Energy efficiency

WWTP Berlin

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Electricity production

From digester gas, steam and wind 90 GWh of electricity were produced in 2016.
Energy efficiency – WWTP Berlin

WWTP Waßmannsdorf - bivalent zone

Process optimisation

source: Berliner Wasserbetriebe
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**WWTP Waßmannsdorf - bivalent zone**

Process optimisation

- anaerobic
- anoxic + bivalent 50 %
- aerobic 50 %
- degassing

Inflow

| board | mixers |

Oxygen, NOx, NH4

II

III

NOx, NH4

P

O2, T

O2, T

NOx, NH4

Q

RS

Reci
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**WWTP Waßmannsdorf - bivalent zone**

**Effect on energy demand**

- Ø 3,000 m³/h

≈ - 500,000 kWh/year/line
WWTP Waßmannsdorf - bivalent zone
Mixing
Energy efficiency – WWTP Berlin

**WWTP Waßmannsdorf - bivalent zone**

**TSS profile measurement**  
(SVI ≈ 60 ml/g)

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**short term aeration with**  
30 minutes breaks  
w/o sedimentation

SVI tested:  
40 - 120 ml/g

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**Time TSS [mg/l]**

- **Depth [cm]**
- **Time**  
  - 12:05
  - 12:12
  - 12:20
  - 12:29

**Aeration break** 12:01 – 12:30
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**WWTP Waßmannsdorf - bivalent zone**

Mixing – effect on energy demand

$V_{\text{biv}} = 2,285 \text{ m}^3$

3 mixers a 3 kW = 9 kW
3.9 W/m³

Ø 60 - 80 m³/h air volume
21 Wh/m³ → 1.3 – 1.7 kW
0.55 – 0.74 W/m³

≈ - 65,000 kWh/year/line
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Oxygen probe
Contamination
Oxygen probe
Effects of dirty O$_2$ probes – less aeration

- measuring of too high O$_2$ concentrations
- feedback control results in minimum aeration
  → low aeration - danger of high ammonia

process probe (red) / real concentration (blue)
Oxygen probe
Effects of dirty O$_2$ probes – excess aeration

- measuring of too low O$_2$ concentrations
  → excess aeration - higher energy demand
Oxygen probe
Effects of dirty $O_2$ probes – excess aeration

$O_2$ measurement has a significant impact on the energy demand!

Worst case:
additional costs of 1,000 € / d / line due to dirty $O_2$ probes

Improvement of cleaning strategies for all WWTP
Optimisation of aeration

Fields

**Blower**
- model
- operating range
- efficiency
- adjustment

**Air distribution system**
- number of adjusted zones
- $O_2$-concentration
- control devices
- measurement accuracy

**Air diffusion system**
- material
- shape
- efficiency
- lifetime
Optimisation of aeration Evaluation

1. Comparability
   Relating to ODCND

2. Operation Evaluation
   Operating figure eOD
   (including all influencing factors)

3. Possible reasons for change of eOD
   a) eBlower,p
      Efficiency of blowers
   b) O2-concentration
      (TSS, recirculation,...)
      Efficiency of operation
   c) sSOTR
      Efficiency of aerators

Continious development and automation of operating figures calculation

► Evaluation of aeration efficiency with focus on indicating need for action
Optimisation of aeration
Database

Design
Equipment
Operating data
(year / month average)
Operating figures
Optimisation of aeration
Evaluation of pressure loss

pressure loss [mbar]
Optimisation of aeration
Aerator cleaning

Brandol 60 with hydrochloric acid (5%)
Optimisation of aeration

Cleaning Results

sSOTR (specific standard oxygen transfer rate $[gO_2/m^3/m_{\text{submersion depth}}]$)

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