



Drausy[®] Professional

Sustainable and climate-friendly oxygen therapy



Environmental biotechnology treatment - can air remediate a water body?

In biological treatment, microorganisms break down the pollutants in the water - they are already in the water body - however, oxygen is needed - where they are supposed to act: at the bottom of the water body.

Aeration supplies oxygen to the bacteria, which is needed to treat and stabilize the water. The oxygen supplied is used by the bacteria in the water to break down the carbonaceous organic matter into carbon dioxide and water.

Without sufficient oxygen, the bacteria are unable to biodegrade the added organic matter in a reasonable time. In an anaerobic environment, degradation must take place under septic conditions: the slow and odor-intensive transformation of the pollutants is incomplete.

Since oxygen is present in the ambient air, no additives are used for microinvasive basic aeration with Drausy® Professional - the treatment is environmentally biotechnological.



Long-term and sustainable management of artificial waters (excerpt)

Dr.-Ing. U. Urban and C. Jäger at World Canals Congress Leipzig 2022

Summary:

Area-wide microinvasive aeration along the entire stream surface transforms the environment from low-oxygen to high-oxygen.

Results:

- Degradation of organic matter
- Permanent binding of pollutants and nutrients to the sediment
- Avoidance of algae and cyanobacteria
- Enrichment with oxygen
- Reduction of harmful greenhouse gases

Key messages:

Lakes, rivers, ponds and wetlands are important habitats in their own right - a long-term and sustainable management is presented under the aspects of water conservation, water maintenance, protection of biotopes, enrichment of the quality of life for humans and reduction of climate-damaging gases.

Most of the artificially created water bodies are unable to regenerate naturally - they produce organic sludge, silting up, and becoming a nuisance for residents due to their unpleasant odors and unsightliness. In addition, climate change is causing an increase in methane emissions.



Long-term and sustainable management of artificial waters (excerpt)

Dr.-Ing. U. Urban and C. Jäger at World Canals Congress Leipzig 2022

Method:

The linear micro-invasive aeration system Drausy® Professional provides a remedy - it is able to discharge the smallest discharge quantities of liquids and gases over long distances with only one feed. As a result, the ambient environment becomes oxygen-rich and biological processes are triggered:

Without sufficient oxygen, bacteria present in the water body are unable to biodegrade the added organic matter in a reasonable amount of time. Dead plants and inputs from animals (fish, birds) form dead biomass that settles to the bottom - the organic biomass forms sludge - this causes oxygen deficiency. During the decomposition of biomass at the bottom of the water body, O₂ is consumed. In an anaerobic environment, decomposition must take place under septic conditions: the slow and odorous transformation of pollutants is incomplete and odorous.

Increased sludge volume (organics), leads to siltation processes, aquatic habitat is damaged, climate-damaging gases such as methane are produced and rise to the surface - this is prevented by treatment:

The Drausy® linear aeration system works on the bottom of a lake. It can be recognized by the light line of air bubbles on the surface.

The aim is to keep the residence time of the fine submilli-bubbles in the water body as long as possible, thus the bubble trace is very small. The entire water body is enriched with oxygen - **the residence time is ensured by the fine distribution - we call this the champagne effect: the nanobubbles settle at the bottom.**



Long-term and sustainable management of artificial waters (excerpt)

Dr.-Ing. U. Urban and C. Jäger at World Canals Congress Leipzig 2022

During biological treatment, microorganisms break down the pollutants in the water –

Aeration supplies oxygen to the bacteria in the water body, which is needed for the treatment and stabilization of the water - they are activated. The supplied oxygen is used by the bacteria in the water body to break down the carbonaceous organic substances into carbon dioxide and water.

Pollutants and nutrients that cannot be degraded are permanently bound to the sediment by the treatment - they are removed from the water body and keep the water habitat fresh.

Since oxygen is already present in the ambient air, no additives are used for microinvasive ground aeration with Drausy® Professional - the treatment is environmentally biotechnological.

Resultats:

When aerating with the Drausy® system, the natural self-purification effect of the water body is supported by oxygen input to achieve a decomposition of the organic substances in the sludge and free water.

The decomposition of organic substances in the water and the sludge layers results in a reduction of the chemical and biological oxygen demand (BOD/COD), which in turn has a positive effect on the flora and fauna in the water.



