Analytik Labor Nord on the usage of carrier material Poret®aqua
"An advantage that should not be neglected is the permanent conservation of the bacteria cultures (...) and the reduction of produced surplus sludge (secondary sludge) or sewage sludge."

Secondary sludge comes from the biological cleaning section of a wastewater treatment plant. In the same section, EMW®'s carrier material, Poret®aqua, is used. Already during initial reference projects with Poret®aqua, a reduction of secondary sludge was noticed. This effect is not only due to the carrier material - the volume is already reduced by changing from the activated sludge process to the biofilm process. However, the above mentioned reference projects have shown that using Poret®aqua allows the reduction of secondary sludge at a level above the average. To look into this finding, a comparative study was started:

Activated sludge process vs. biofilm process with Poret®aqua

Structure of the comparative study

The chosen site was a local capacity 2 treatment plant (pop. 1,000-5,000). The dry weather inflow is about 220m³/day. For the purposes of this comparative study, a mobile container treatment plant was installed at this treatment plant. Split into project phases I and II,

About sewage sludge

Sewage sludge from wastewater treatment plants can be categorised in the three types primary, secondary, and tertiary sludge. Primary sludge is the sludge separated in primary treatment. Secondary sludge comes from the biological section of the cleaning plant and is produced due to the constant replication of microbes. The removed portion of secondary sludge is called surplus sludge. Tertiary sludge is a combination of compounds formed by the use of flocking agents and other ingredients of wastewater that cannot flock out.

Activated sludge process vs. biofilm process with Poret®aqua

The focus of the comparison was on the reduction of secondary sludge. The scenario was a mobile treatment plant in container design that was operated in parallel with a capacity 2 treatment plant. Split into two project phases, the activated sludge process and the biofilm process were observed separately from one another. During the biofilm process, the carrier material of EMW®, Poret®aqua, was used.

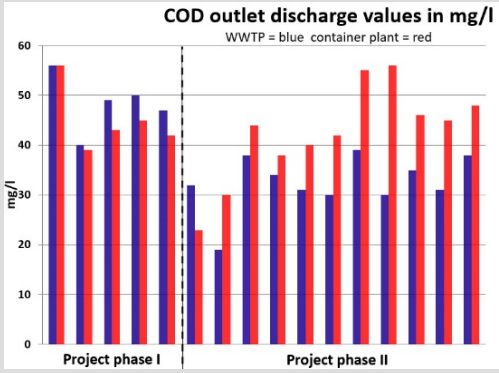
the container treatment plant was fed with the wastewater inflow of the main treatment plant in parallel. In **project phase I**, the container treatment plant was conventionally operated in the activated sludge process and with downstream secondary clarification. In **project phase II**, the change to the **biofilm process** with Poret®aqua as carrier material took place. Each project phase took 1 month.

The analytic investigation was carried out by the external lab Analytik Labor Nord. The investigation included all parameters relevant to the wastewater. In addition, the accrued sewage sludge was analysed during both the activated sludge process and the biofilm process with Poret®aqua. Sampling was carried out as qualitative sampling according to the usual legal requirements and regulations.

COD purification performance

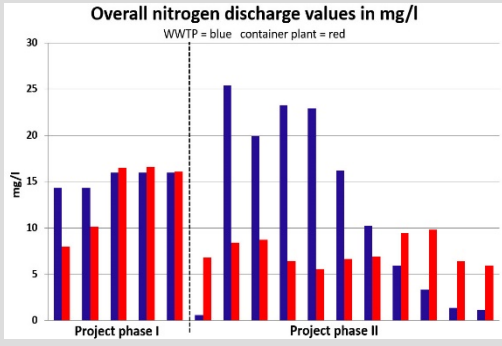
During the project phases, the dry weather inflow was about 800mg/l COD on an average. Instead of the normal discharge of 120mg/l COD required by law, a self-defined limit of 80mg/l was set.

Despite of partially heavy rain, this value was far from being reached in both project phase I and project phase II. In the process, even more disturbances could have been accommodated without any problems.



Purification performance with nitrogen

Despite of the inconstant inflow circumstances already mentioned, extraordinarily good reduction rates with regard to nitrogen were achieved. In the process, project phase II with Poret®aqua constantly showed measurements <10mg/l of overall nitrogen.



