

# New aspects of anaerobic-aerobic treatment of brewery wastewater



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## Aspectos del tratamiento anaerobico-aerobico del agua residual de cervecerías

### 1 Introduction

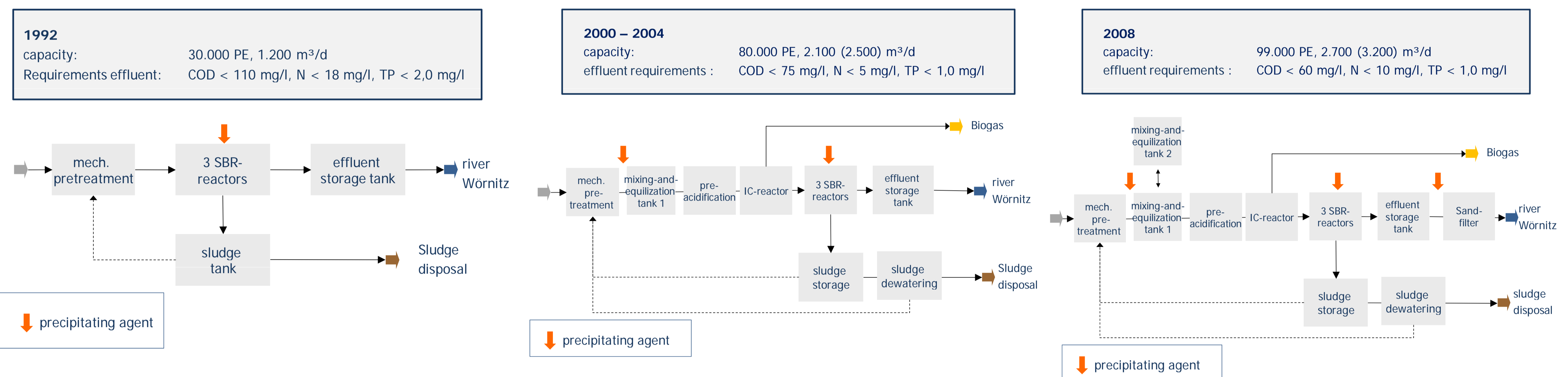
Nutrients in brewery wastewater are usually in the range of sludge incorporation: TN:BOD < 0,05 and TP:BOD < 0,02. During anaerobic treatment most of the organic compounds are degraded. In contrast, the nutrients remain. The ratio of total nitrogen and BOD can exceed 0,25 – a typical value for municipal wastewater. The ratio of total phosphorous to BOD can even reach 0,1 (!).

Parameter	Raw wastewater	Effluent anaerobic treatment		
COD <sub>total</sub>	mg/L	2.000 – 4.000	400 – 1.000	
TN	mg/L	30 – 100	25 – 90	
TP	mg/L	10 – 30	10 – 25	
TN:COD		1,5 – 3,0 %	6 – 10 %	N <sub>inc</sub> = 3,3 %
TP:COD		< 1 %	2,5 %	P <sub>inc</sub> = 0,7 %

Effluent requirements	Municipal wastewater 10.000 – 100.000 PE	Oettinger Brewery 99.000 PE	
TIN	mg/L	18	10
NH <sub>4</sub> -N	mg/L	10	1,0
TP	mg/L	2	1,0

The anaerobically treated brewery wastewater of Oettinger Bier GmbH, Oettingen Germany is discharged directly to the sensitive river Wörnitz. Very strict effluent requirements, below requirements for municipal wastewater, apply. Therefore, a secondary treatment for the reduction of the TN and TP is necessary.

