

## Business Unit Water Treatment

Area of Application: Food and Beverage Industry, Paper Industry, Pharmaceutical Industry, Chemical Industry, Semiconductors, Photovoltaics, and Wastewaters from Agriculture, Protected Landscapes and Municipality

### Cardinal Utility

Next to waste gas abatement, DAS Environmental Expert GmbH offers its customers versatile solutions for efficient, safe and cost-effective wastewater treatment. Many processes in chemical, pharmaceutical or food production, for instance, require the pre-treatment of organically contaminated wastewaters prior to discharging them into the environment or public sewage systems.

This not only prevents environmental damage, but also reduces the company's sewage charges. Traditional biological wastewater treatment systems, while offering high degradation capacities and high reaction rates, are usually associated with high maintenance and overhead expenses for the aeration of the wastewater lagoons.

### TFR Technology (Trickle Flow Reactor)

DAS Environmental Expert GmbH specializes in biological wastewater treatment systems that keep cost and effort to a minimum. The TFR bioreactors are based on the DAS trickle-flow principle. The wastewater trickles down through a very light, small-grain carrier material covered with a highly active mixed population of bacteria. The microorganisms degrade the pollutants into clean water and clean air. Unlike commonly implemented wastewater systems and international state-of-the-art, the TFR bioreactor's carrier material bed is not located within a closed body of water and thus can easily be supplied with sufficient amounts of oxygen. This working principle ensures unimpeded contact and short transitions between the microorganisms, the wastewater pollutants and the oxygen. In combination with the highly active mixed population of bacteria that is optimally adapted to their respective conditions, the TFR bioreactor offers highly stable degradation capacities even with fluctuating wastewater compositions and concentrations.

Since the system's aeration does not entail high pressure and the biomass or the carrier material does not require artificial movement, the bioreactor consumes little energy while its simple set up makes it a nearly maintenance-free system. **This offers immense advantages to its users:** Low operating and investment costs, small equipment volume and low maintenance efforts.

The fully automated systems are installed in single modular components made from polyethylene and individually dimensioned according to pre-existing treatment systems and respective conditions. The modular principle provides each customer with the optimum system size. Transport, installation and corrosion problems are eliminated. The reactor's light-weight

construction does not require special preparation at the customer's facilities and allows for intermediate installation.

### **Ranges of Application**

The TFR bioreactor can be applied:

- To pre-treat wastewaters (entire or partial wastewater streams prior to discharge into own or municipal wastewater treatment plant)
- For complete treatment of wastewaters (prior to discharge into rivers and water bodies)
- Treatment for water reuse and water recycling

### **Matching the Application's Purpose**

The design of each system depends on the biodegradability of the organic loads.

In order to correctly evaluate the wastewater at hand, DAS Environmental Expert GmbH will determine its rate of degradation in our own Dresden laboratory. Based on this analysis, maximum attainable output, complexity and the necessary size of the TFR bioreactor can be assessed. Afterwards, the optimum equipment scope will be further determined by installing an on-site pilot system or by early installing and commissioning the first reactor of a large-scale system.

### **MBBR Technology (Moving Bed Bioreactor)**

Depending on the daily volumes involved, there are also other technological procedures that can be used to biologically treat wastewater. The MBBR or fluidised bed process is based on the biological process with sessile biomass (biofilm process). This allows microorganisms to grow inside the biofilms, which consist of immobilised biomass, and become established on the surfaces of the filling material (substrate biology). In contrast to TFR technology, the filling material in this system floats in a water column. The MBBR process is often the more cost-effective solution, especially for very large volumes of wastewater (500 m<sup>3</sup>/d or more) and high COD loads (> 1,000 kg/d).

### **MBR Technology (Membrane Bioreactor)**

For sanitary and municipal wastewater with a population equivalent of approx. 100 or more, DAS uses the tried and tested MBR technology. This system forces the wastewater through fine-pored membranes at high pressure. The membrane holds back particles with sizes of right down to 0.1 µm, thus producing very clear, odourless water that can be used for applications such as watering greenspaces.