Sustainability and climate neutrality

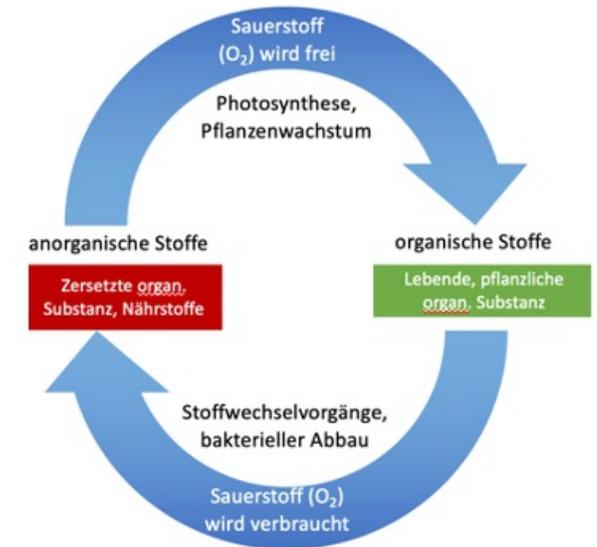
Savings potential through linear aeration

Restoration measures are only successful in the long term if back-fertilization from the sediment, especially by phosphorus, is prevented. Therefore, biotechnical desludging can be considered as a supplement to other measures that prevent back-fertilization.

It can be usefully applied if mechanical desludging cannot be carried out for various reasons, e.g. the contamination of the sludge with heavy metals and thus too high disposal costs.

Furthermore, biotechnical desludging is promising from a loss on ignition content of 10%.

- **Permanent prophylaxis to avoid organics in the sediment** - siltation is prevented / the use as a fire water reserve
- **Permanent pollutant binding** prevents pollution by rainwater from roof surfaces from deteriorating the water body due to harmful substances
- **Permanent greenhouse gas reduction**, as methane is first reduced by conversion to CO₂ and water and then completely avoided



How are the processes linked? During the decomposition of biomass at the bottom of the water, O₂ is consumed. At O₂ saturation, this decomposition process ends completely. - Avoidance of black sludge and toxic foul gases at the bottom of the water body. No nutrient surplus in the water = no oxygen deficiency at the bottom of the water.

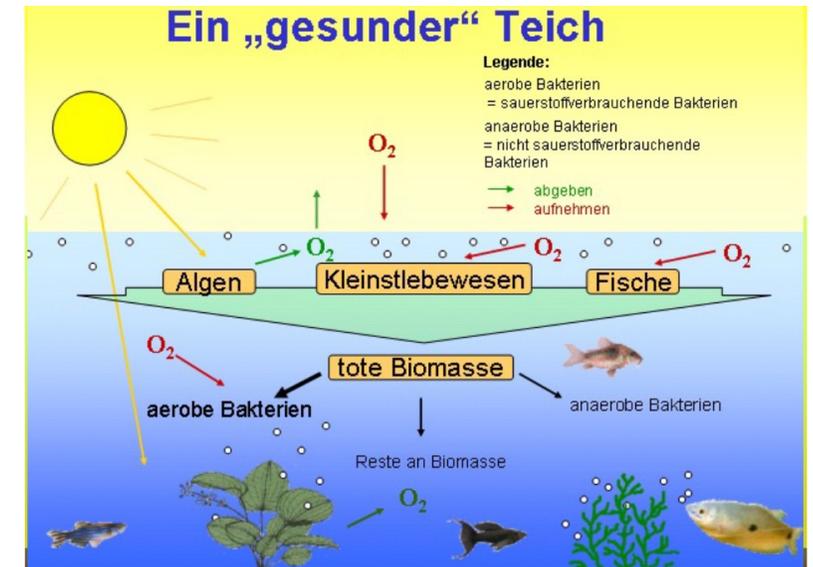


Sustainability and climate neutrality Stadt und Grün – publishedd 2003

Sustainability/ Conservation after mechanical desilting:

"Continuous aeration of the pond creates a **consistently aerobic environment** in the pond and constantly breaks down sludge. Nitrification occurs, i.e. the ammonium contained in the water is converted into nitrate. The nitrate can then serve as an oxygen donor and help maintain the aerobic environment in subsequent ponds or water bodies. There, further degradation of the nitrate to nitrogen can occur and help avoid anaerobic conditions. **Phosphorus compounds are increasingly retained in mineralized sediments.**"

"These processes lead to a **sustainable equilibrium by reducing the in-water nutrient pool and limiting primary algal production**. This limits the formation of new sediment for some time after treatment. **With adequate minimal aeration, the sediment can then be kept aerobic in perpetuity.** Extensive mineralization of the residual sediment allows for the establishment of higher aquatic plants."



