KOMPETENZZENTRUM SPURENSTOFFE-BW

Removal of micropollutants in the Hechingen wastewater treatment plant

Motive and objective

In the Hechingen wastewater treatment plant, powder activated carbon (PAC) has been used for tertiary wastewater treatment since 1999. The initial objective of using PAC was to withdraw dye from the wastewater, which was extensively discharged by the textile finishing industry, and to treat landfill leachate, which was discharged untreat from a local landfill site.

Due to the economic developments in the textile industry, it is no longer necessary to withdraw the dye from the wastewater. The limiting values of the effluent from for the local landfill site are now being complied with. Due to the 'no deterioration' concept, PAC is therefore currently used with the general aim of reducing the concentration of micropollutants.

The quality of the treatment achieved with the process technology used is primarily measured on the basis of the COD and AOX sum parameters. Owing to the development of more refined measurement methods in recent years, which can be used to quantify individual micropollutant concentration levels, a reduction in micropollutant concentration levels has meanwhile been proven in the meantime.

Process technology used

The Hechingen wastewater treatment plant uses the AFF process, which has been developed at Stuttgart University and is characterised by a combination of PAC adsorption, chemical flocculation and filtration.

Adsorptive treatment of the wastewater primarily succeeds the biological treatment in a separate two-lane process stage consisting of one contact tank in each lane, which again is subdivided into three individual tanks of difference sizes, as well as a downstream sedimentation tank (➔ Figure 1).

Specifications of the wastewater treatment plant

Treatment capacity and load

Treatment capacity	57,200 PE
Load*	35,200 PE

Inflow volumes

Max. in rainy weather	400 L/s
Biologically treated wastewater volume p.a.	4 million m³

Former process technology

Mechanical treatment	Coarse rack, screen, grit chamber, grease trap, primary sedimentation tank
Biological treatment	One-stage aeration plant

* Mean value of 2013 to 2015; determined on the basis of the mean COD value measured in the inlet and the annual wastewater volume.

Process technology used

The effluent of the secondary sedimentation tank is initially distributed to the two lanes via a raw water tank where fresh PAC is added before the effluent enters the contact tank. After the wastewater has passed the ›reaction tank‹ (V = 200 m³ each), precipitant is initially added in the ›destabilisation tank‹ (V = 13 m³ each), followed by flocculant in the form of polymers in the ›flocculation tank‹ (V = 110 m³ each) in order to be able to separate the carbon sludge in the sedimentation tank. The sedimentation tank, however, is not designed as a classic sedimentation tank. Due to its small size, it is additionally equipped with lamella separators in order to enlarge the effective surface area. For reuse of the adsorbent, the partially loaded PAC is returned to the biological treatment stage as excess carbon.

Furthermore, the sand filter, which had to be newly installed at the time, also constitutes a component of the AFF plant, which is dimensioned for the total flow rate. The sand filter is designed as a two-layer filter. The filter material had to be replaced in 2008 due to flood damage. At present, the filter bed consists of 0.75 m filter sand and 1.0 m hydroanthracite.

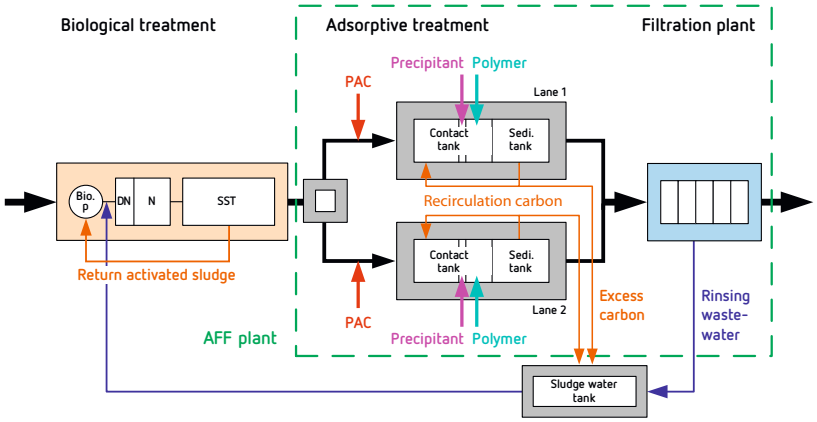

Figure 1 Arrangement and structure of the AFF plant

Dimensioning of the adsorption stage of the AFF plant

Maximum treatable volumetric flow rate	$Q_{max, ads.} = 400$ L/s

Contact tank

Total volume	$V_{CT} = 2 \times 323$ m³
Minimum retention time for design flow	$t_{RT, CT} = 27$ min

Sedimentation tank

Volume	$V_{sedi.} = 2 \times 230$ m³
Actual surface area	$A_{sedi.} = 2 \times 49$ m²
Effective surface area	$A_{effective, L} = 2 \times 485$ m²
Minimum retention time for design flow	$t_{RT, sedi.} = 19$ min
Maximum surface load for design flow	$q_{RT, sedi., L} = 1.5$ m/h

References

Hauck, T.; Kapp, H. (2006):
Investigations regarding the optimisation of PAC use in the AFF plant of the Hechingen wastewater treatment plant. Research report by order of the Zollernalbkreis district administration (unpublished).

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