerobic processes are particularly suitable for industrial wastewater, which is often heavily contaminated with organic substances (e.g. food industry). There is a variety of different processes or reactor types available for this purpose. Under anaerobic conditions, the degradation of organic matter creates biogas, which consists mainly of methane. Biogas can be used, for example, with combined heat and power plants to generate electricity. This is a positive secondary aspect of anaerobic wastewater treatment and clearly illustrates the close interconnection of issues from the field of energy and environment.