Metabolism in a "healthy" pond with sufficient oxygen supply. In a sufficiently oxygenated pond, the produced and dying biomass is in circulation. Dead biomass is mineralized by aerobic bacteria. Plants at the bottom of the pond ensure sufficient oxygen supply there as well. Sludge deposits occur only to a small extent.



AGK Prof. Dr. H. Hötzl 2001: Functional suitability of the Drausy® hose system (excerpt)

Functional principle and material properties of Drausy® Professional

Energy efficiency and pressure equalization:

„ Due to its material properties and special geometry, the Drausy® hose compensates for different internal pressures by cross-sectional deformation. This results in changes in the hole size, which is uniform in the initial state. Thus, at high pressure, a small hole is created, while at decreasing pressure the holes become larger (Fig. 1). As a result, all outlet holes have the same outlet volume. This property makes it possible to introduce liquids and gases into the wastewater over long distances (up to 10 km) in a uniformly finely dosed manner.“

Longevity:

„Drausy® Professional is characterized by high wear resistance, which is reflected in its high impact resilience and abrasion resistance, as well as in its tear, tear propagation and tear resistance.“

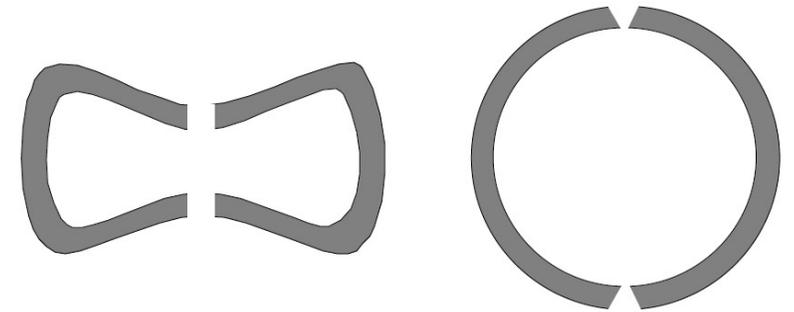


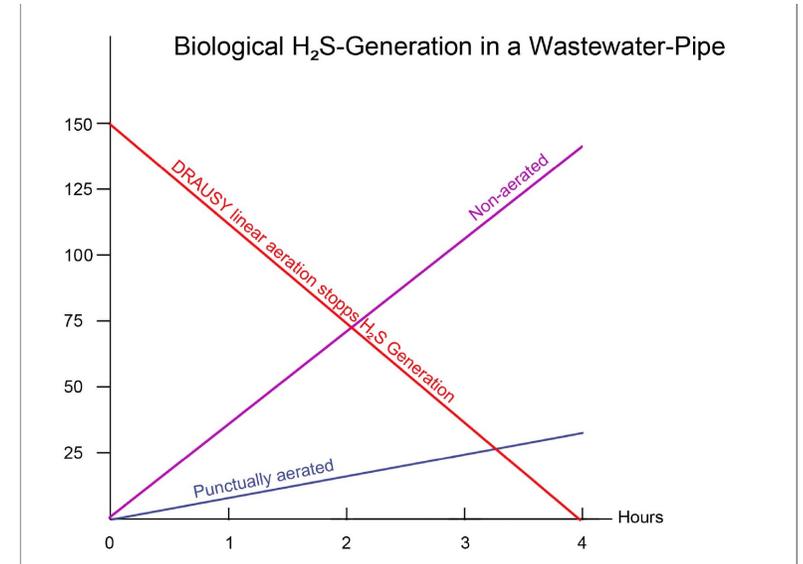
Fig.1: Cross-sectional deformation of the Drausy® hose: pressure compensation by changing the outlet opening



Report about the on-site examination of the Drausy-type linear aeration system installed in the Dunaföldvar-Bölcske-Madocsa region, Hungary (HAS Report 2006)

The local authorities determined to have the Drausy® technology deployed since it seemed to be the most favorable solution. The about 1-year experience with the O₂-fed Drausy® linear aeration system can be summarized as follows:

- the malodor and the related health problems in the region were fully eliminated
- the system worked with proper efficiency in all seasons of the year
- the operational problems of the recipient waste water purification plant at Madocsa, Hungary, were significantly reduced,
- no problems were detected in the hydraulic transport of the waste
- the PSA-Drausy® system operated free of trouble
- the operation and maintenance costs were lower than the calculated costs of all the potential alternative solutions



