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Removal of micropollutants in the Böblingen-Sindelfingen wastewater treatment plant

Motive and objective

The Böblingen-Sindelfingen wastewater treatment plant discharges the treated water into the Schwippe river, which is characterised by a relatively low water flow. Depending on the flow situation, the proportion of the wastewater discharged by the wastewater treatment plant constitutes more than 80 per cent of the water body. In order to sustainably improve the water quality in the Schwippe river, the wastewater treatment plant was extended by a contact filter as early as in 2007, which reduces the amount of particulate matter and phosphorus discharged into the river. Since October 2011, the Zweckverband Kläranlage Böblingen-Sindelfingen (Böblingen-Sindelfingen Wastewater Treatment Plant Association) has been operating a treatment stage that eliminates micropollutants. These two measures have been implemented on a voluntary basis.

Process technology used

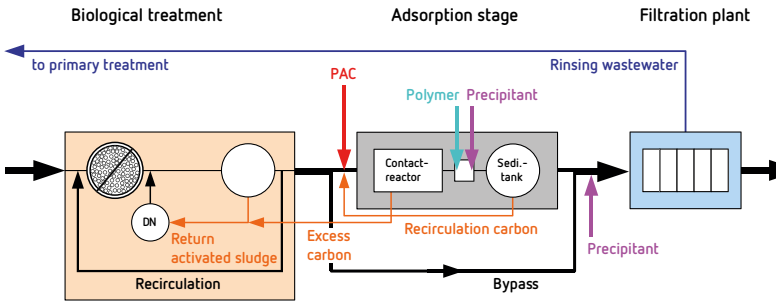

Figure 1: Integration of the adsorption stage into the current process

In the Böblingen-Sindelfingen wastewater treatment plant, micropollutants are eliminated using powder activated carbon (PAC).

Specifications of the wastewater treatment plant

Treatment capacity and load

Treatment capacity	250,000 PE
Load *	141,200 PE

Inflow volumes

Max. in rainy weather	2,000 l/s
Biologically treated wastewater volume p.a.	14.5 million m^3

Former process technology

Mechanical treatment	Screen, grit chamber, grease trap and primary sedimentation tank
Biological treatment	Trickling filter system with downstream denitrification system
Filtration plant	Two-layer filter with support layer (0.20 m basalt, 0.40 m quartz sand, 1.40 m anthracite)

* Mean value of 2010 to 2012; determined on the basis of the mean COD value measured in the inlet and the annual wastewater volume.

Process technology used

Essentially, adsorptive treatment of the wastewater succeeds the biological treatment and precedes the existing filtration process in an adsorption stage consisting of a contact reactor and a downstream sedimentation tank (➔ Figure 1). In order to improve the integration of the auxiliary substances (polymer and precipitant), which are necessary for the separation of the PAC, a mixing (V = 12 m3) and an aggregation tank (V = 120 m3) have been constructed between the contact reactor and the sedimentation tank. Due to limited space conditions, the adsorption stage has been constructed as a compact structure with an external circular contact reactor and an internal sedimentation tank (➔ Figure 2).

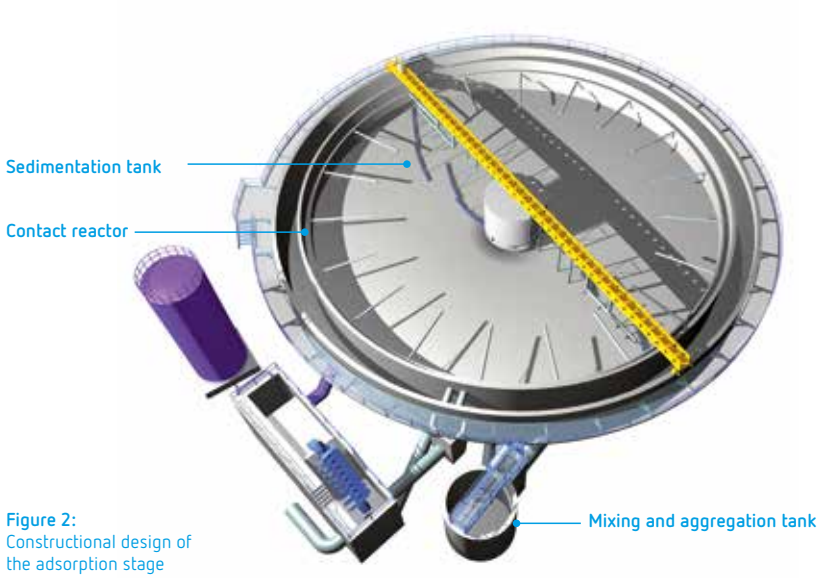

Figure 2:
Constructional design of the adsorption stage

In order to further utilise the adsorbent, the partially loaded PAC is returned to the denitrification tank as excess carbon together with the return activated sludge of the biological treatment stage.

Being designed as a partial flow treatment, the adsorption stage is able to treat a maximum wastewater volume of 1,000 L/s. However, this dimensioning, which is able to process only 50 per cent of the maximum inflow of combined wastewater, allows for the additional treatment of approximately 90 per cent of the total annual wastewater volume in the adsorption stage.

Operator contact

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Dimensioning of the adsorption stage

Maximum treatable volumetric flow rate	$Q_{max, ads.}$ = 1,000 L/s

Contact reactor

Volume	V_{CR} = 1,800 m³
Minimum retention time for dimensioning inflow	$t_{R, CR}$ = 30 min

Sedimentation tank

Volume	$V_{sedi.}$ = 7,200 m³
Surface area	$A_{sedi.}$ = 1,800 m²
Minimum retention time for dimensioning inflow	$t_{R, sedi.}$ = 2 h
Maximum surface load for dimensioning inflow	$q_{R, sedi.}$ = 2.0 m/h

References

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