

Plastic Recycling



**Advanced wastewater
treatment for plastic
recycling processes**



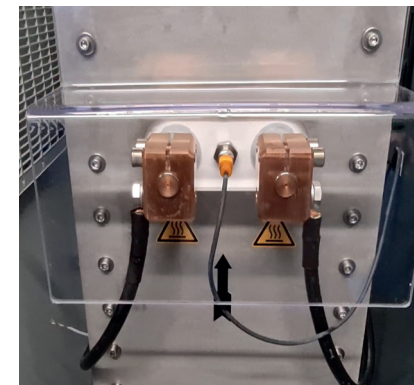
A totally customised, modular solution that can be integrated easily with any plastic washwater system.

Reference Projects



France - PET Recycling

300 m³/hr recycling system with partial reuse for a major PET recycling company in France.



Croatia - PP recycling

15 m³/hr washwater recycling system with full reuse for a polypropylene bag recycler.



Germany - HDPE recycling

Cleaning and discharge to public sewer of highly polluted washwater from a HDPE recycler in Germany.

A totally customised and flexible solution that integrates perfectly with plastic recycling washwater systems

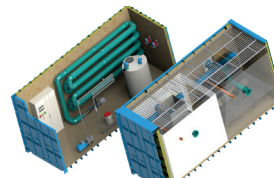
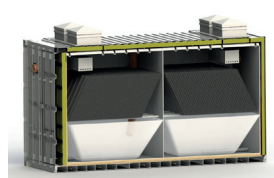
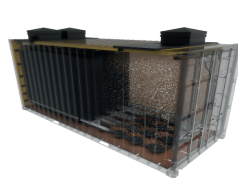
Compact, plug & play, fully automatic modular solutions that save money and the environment!

ClearFox® Advanced Plastic Recycling Wastewater Treatment Modules are suitable for any recycling facility

Customised solutions for flowrates between 10 - 1000 m³/hr

A range of modular options for different plastic washing applications and different cleaning standards:

- Mechanical screening
- Physical and chemical treatment
- Biological treatment
- Ultrafiltration
- Sludge management



- 1 Reuse your water**
Save money by reusing your wastewater in the washing process.
- 2 Protect the environment**
Removes microplastics from the wastewater and prevents pollution.
- 3 Save money**
No more tankering of wastewater offsite or high sludge disposal costs.

Special features

Our solutions stand out from competitors due to a number of unique selling points. Visit our website to read about them in more detail.