Abwasserbehandlung: Lineare Belüftung Drausy® Professional zur Eliminierung von H₂S-Bildung



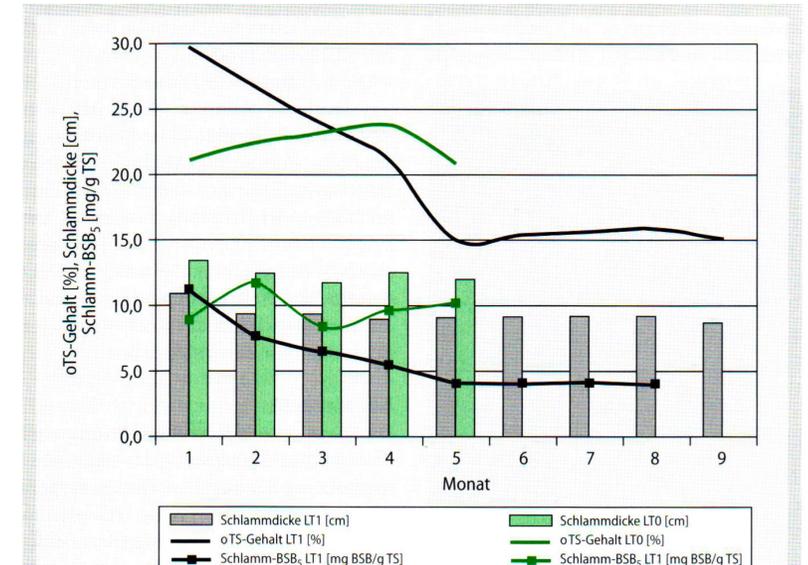
Aeration of shallow standing waters

in dependency of the treatment objective (Wasser und Abfall 3/2010)

Summary of the investigation

„The shallow depth of ponds poses a major problem in aeration measures due to the short contact time between rising air bubbles and the water body. **The oxygen utilization of the Drausy® system is relatively high compared to other systems, so Drausy® can be used effectively for shallow standing waters.**“

„ The investigations under laboratory conditions have shown that by supplying sufficient amounts of oxygen, an almost complete degradation of the oxygen-consuming load of the water body and a 60 to 70 % degradation of the sludge parameters can be achieved. The hose lengths or air quantities required for this are calculated using the oxygen demand of the pond. The parameters to be included in the calculation of the oxygen demand vary depending on the treatment objective or application area.“



Laboratory pond: course of sludge parameters (sludge BOD₅, oTS content, sludge thickness) in LTO and LTI during the study period; no degradation of sludge parameters occurred without aeration (LTO). In the aerated laboratory pond (LTI), however, there was a significant degradation of the sludge parameters.



Long-term experience in a fishing water

Tank ditch Malsch, aeration since 2012

Siegbert Hennhöfer- **Angelsportverein Malsch (ASV)**: "the majority was in favor of the procedure to rehabilitate the tank ditch, which had become increasingly silted up and in some cases even stank due to years of input of leaves, needles as well as bird and fish excrement and a permanent nutrient input from the adjacent agriculture. A fish kill in 2011 had again dramatically clarified the situation."

Area of the tank ditch: 1.6 ha

mined sludge volume of about 11,200 m³ (report from Nov. 2012).

The project was documented from 04/2012 to 11/2012

The achieved deepening of the tank ditch, i.e. the degraded amount of organic sediment, was on average 70 cm after the seven-month intensive aeration. **This sludge reduction occurred on the one hand due to biodegradation and on the other hand due to compaction of the sediment.** The total volume of sediment decreased by about 60%. Fish mortality no longer occurs.



Due to the gentle remediation with oxygen, the tank ditch became clean again

The aeration system was reduced at the end of 2012 - since then the aeration line is moved every year, so that the water body is aerated every four years in rotation.



Oxygen saturation and residence time

Ostfalia: Aeration systems of standing waters – 1/2020

Oxygen enrichment- residence time of oxygen bubbles in the water body:

"The Drausy company manufactures hoses for water aeration that can discharge particularly fine air bubbles. As a result, they achieve particularly high oxygen utilization."