### **Activated Sludge Process**

For municipal wastewater applications with no specific space restrictions, the activated sludge process is the most cost-effective option. During this process, there is always a certain amount of sludge in the basins of the wastewater treatment plant. This is made up primarily of aerobic micro-organisms, i.e. bacteria that require oxygen to survive. Aerating the suspended sludge evenly not only supplies it with the necessary oxygen – it also keeps it afloat, thus ensuring that the bacteria have sufficient contact time with the contaminants contained in the wastewater.

### **Aeration and Mixing with Ejectors**

Biological wastewater treatment plants always require an active supply of oxygen or ambient air in order for the aerobic bacteria to work.

Since traditional compressors typically consume a lot of energy, wherever possible DAS EE relies on a combination of ejectors and corresponding propulsive jet pumps for fine-bubble and full area aeration. This provides almost perfect mixing conditions for the wastewater in the biological treatment plant.

### The Benefits of DAS Ejectors

DAS ejectors make optimal use of oxygen by forming fine bubbles that provide a large contact area between air and water. Since the level of oxygenation is equally dependent on both the bubble size (contact area between air and water) and the regeneration of the bubbles' border layer as a result of the turbulence in the water, the permanent mixing of the water means that ejectors offer a very high level of oxygen utilisation. The force of the incident flow towards the bottom of the basin prevents deposits from forming. The oxygen supply can be regulated easily by adjusting the volumetric flow rate of the air; the contents of the basin are mixed thoroughly at all points within the control range. The ejectors do not have any moving parts, so they require no special maintenance work.

The air/water mixture is fed into the basin with a high level of turbulence, which enables the ejector to guarantee optimum oxygen supply and thorough mixing. Even when the water has a high solids content, the ejector can achieve high enough flow rates to prevent deposits from forming on the bottom of the basin.

### **DAS Solutions are Complete Solutions**

DAS solutions always fit – no matter if installing a single treatment step, a complete wastewater treatment plant or supplying an entire fab with water treatment systems. DAS turnkey solutions are complete solutions that can get to work immediately. The company provides all steps of the process, from planning and concept development, to tailor-made adjustments to meet individual needs and specifications, down to the equipment's installation and commissioning. After complete commissioning, the company provides comprehensive service from general maintenance to a complete operating agreement. DAS also offers owners of existing wastewater treatment plants consultation on the optimisation options available to them. Sometimes, an update to the plant's automation systems is all that is needed for a significant reduction in energy requirements. As such, DAS Environmental Expert also counts building control cabinets and programming OMRON and Siemens plant control systems among its services.

### **Successful Applications**

Since first introducing wastewater treatment solutions, DAS has relied on the principle of the trickle-flow technology that is successfully operating in Europe, South America and South East Asia. Systems are employed prior to the discharging wastewater into sewage systems or before directly discharging them into rivers or water bodies. First trials along with functioning systems prove that trickle-flow technology is not only capable of treating easily biodegradable loads, but also provides the cost-efficient reduction of slowly biodegradable compounds.

## Energy from Industrial Wastewater

For customers who want energy-efficient, high-performance wastewater treatment, DAS Environmental Expert has come up with a new product: the self-cleaning, high-efficiency DAS E-Plate heat exchanger. This heat exchanger has especially been designed to handle the demands of heavily contaminated wastewater with high solids content. The recovered heat energy increases the efficiency of existing wastewater treatment plants, allowing customers to save up to 40 per cent on heating costs.

### E-Plate – Features

- Wide ring clearances (12 cm) for almost no clogging
- Continuous self-cleaning using easy-to-replace brushes
  - Service life > 2 years
  - Easy to maintain and inspect during the course of general plant repair work
  - No redundancy required
- Pressure loss minimised for high efficiency
- Good heat transfer thanks to high level of turbulence (rotating brushes)
- Easy to operate and handle

### Successful Applications

Reference plant E-Plate: heat recovery from process water of paper industry