Our Advantages

Automatic



Automatic operation with remote monitoring

Modular



Modular and totally customised solutions that are easy to expand

Certified

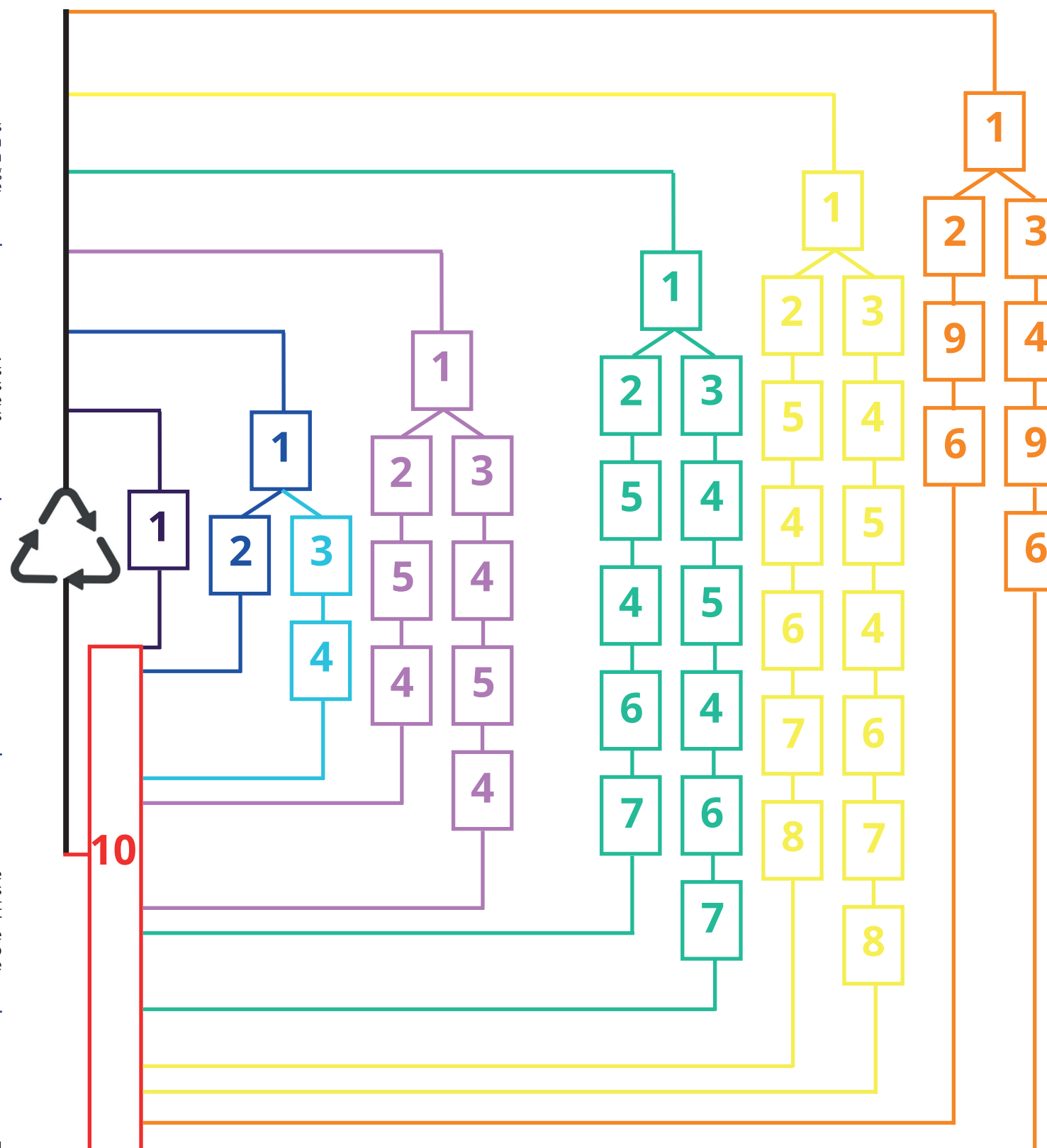


Independently certified and approved products system

- ✓ A totally customised and modular solution
- ✓ Simple to install in conjunction with recycling and washing equipment
- ✓ Different treatment steps available in modules for different wastewater cleaning and reuse requirements
- ✓ Simple to expand to handle future increased flowrates and capacities
- ✓ Remote monitoring and control systems available for total peace of mind
- ✓ Removal of microplastics from the wastewater
- ✓ All process steps manufactured by one company
- ✓ Full installation, maintenance and operation support available
- ✓ Systems installed and operational in over 50 countries
- ✓ CE marked and manufactured to strict quality controls

