



**WASSER
3.0**

FACTSHEET

WASSER 3.0 PE-X®

Two-Stage Microplastic and COD Removal in Industrial Wastewater - Plastic Processing Industry

98%

MP Removal (mass, TSS)

98%

MP Removal (count)

96%

COD Reduction

90%

Water Reuse potential

OVERVIEW

This factsheet summarises the results of a three-month pilot study investigating a two-stage automated process for simultaneous microplastic (MP) removal and COD reduction from industrial wastewater at a plastic processing company in Germany. The Wasser 3.0 PE-X® pilot plant used Agglomeration-Fixation (Clump & Skim) for MP removal and a fixed-bed reactor with modified absorbent materials for COD reduction. The study focused on reproducibility, impact analysis, and economic feasibility across eight test phases.

TEST SITE & METHODOLOGY

Location	Plastic processing company, Germany
Wastewater source	Process wastewater from plastic processing operations
Test duration	3 months (8 test phases)
Sampling	12 samples per test phase analyzed for 6 parameters
Parameters	COD, TSS, particle count, pH, turbidity, filterable solids (AFS)
Process stages	Stage 1: MP removal (Agglomeration-Fixation); Stage 2: COD reduction (fixed-bed reactor)

TECHNOLOGY

Process	Two-stage: Wasser 3.0 PE-X® Agglomeration-Fixation (Clump & Skim) + fixed-bed reactor for COD reduction
Reagent	Hybrid silica gel (non-toxic) for MP agglomeration; modified absorbent materials for COD reduction
MP detection	Fluorescence staining + automated particle counting (TSS-based and count-based)
Throughput	Scalable; rental model tested for pilot feasibility
TRL	Pilot-scale (on-site industrial application)

KEY RESULTS

MP removal (mass/TSS)	-98.3% reduction
MP removal (count)	-97.9% reduction
COD removal	-96% reduction
Turbidity	Significant reduction achieved
pH	Stable throughout process
Annual MP avoided	-2.7 tons microplastics per year (estimated)
Annual COD avoided	-70.7 kg COD/day at 8 m ³ /day capacity

CIRCULAR ECONOMY & SUSTAINABILITY

Water reuse	Up to -90% process water reuse potential through recirculation
Agglomerate reuse	Recovered agglomerates suitable as construction/insulation materials
Energy	Low-tech approach with minimal energy and maintenance requirements
CO footprint	1.0 kg CO ₂ /m ³ wastewater (optimized circular model, LCA)
Cost savings	20% lower CAPEX and -75% lower operational costs vs. competitors
Return on invest	Typically < 3 years

BENEFITS OF TWO-STAGE UPSTREAM REMOVAL

By combining MP removal and COD reduction at the industrial source (start-of-pipe), this approach prevents microplastics from entering municipal wastewater treatment plants (WWTPs), which are not designed to remove MPs. Upstream treatment reduces the total environmental MP load far more effectively than end-of-pipe treatment alone. Additional benefits include lower total wastewater volumes, reduced energy demand, adherence to the polluter-pays principle, reduced burden on municipal WWTP infrastructure, and enabling industrial water reuse to approach zero liquid discharge (ZLD) targets.

KEY ADVANTAGES

Two-stage process	Simultaneous MP removal and COD reduction in a single workflow
Reproducible	Consistent results across 8 test phases despite varying wastewater composition
Low-tech design	Tank, stirrer, fixed-bed reactor – no expensive filter systems required
Circular process	Water reuse + agglomerate recovery + chemical reuse (surfactants)
Cost-effective	Lower CAPEX/OPEX, reduced discharge fees, agglomerate valorisation
Polluter pays	Shifts treatment responsibility and costs to the industrial source
Scalable	Modular systems (250 L / 1000 L); rental model available for trials

REFERENCE

Sturm, M.T.; Myers, E.; Schober, D.; Korzin, A.; Schuhen, K. Beyond Microplastics: Implementation of a Two-Stage Removal Process for Microplastics and Chemical Oxygen Demand in Industrial Wastewater Streams. *Water* 2024, 16, 268. <https://doi.org/10.3390/w16020268>



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