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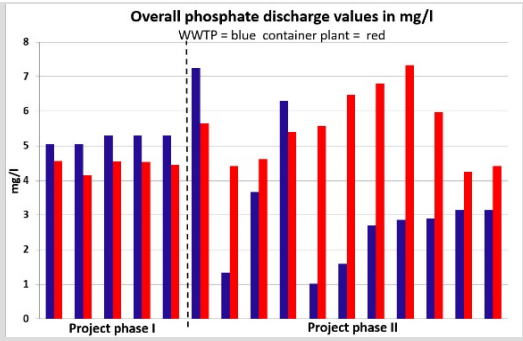
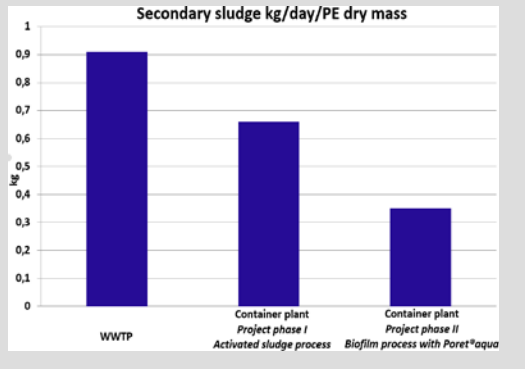
Purification performance with phosphate

To flock the phosphate, a customary iron chloride solution was additionally dosed in the main treatment plant. Dosing is carried out using a pump and does not depend on the feed flow but rather on time. The container plant was operated without the help of chemical additives. The main treatment plant twice exceeded the self-defined limit for phosphate of 6 mg/l, the container treatment plant exceeded this value three times. On an average, the container treatment plant fulfilled the limit during both project phases without the use of flocking agents.



Secondary sludge production

The sewage sludge analyses were carried out in accordance with the applicable Sewage Sludge Ordinance (KVO). Both investigated sludges from the activated sludge and biofilm processes didn't even reach 70% of the defined limits of the applicable KVO and can be used in agriculture without any restrictions. In each project phase, the dry substance content and the accrued volume of the corresponding secondary sludge were checked. Thus the exact volume of the accrued secondary sludge in kg/day of dry matter could be determined.



Secondary sludge - volumes compared

Measuring point (procedure)	Average DS content	Volume Secondary sludge
Main treatment plant (Activated sludge process)	0.26%	0.91kg / day / PE
Container treatment plant (Activated sludge process)	0.15%	0.66 kg / day / PE
Container treatment plant (Biofilm process with Poret®aqua)	0.07%	0.35 kg / day / PE

A reduction of the accrued volume of secondary sludge within the biofilm process with Poret®aqua can be shown according to the specifications.

A reduction of the accrued volume of secondary sludge within the biofilm process with Poret®aqua is shown in the preceding diagram.

What explanation is there for this reduction?

Results in terms of microbiology

The task of detecting the cause of the huge reduction of secondary sludge when using the biofilm process with Poret®aqua was - in consensus with TU Berlin - assigned to the BIOTECON Diagnostics institute residing at the same place. Samples from secondary sludge of the activated sludge process at the local treatment plant and the biofilm process with Poret®aqua at the container treatment plant were examined. The results showed that the biofilm process with Poret®aqua sample contained a 10 times higher concentration of living microbes. The microbial cultures were highly active and thus could be established within the system over a longer time. Thus also the dead mass is reduced resulting in a strongly reduced production of secondary sludge. By providing an effective surface of 1,000m²/m³, carrier material Poret®aqua creates optimal conditions. Investigations of Analytik Labor Nord have shown that this surface does not only exist in theory. The achieved nitrogen discharge values show that the biofilm is very efficient and pronounced.

It was found that the microbial cultures on the Poret®aqua carrier material are permanently established. Growth down to the inside of the carrier without clogging the material is consistently noticeable. Since hardly any oxygen accumulates in the inside of the carrier, both aerobic and up to almost anaerobic zones can be found. It can be assumed that differently specialised cultures will establish down to the depths of the carrier. The final assessment of the use of Poret®aqua by Analytik Labor Nord institute says: *"An advantage that should not be neglected is the permanent conservation of the bacteria cultures (...) and the reduction of the produced surplus sludge (secondary sludge) or sewage sludge."*

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