Wastewater Treatment in Plastic Recycling Process

- 1 Pretreatment**
Removal of sand, crushed paper and macro plastic
 Technology:
 • Drum screen internally fed
 • 500 - 1000 µm
 • Sand trap
 • Combined screen unit
 The screen is completely made of stainless steel and is characterised by its automatic self-cleaning. Different mesh sizes and shapes are used depending on the application. High volume flows are no challenge for the screen, nor are fluctuating wastewater loads. Operating costs are kept to a minimum. Due to the few mechanical parts, maintenance is hardly necessary.
- 2 Chemical/Physical Treatment**
Conversion of dissolved wastewater constituents into undissolved substances. Removal of undissolved substances (solids) by flotation.
 Technology:
 • Dissolved Air Flotation
 The entire DAF system is made of polypropylene (PP) and HDPE. This makes the system completely corrosion resistant. Thanks to the integrated sludge thickener, no scraper is necessary. This keeps maintenance and operating costs to a minimum. The complete system is CE marked and reliably removes microplastics from the wastewater.
- 3 Chemical Treatment**
Conversion of dissolved wastewater constituents into undissolved
 Technology:
 • Precipitation/flocculation
 PPU Umwelttechnik GmbH developed the chemical treatment processes without dead zones, so that a small amount of chemicals is sufficient to clean the wastewater. High-efficient wastewater treatment with low chemical input.
- 4 Physical Treatment**
Separation of solids (undissolved constituents) by sedimentation
 Technology:
 • Lamella Clarifier
 • Sedimentation tank
 The ClearFox® lamella clarifier impresses with its high surface area in a small space. With this easy system only one pump is required for the sludge. A simple control system is sufficient for operation. Underload or overload are no challenge for the lamella clarifier. Depending on the project and sludge consistency, different plate spacings are suitable - larger ones to avoid clogging or smaller ones to benefit from a larger surface area.
- 5 Biological Treatment**
Biological precipitation of COD and BOD₅ up to direct discharge quality possible
 Technology:
 • Fix Bed Biological Reactor (FBBR)
 • Moving Bed Biological Reactor (MBBR)
 • Membrane Biological Reactor (MBR)
 The biological cleaning processes of PPU are self-regulating and fully automatic systems. They have been independently tested and awarded for their outstanding cleaning performance. The biological cleaning process produces low sludge and is able to work with both overload and underload.



- 6 Filtration**
Subsequent filtration of the oxidised substances
 Technology:
 • Sand filter
 Various filter media are available for the sand filter. Depending on the time or pressure difference, automatic backwashing takes place. The sand filters impress with their automatic operation, whereby several filters can be operated one after the other or in series. The filter material hardly wears out and does not age, which means that it only needs to be replaced very rarely.
- 7 Optional Polishing**
Separation of viruses for ultra clean wastewater
 Technology:
 • Ultrafiltration
 Ultrafiltration retains viruses and microorganisms. It has a modular design and a resistant membrane. The low pressure used in this process results in much lower energy consumption than conventional membrane processes. The system completely removes deposits by means of water-air rinsing. The entire process is sensor-monitored, and fully automatic operation is ensured by a PLC control with HMI.
- 8 Membrane Filtration**
Further treatment and the removal of salts in order to counteract salinisation by evaporation with permeate quality
 Technology:
 • Reverse osmosis
 Reverse osmosis ensures the retention of ions at low investment costs. The system achieves the desired water quality via pressure and recirculation. The entire process is sensor-monitored, and fully automatic operation is ensured by a PLC control with HMI.
- 9 Advanced Oxidation**
Oxidation of heavy metals and other undesirable substances. Filtration of the oxidised substances through filters is necessary.
 Technology:
 • DiOx
 ClearFox® DiOx advanced oxidation is one of the most outstanding wastewater treatment solutions on the market. There is no need for ozone or other consumables. The boron-doped diamond electrodes are so durable, that they never need to be replaced. Oxidation of persistent substances is no challenge for the ClearFox® DiOx.
- 10 Sludge Treatment**
Increasing the dry matter of the sludge to reduce its volume
 Technology:
 • Sludge press
 The ClearFox® sludge treatment processes use market-leading dewatering systems. The resulting dry matter content is outstanding. Biological sludge or sludge from flotation is no challenge. All sludge treatment systems can be easily combined with other processes.

Pretreatment

The solution removes sand, pulped paper, fibres and macroplastics. The cost-efficient and effective method reliably separates solids and is particularly suitable for direct discharge. The system is very robust, which is why it is hardly necessary to replace parts.

Thanks to the mesh size of 500 - 1000 µm, the removal of filterable substances is no challenge. At the same time, the solution has little to no influence on COD and BOD₅. No chemicals are used. The continuous operation, the small footprint and the automatic cleaning make the system an outstanding solution. The volume share for reuse is 50 - 65 %, for direct or indirect discharge 35 - 50 %.

