Biological wastewater treatment

Zeitz Industrial Area / Germany

Wastewater streams from the production of adipic acid containing high loads of nitrate

Equalising tanks, heavy metal removal and pH - adjustment are the process steps for pretreatment of the industrial wastewater streams. For joint biological treatment with other streams, such as sanitary wastewater, two Bamag Deep Tanks are operated in parallel to ensure consistent compliance with regulatory discharge limits. The Bamag Deep Tanks were designed to meet the specific requirements of the industrial streams offering zones for denitrification and carbon removal. Biological treatment is followed by sandfiltration for further improvement of effluent figures before the treated water is discharged to the river Weiße Elster.

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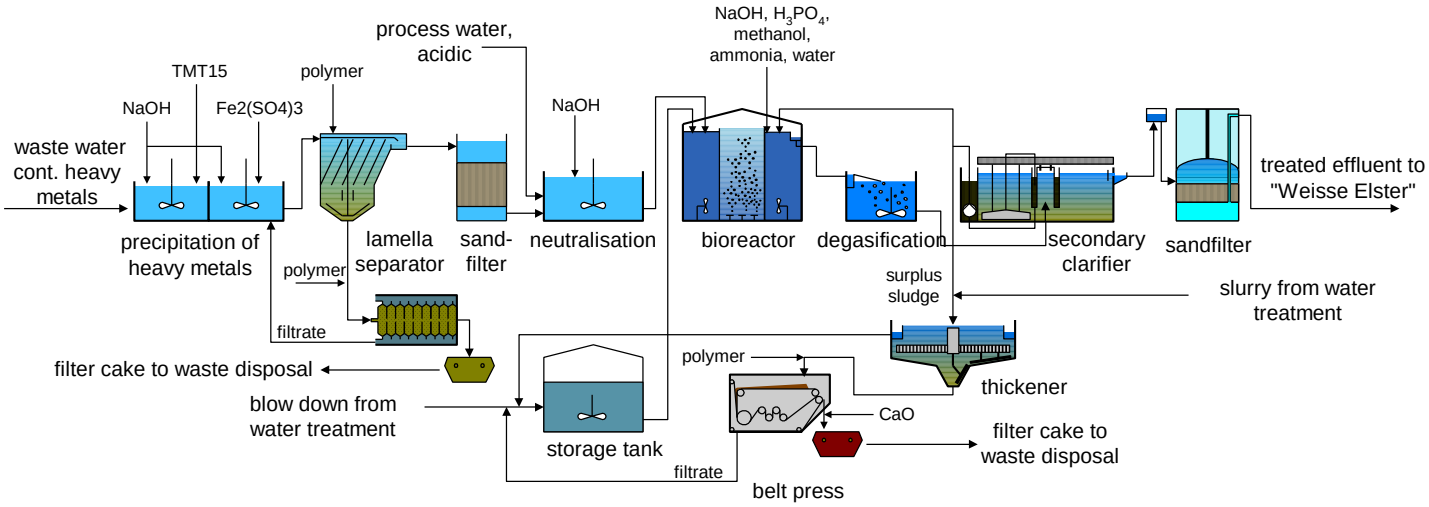

1. Objective

Treatment of wastewater from a process producing adipic acid. The waste water contains high amounts of nitrates and heavy metals. Along with the treatment of the process water, also sanitary sewage and blow downs from a water treatment plant are treated.

Main design parameters are:

- Industrial waste water before pre-treatment

total	40 m³/h

Without heavy metals (1)

DOC	800 mg/l
HNO_3	3.000 mg/l
HNO_2	1.200 mg/l
pH-Value	1-3

Containing heavy metals (2)

DOC	4.000 mg/l
HNO_3	9.000 mg/l
Copper	bis 300 mg/l
pH-Value	0-1

- Feed to the biotreatment stage

Flow	up to 165 m³/h
COD	1.200 mg/l
HNO_3	2.000 mg/l
HNO_2	700 mg/l

- Final effluent requirements

COD	115 mg/l
Total N	50 mg/l
Phenolindex	0,15 mg/l
AOX	0,49 mg/l

2. Plant concept

- **Process steps**

Pre-treatment of industrial wastewater
Neutralisation, precipitation of heavy metals by dosing of NaOH, Ferricsulfate and if needed TMT-15.

Central wastewater treatment plant:
Bamag deep tank bioreactor (2 lines, operating in parallel) with denitrification and C-removal, degasification tank, secondary clarifier, sand filter with automatic back washing, sludge thickening, belt filter press, post conditioning of sludge with quick lime.

- **Brief description**

Pre-treatment of the industrial waste water:
Precipitation of heavy metals from stream (2) as hydroxide respectively ferricvanadate. If needed TMT-15 is dosed as well. Separation of precipitated compounds by sedimentation in a lamella separator, followed by sludge dewatering in a filterpress. The effluent from the lamella separator is transferred along with stream (1) to the neutralisation tank where the pH is adjusted according to the process requirements.

Central wastewater treatment plant:
The biological treatment of the pre-treated industrial wastewater along with the sanitary water and the blow downs from the water treatment is accomplished in two bio reactors, operating in parallel. The reactors consist of a de-nitrification zone (outer zone) and the aerated inner zone where COD removal takes place. To increase the COD/nitrate-nitrite ratio to the extent required to maintain a low NO_3/ NO_2 level, methanol has to be dosed. To avoid flotation of activated sludge in the clarifiers a flocculation/degasification tank is installed between bio reactors and secondary clarifiers. Prior to be discharged to the river Weisse Elster the effluent from the clarifiers is polished by two sandfilters with automatic backwash, working in parallel.
Surplus sludge from the biological treatment is discharged to a thickener along with slurry from the water treatment. The thickened sludge is de-watered with a belt press to values well above 22 % solids concentration. To further increase the solids concentration to values above 35 %, quick lime is added. The sludge has to be disposed off at an adequate disposal area.

3. Characteristic plant data

2 Bamag deep tank bioreactors
Each tank:

Ø	13 m
Depth of water	11 m
Total volume	1400 m³
Denitrification zone	800 m³
COD removal zone	600 m³

2 secondary clarifiers with suction scrapers, each:

Ø	13,5 m
Clarification area	143 m²
Depth of water	3,5 m

4. Operating experience

As a huge amount of seeding sludge was available the process equilibrium could be reached within a few weeks. Between April and July 2002 the final effluent values were analysed:

COD	50 mg/l
NO_3-N	4 mg/l
Phenolindex	<0,01 mg/l
AOX	0,05 mg/l

It has to be highlighted that despite of strong variation in the quality of the incoming waste water, sometimes overriding feed specifications by far, the plant has at all times delivered effluents within the specified data. At the same time the process showed to be completely stable.

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