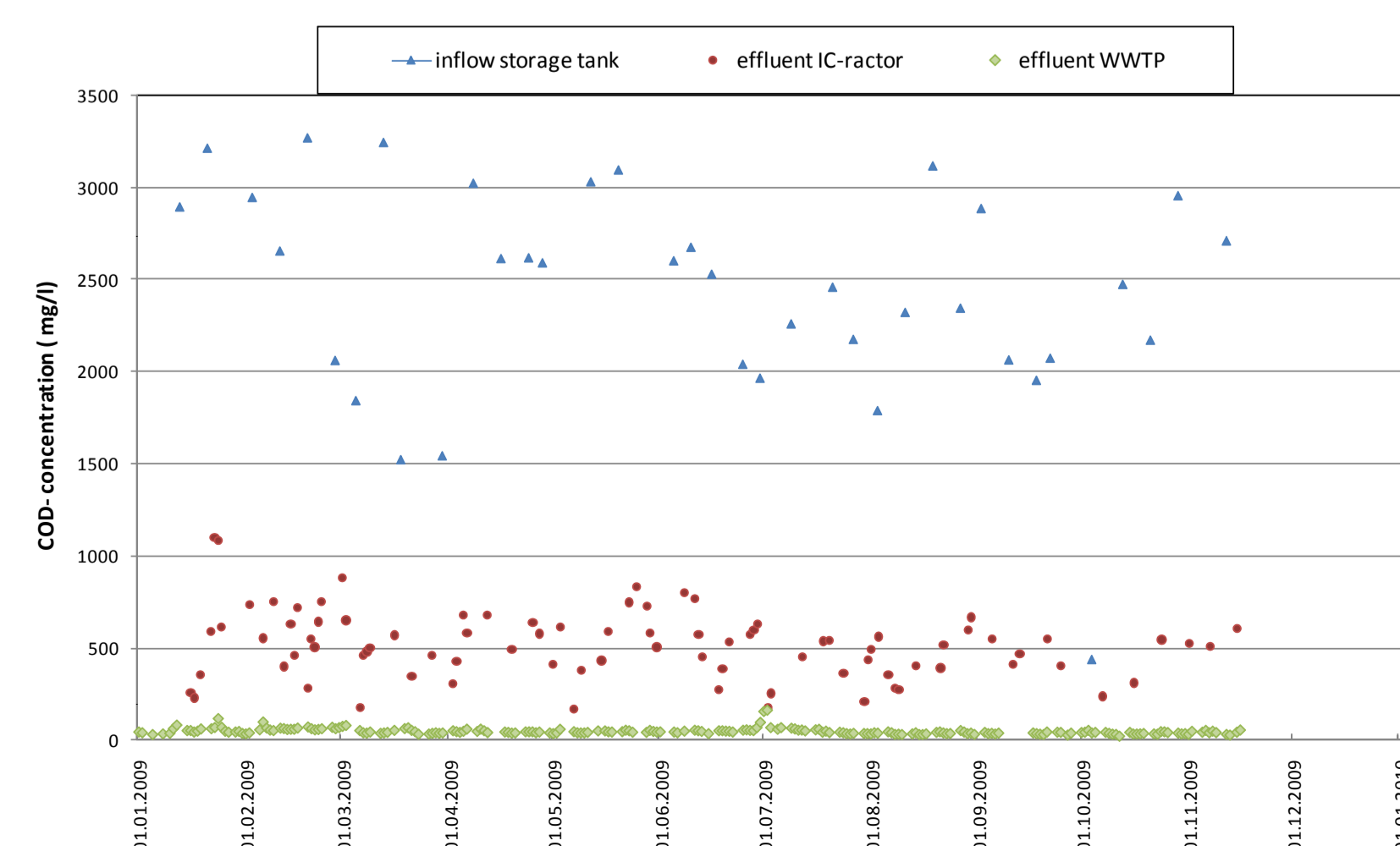
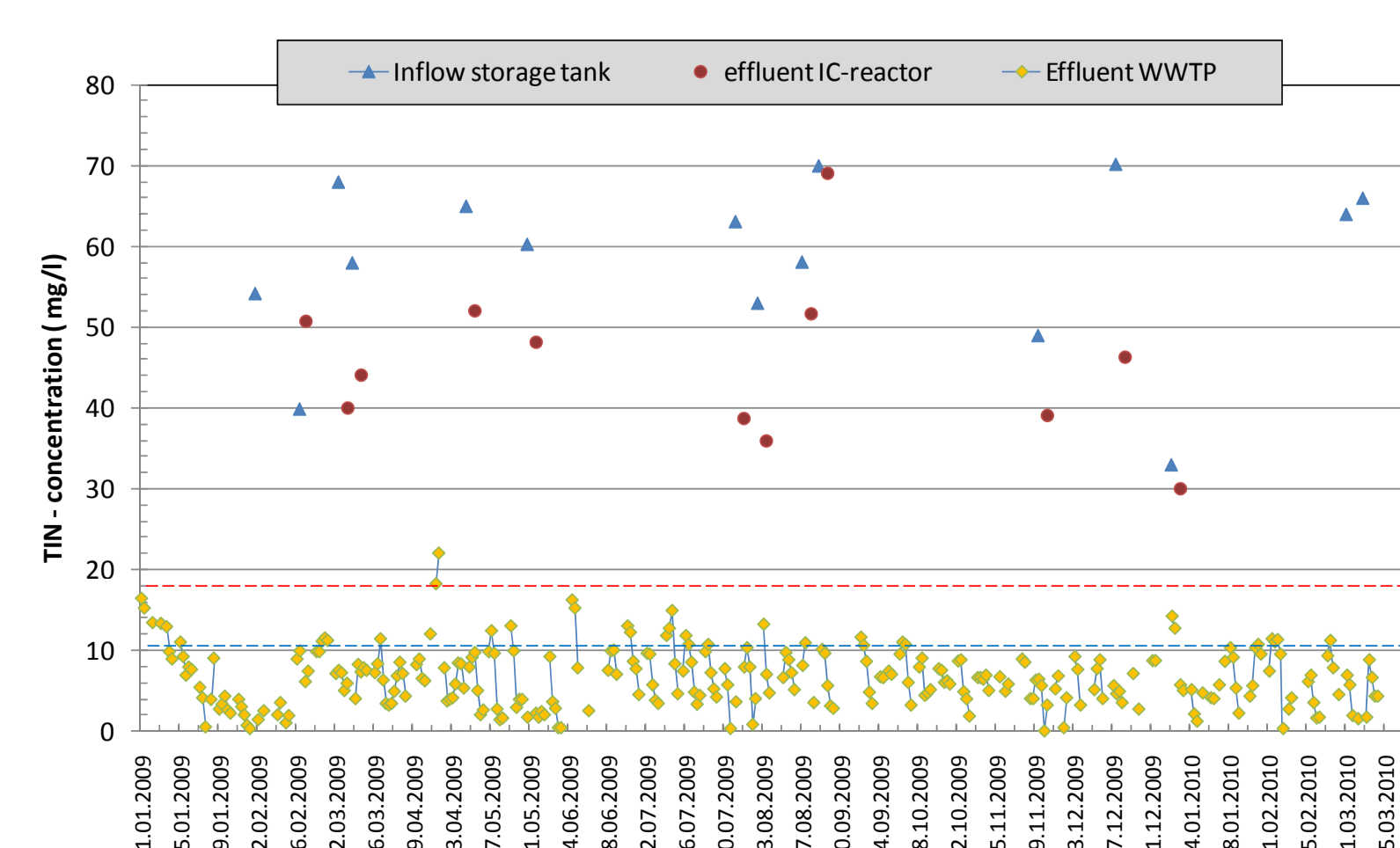
### 2 Oettinger Bier GmbH, Germany