Technology:

Drum Screen, sand trap or combined screen unit



Dissolved Air Flotation

Chemical treatment removes dissolved substances from the wastewater. In the process, it separates the floating substances by means of air bubbles. This process is mostly suitable for direct dischargers, is inexpensive and effective in removing dissolved substances.



This solution reduces COD/BOD₅ between 60 and 80 % and TSS up to 90 %. The dry matter content of the sludge is around 5 %, with significantly less sludge being produced than with sedimentation. There is automatic pH-adjustment during continuous operation. The plant requires a low amount of space and uses chemicals for precipitation, neutralisation and flocculation. The volume fraction for reuse is 65 - 85 %, for direct or indirect discharge 15 - 35 %.

Technology:

Drum Screen

Dissolved Air Flotation

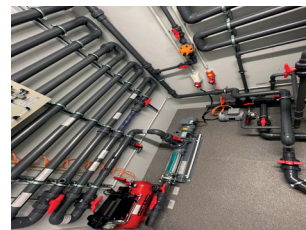
Clarification

Chemical treatment removes dissolved substances from the wastewater, whereas a lamella clarifier removes settleable substances. The process is mostly suitable for direct dischargers, is inexpensive and effective. No complex control or high maintenance is required. The solution is suitable for almost all types of wastewaters in the recycling industry, as it reliably filters the resulting wastewater.

The process reduces COD/BOD₅ by between 50 and 60 % and TSS by up to 80 %. The dry matter content of the sludge is around 3 %. The complete solution requires a medium amount of space and is completely automatic in its operation.

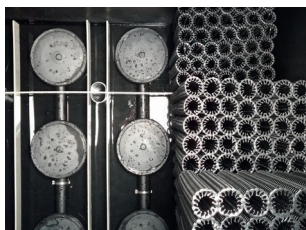
Technology:

Drum Screen
Precipitation & Flocculation
Clarifier



Biological

In this process, which is mostly suitable for direct dischargers, aerobic degradation of the organic wastewater constituents takes place. The entire system can handle fluctuations in the inflow and is resistant to clogging. High efficiency with low maintenance.



The process reduces COD/BOD₅ and TSS by up to 95 %. The dry matter content of the sludge is around one percent, plus the sludge from DAF and precipitation/flocculation. The solution operates continuously and automatically and has a medium space requirement. The volume share for reuse is 75 - 90 %, 10 - 25 % of the wastewater achieves direct discharge quality.

Technology:

Drum Screen

Fix Bed Biological Reactor

Clarifier

Dissolved Air Flotation or Precipitation & Flocculation

Filtration

The special feature of this process is the pre-filtration through a sand filter and the polishing with an ultrafiltration. Due to the high purification performance, the treated wastewater is suitable for direct discharge and for reuse in the water cycle.

This specific equipment reduces COD/BOD₅ and TSS by up to 95 %. The use of this fine filtration step makes it particularly suitable for the separation of viruses. The volume share for reuse is 85 - 90 %, 10 - 15 % of the wastewater reaches direct discharge quality.

Technology:

Drum Screen

Clarifier

Dissolved Air Flotation or Precipitation & Flocculation

Sand Filter

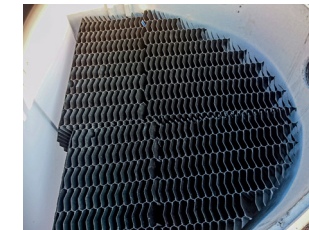
Fix Bed Biological Reactor

Ultrafiltration



Membrane Process

The membrane process has a very high purification capacity. The aim of this process step is to reuse the wastewater. There is the possibility of "blending" this ultrapure water with other wastewater to achieve a specific effluent quality. Variable flow is not a challenge.



The solution removes COD/BOD₅, salts and TSS up to 95 %. The core function of the solution is the separation of ions, resulting in fully demineralised water - permeate. The volume share for reuse is 90 - 95 %, 5 - 10 % of the wastewater reaches direct discharge quality.

