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Removal of micropollutants in the Albstadt-Ebingen wastewater treatment plant

Motive and objective

In the Albstadt-Ebingen wastewater treatment plant, powder activated carbon (PAC) has been used for tertiary wastewater treatment since 1992. The initial objective of using powder activated carbon (PAC) was to withdraw dye from the wastewater, which was extensively discharged by the textile finishing industry. These dyes could not be withdrawn by the mechanical-biological wastewater treatment alone and occasionally led to strong discolouration of the Schmiecha river.

Micropollutants have also been removed since the process technology used has been put into operation. However, the removal of micropollutants could not be measured until the development of more refined measurement methods in recent years. Today, the concentration of micropollutants can be quantified at very low concentration levels.

Process technology used

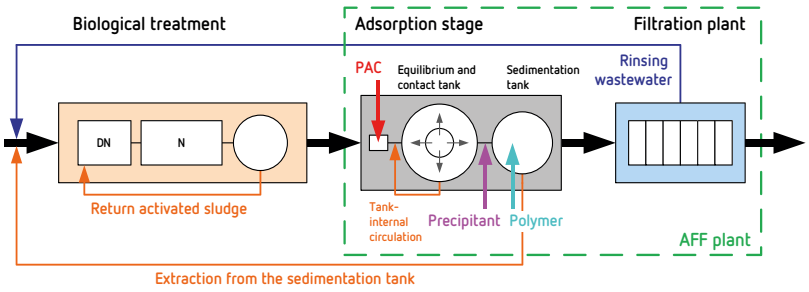

Figure 1: Integration of the AFF system into the current process

The Albstadt-Ebingen 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.

Specifications of the wastewater treatment plant

Treatment capacity and load

Treatment capacity	125,000 PE
Load *	58,100 PE

Inflow volumes

Max. in rainy weather	980 L/s
Biologically treated wastewater volume p.a	12.7 million m³

Former process technology

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

* 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

Adsorptive treatment of the wastewater primarily succeeds the biological treatment in a separate process stage consisting of equilibrium and contact tank as well as a downstream sedimentation tank (➔ Figures 1 and 2). The process technology was installed after the corresponding redesign and conversion of the existing tanks, i.e. an accelerator and a cyclator, which were no longer in use.
The wastewater that has been mixed with PAC initially passes an inverted siphon and subsequently enters the inner area of the equilibrium and contact tank before being directed to the outer area through multiple openings in the upper part of the installed separator. As an option, a part of the wastewater may be returned to the inner area while the remaining wastewater is subsequently discharged into the sedimentation tank. The carbon sludge that has settled in the sedimentation tank is then returned to the inlet of the biological treatment stage for further loading of the adsorbent (➔ Figure 3).
Furthermore, the grit chamber, 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 grit chamber is designed as a two-layer filter system with a support layer (0.25 m gravel, 0.60 m quartz sand, 0.90 m hydroanthracite).

Figure 2: Sedimentation tank (former cyclator)

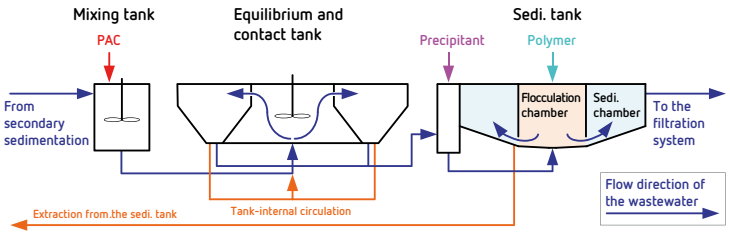

Figure 3: Flow direction of the wastewater within the adsorption stage

Operator contact

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Specifications of the adsorption stage of the AFF plant

Maximum treatable volumetric flow rate	$Q_{max, ads.}$ = 980 L/s

Equilibrium and contact tank

Total volume	$V_{EaC.}$ = 4,630 m³
Minimum retention time for dimensioning inflow	$t_{R, EaC.}$ = 1.3 h

Sedimentation tank

Total volume	V_{sedi} = 2,200 m³
Sedimentation chamber volume	$V_{sedi. ch.}$ = 1,750 m³
Surface area of the sedimentation chamber	$A_{sedi. ch.}$ = 525 m²
Minimum retention time for dimensioning inflow	$t_{R, sedi.}$ = 37 min
Maximum surface load for dimensioning inflow	$q_{R, sedi.}$ = 6.7 m/h

References

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Tertiary textile wastewater treatment using adsorption, flocculation and filtration in the municipal wastewater treatment plant in Albstadt). Final report on the research and development project (Gesch.Z.: II 1.1-20441-1/3), Stuttgart University.

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Persistent substances with oestrogen-like effects in wastewater: Identification, quantification and estimation of the risk potential caused by the combination of HPLS/MS and in-vitro biotesting (e-screen assay)). Final report (part 1) by order of the Ministry of the Environment and Traffic Baden-Württemberg.