In 1992 the brewery WWTP consisted of 3 SBR-reactors ( $V = 3 \times 850 \text{ m}^3$ ) for 30.000 PE. Nutrients were incorporated. Due to a significant increase in the beer production an anaerobic IC reactor ( $V = 3 \times 850 \text{ m}^3$ ) was added to the WWTP in 2000 (80.000 PE) for the degradation of COD. Nutrients were removed in the existing aerobic SBR (second stage). A further raise in the beer production made a second increase of the capacity of the WWTP (99.000 PE) necessary in 2008/2009. In order to protect the river Wörnitz, the effluent requirements for pollutant loads in the effluent were kept constant despite the increase in PE, resulting in lower effluent concentrations. A second equalization tank was implemented to maximize the capacity of the IC-reactor. For the secure elimination of nutrients a third stage was added consisting of a sandfilter for denitrification and post precipitation.

### 3 Results

Nitrification is unproblematic under normal conditions. At times, quartary ammonia compounds and resolutions cause higher nitrogen concentrations in the effluent of the SBRs. Denitrification is more problematic due to the high hydraulic loads and therefore short SBR-cycles ( $t < 8 \text{ h}$ ). Depending on the concentrations of the raw wastewater, the anaerobic reactor is bypassed to the SBR-reactors to enhance denitrification. Additionally, an external carbon source can be dosed in the sandfilter for further denitrification.



Elimination of TP:

- **Pre-precipitation:** manual dosing after mechanical pre-treatment of the wastewater; precipitation sludge separation prior to the IC-reactor
- **Simultaneous precipitation:** automatic dosing according to TP concentrations; at the end of the aeration phase of the SBR; precipitation sludge separation with surplus sludge
- **Post-precipitation:** dosing according to PO<sub>4</sub>-P concentration in effluent (online sensor); precipitation sludge separation through sandfilter backwashing