Technology:

Drum Screen

Sand Filter

Dissolved Air Flotation or Precipitation & Flocculation

Ultrafiltration

Fix Bed Biological Reactor

Reverse Osmosis

Clarifier

DiOx AOP

This process is mostly suitable for direct dischargers. Diamond electrodes oxidise persistence substances that are difficult to degrade. The solution is suitable for fluctuating inflow values and for very low as well as very high-volume flows. The process usually works in bypass mode, which means that the flow rate of the plant can deviate from the flow rate of the DiOx.

It removes COD/BOD₅ and TSS up to 95 %. No chemicals are used in the process. Due to the adjustable current voltage and strength, the cleaning performance increases constantly with the energy consumption. Any deposits on electrodes can be removed by changing the polarity, which ensures low-maintenance operation. The volume share for reuse is 85 - 90 %, 10 - 15 % of the wastewater reaches direct discharge quality.

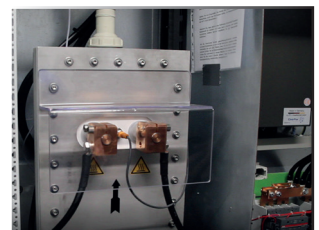
Technology:

Drum Screen

DiOx

Dissolved Air Flotation or Precipitation & Flocculation

Sand Filter



Sludge Treatment

Various sludge treatment solutions can be used including dewatering big bags, thickeners, belt filters, chamber filter presses or screw presses. The sludge management solution selected depends on the flow rate and the number of process steps used.



The sludge treatment solutions press the wet sludge from dissolved air flotation and biological processes. The dry matter content of the sludge after pressing is around 20 - 25 %. The volume can be reduced by a factor of 20. Depending on the type of plant, the pressed water can be recycled. Each plant can have an integrated sludge tank. While the dry matter content of DAF sludge is around 3 - 5 %, it is 0.8 - 1 % for FBFR sludge. Depending on the application, polymers may be necessary to enhance dewatering process.

Technology:

Sludge Treatment



PPU Umwelttechnik GmbH

PPU Umwelttechnik GmbH is a technology company based in Bavaria, Germany. We develop unique wastewater treatment processes, including physical, biological, chemical, filtration and oxidation steps. We offer products and complete tailor made solutions for any industrial or municipal applications. We manufacture all of our products and solutions at our factory in Bavaria.

ClearFox®

ClearFox® is the brand name for the range of products and solutions, manufactured by PPU. ClearFox® products are exported all over the world. Systems are currently installed and operating in Africa, Europe, Middle East, Russia/CIS and Asia. The ClearFox® brand is globally recognised as a specialist provider of solutions for wastewater treatment.

Why choose PPU?

Quality control

Our plants and systems are entirely manufactured, independently certified, and tested in Germany. Before delivery, they go through an independent approval process. Customers in over 50 countries worldwide use ClearFox® wastewater treatment plants.

Cost saving

We use the most advanced technologies, which are particularly energy-efficient. PPU offers solutions that work completely without electricity. This means that the operating costs are very low or completely eliminated.

Risk free purchases

You get up to 15 years warranty on selected parts. All ClearFox® treatment systems use corrosion-free materials designed to last. With our systems, we guarantee compliance with all agreed purification standards.

Exclusive technology

Only with us you get patented and specialised solutions that are unique on the market. ClearFox® DiOx advanced oxidation removes even persistent substances, while our ClearFox® DAF works without a scraper and thus requires less maintenance. So all of our processes use cutting edge, advanced technology.

Complete service

With our full engineering and installation team we can offer a total service to customers. We analyze your wastewater in our in-house laboratory, which enables us to offer you the best solution at the best price-performance ratio. We take care of the complete project planning for you and are also available to you after the purchase with our 24/7 service team.

Contact Us

PPU Umwelttechnik GmbH

Carl-Kolb-Str. 6

95448 Bayreuth, Germany

+49 (0) 921150 63 99 0

info@clearfox.com

www.clearfox.com

