MBR
as unit operation in the treatment of Galvanic Wastewater

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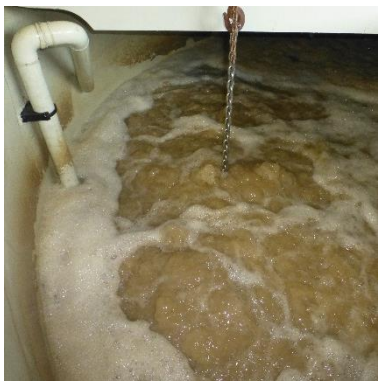
Introduction

The technology of membrane bioreactors (MBR) is used successfully in industrial wastewater treatment. Also, in communal wastewater treatment the use of membrane technology is increasing.

MBR-Plant for the treatment of galvanic wastewater

In the galvanic industry wastewater from the surface treatment of metal compounds is generated. In the first treatment steps flocculation and precipitation take place. The filtrate of the subsequent chamber filter press contains COD, heavy metals (e.g. zinc, iron, chrome) and also filterable solids. The MBR concept is used as final cleaning stage to reach direct discharge quality.

The central part of the MBR wastewater treatment is the membrane bioreactor with hollow fiber membranes, which are combined into modules.



The biological treatment takes place in the MBR tank. Due to the membrane, all biomass in the form of activated sludge is held back and therefore, the sludge age can be freely chosen. Aeration on the bottom of the tank ensures aerobic degradation of organic substances, as well as prevents sludge particles from clogging the membrane. Heavy metals and persistent organic substances are eliminated by accumulation in the activated sludge.

Acetic acid and fertilizer are added to enhance sludge growth and reduce sludge age. This is especially important for zinc removal.

Below some key data to the MBR plant is presented:

- Membrane area 400 m²
- COD-degradation > 80%
- Zn-Removal > 60%
- Dry substance > 15 g/l

Fluctuating amounts and quality of wastewater can be handled effectively by adaptation of the dry substance content.

Possible changes in sludge quality as well as high hydraulic loads do not cause a loss of biomass due to wash out.

The reduced space requirements in comparison to conventional activated sludge processes with a final sedimentation basin is an additional advantage especially for existing industrial plants with limited space.

Summary

The experiences gained by the application of MBR as final treatment stage in galvanic wastewater treatment show that the MBR technology can be adapted easily to very different kinds of wastewater. The main advantages include cost-effective construction works due to reduced space requirements and the freely selectable sludge age allows for high degradation rates, since the sludge is retained to 100%.

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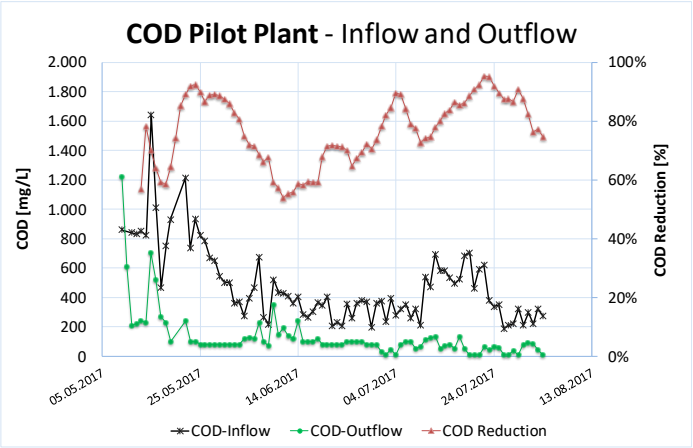
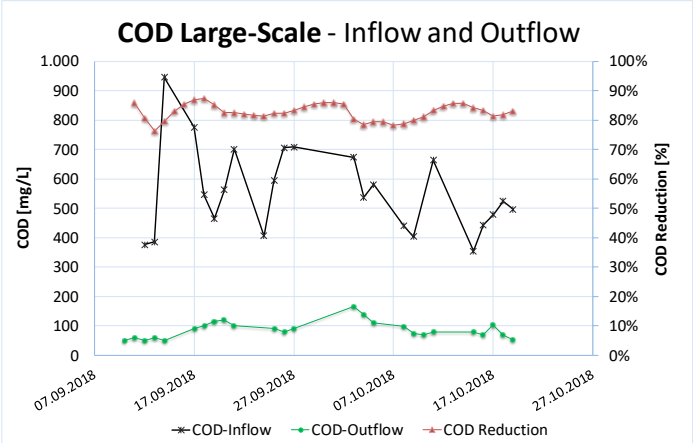
Characteristic data and trends

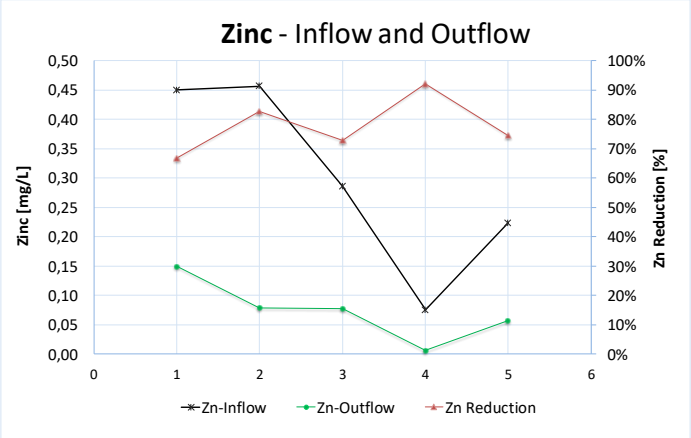
	Design Large-Scale	Results Pilot Test
Inflow [m³/d]	60	4,9
Membrane area [m²]	400	15
COD [kg/d]	36	2,0
COD Volumetric Load [kg/(m².d)]	0,98	0,37
COD Sludge Load [kg/(kg.d)]	0,053	0,035
Zn Inflow [mg/L]	< 2,0	< 1,0
Zn Outflow [mg/L]	< 1,0	< 0,5



During the three months of the pilot test the COD-outflow concentration could be continuously decreased. COD reduction rates up to 90% were achieved.

The diagram shows stable degradation rates from the beginning in the large-scale plant. The effluent limit of 200 mg/L is easily fulfilled.





Heavy metals in wastewater can be eliminated by incorporation in the activated sludge. The data from the pilot test shows that over 60% of Zinc is eliminated.