"In principle, the statement can be made that the ascent speed increases with increasing radius of the air bubble. If the radius is reduced from, for example, 1 cm to 0.01 cm, the ascent rate remains almost constant. If the same relationship is applied to the sizes 0.1 cm to 0.01 cm, it becomes clear that the ascent velocity changes by a factor of 10. Above this range, the behavior is exponential. If this relationship is linked to the time mass transfer rate, the result is the amount or mass of oxygen that can be transferred from a bubble to the water."

"It is a fact that the longer the contact time between the air bubble and the water, the more oxygen can pass from the bubble into the water until the maximum oxygen saturation of the water is reached, which in turn is influenced by boundary conditions such as temperature and depth."

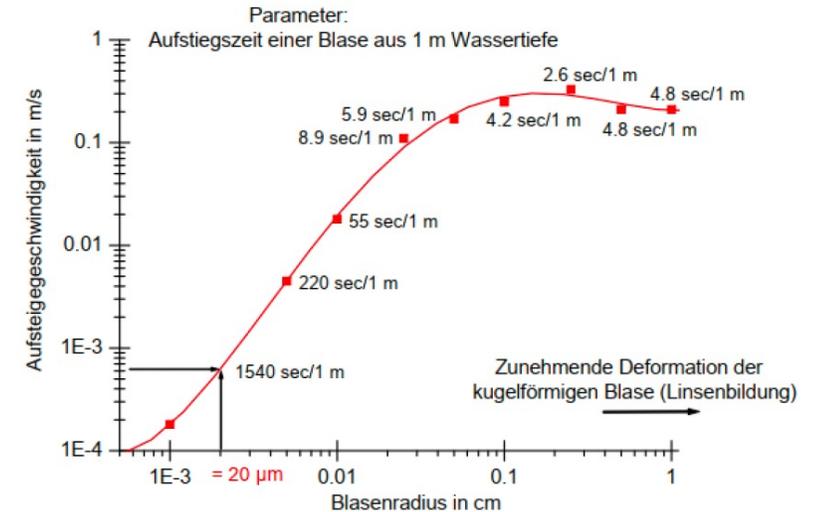


Fig.7 Ascent velocity of a bubble depending on the bubble radius.

Depending on the bubble radius, its ascent speed changes, which is shown in Fig. 7.



Oxygen saturation and residence time

Water remediation with environmental biotechnology

In the experimental tank, you can see the bubbles emerging and the **fine bubbles** settling:

The submillibubbles have a diameter smaller than 1 mm - thus they settle and **extend the residence time** in the water body.

The entire body of water is enriched with oxygen - the residence time is ensured by the fine distribution - we call this the champagne effect: the nanobubbles settle at the bottom.





Components of a regular aeration system

Compressor and compressed air tank are located in a nearby building. There they are supplied with electricity (e.g. 1 x 400V/ 2.2 kW and 1 x 230V/ 50 Hz for a small plant with up to 500m – pond surface around 5.000m²).

Drausy® Professional Environmental hose:

- Pressure compensating, operating pressure 0.4 bar, air outlet approx. 0.2l/ m

Oil-free compressor:

- Recommendation: screw compressor oil-free, low noise (53 dBA), durable, possibility of maintenance contract in cooperation with manufacturer, power source: 400V/ 2.2 kW, 50 Hz.
- Alternative: piston compressor oil-free, slightly louder (72 dBA) power source: 230V/ 1.5 kW, 50 Hz

Compressed air tank with automatic condensate drain and precision pressure reducer: The compressors buffer compressed air into the tank, therefore running and standing times occur. The power consumption is about the same for both systems.



A system consisting of a linear ventilation system, compressed air tank, compressor and small parts.



Components of a regular aeration system

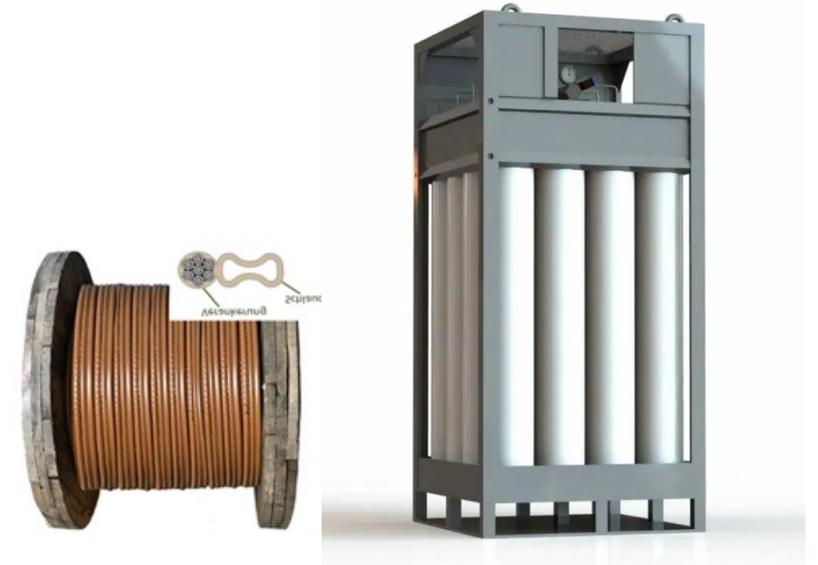
In case of no energy-supply / need of concentrated oxygen or lakes of depth from 15 m:

Drausy® Professional Environmental hose:

- Pressure compensating, operating pressure 0.4 bar, air outlet approx. 0.2l/ m

Oxygen-gas-bundle:

- Since gas bottles are already under pressure, the needed pressure will be adjusted directly from the bundle.



A system consisting of a linear ventilation system, oxygen-bottle bundle and small parts.



Water remediation with environmental biotechnology - since 1998

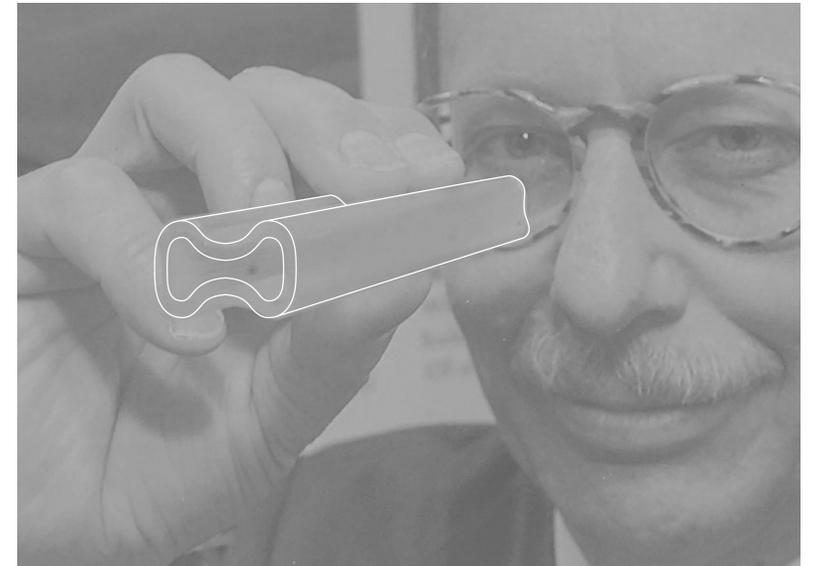
We keep your water in balance!

Drausy GmbH has been active in the field of aeration for decades.

The company's main product is a pressure-balancing special hose, which is capable of discharging small discharge quantities of liquids and gases over long distances with only one feed: Drausy® Professional.

The number and size of the orifices are adapted to the specific application - the main application is the distribution of atmospheric oxygen in water bodies and for the treatment of wastewater.

The patented Drausy® system hose is made of thermoplastic polyurethane (PUR). This material combines the high-quality mechanical properties of elastomers with the processing technology for thermoplastics. Even under the extreme conditions in sewers, especially the temperature ranges encountered there, the hose has excellent elastic properties.



Founder Nikolaus Weth with system hose segment



Sources for this presentation

- 2001 HHoetzl AGK Funktionsweise_Vergleich_Linear-Punktuell_D
- 2003 UUrban Stadt und Grün Neue Methode zur biologischen Entschlammung von Stillgewässern
- 2006 09 HAS statement Boelcske
- 2010 03 FGerlach AHeilmann Wasser und Abfall BWKWU
- 2012 03 30_Datenrecherche zur biolog-Teichsanierung Plan T
- 2012 10 24 Artikel MAZ Malsch
- 2012 11 Abschlussbericht Tankgraben Malsch Kundenreferenz Gewässer- biologische Gewässersanierung
- 2020 01 Wolfenbüttel Ostfalia Belüftungssysteme Kaufmann und Uehlecke
- 2021 02 UUrban und Drausy GmbH Stillgewässer und Klimaschutz
- 2022 01 UUrban und Drausy GmbH Beitrag zur WCC 2022 Leipzig



Aeration line on the watercourse- Drausy® Professional System on the watercourse bottom (not visible)

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