Power & Water | Kingspan. Klargester

Packaged, Chemical-Free Nutrient Removal for Decentralised Wastewater Systems

About Power & Water

Power & Water is a UK technology company specialising in sono-enhanced electrocoagulation for advanced water and wastewater treatment. The patented Soneco® system generates coagulant on-site using metal plates, enabling controlled coagulation and solids separation without liquid chemical dosing. The ultrasonics optimises reaction efficiency and process performance. Systems are configured to suit site-specific water chemistry and operational requirements and are equipped with in-line monitoring to enable automated influent-responding control.

powerandwater.com

About Klargester

Klargester, a Kingspan Group company, is a leading UK provider of wastewater treatment solutions for domestic, commercial and industrial applications. The company has a reputation for reliable off-mains and decentralised systems, including its widely established BioDisc® range which delivers robust, energy-efficient biological treatment using rotating biological contactor (RBC) technology.

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Power & Water

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THE CHALLENGE

Across the UK and Europe, tightening discharge limits for phosphorus, nitrogen, and overall nutrient loading—alongside nutrient neutrality requirements—are placing increasing pressure on decentralised wastewater treatment.

Packaged treatment plants, such as the Klargester BioDisc®, are widely used where connection to the sewer network is unavailable or delayed. These systems provide reliable biological treatment within a compact, space-efficient footprint. However, evolving regulatory requirements are now driving the need for enhanced nutrient removal beyond conventional biological performance alone.

At the same time, operators and developers are increasingly seeking to reduce or eliminate chemical dosing due to rising operational costs, handling and storage requirements, and growing sustainability expectations.

There is growing demand for scalable treatment technologies that can be deployed in both new and existing decentralised wastewater treatment systems, improving treatment performance across a broader range of contaminants without adding operational complexity or requiring major infrastructure changes.

THE SOLUTION

Our integrated packaged treatment solution combines:

- **Biological treatment** (e.g. RBC / BioDisc® technology) for robust removal of BOD, COD and ammonia
- **Soneco® sono-electrocoagulation** for advanced phosphorus removal and final effluent polishing, including reduction of residual COD, suspended solids, FOG and trace contaminants
- Optimised hydraulics and recirculation design to support stable nitrification and denitrification performance

Together, this creates an integrated biological–physicochemical process, delivered as a packaged system for consistent multi-nutrient compliance.

Key Advantages of the Packaged Approach

- **Optimised nitrogen and phosphorus performance in one integrated system**
- **Chemical-free phosphorus removal (no dosing infrastructure required)**
- **Continuous, self-regulating treatment process (no shock dosing)**
- **Compact, space-efficient footprint for constrained sites**
- **Low operator input and maintenance requirements**
- **Predictable sludge production and lower carbon impact**
- **Enhanced effluent quality, including solids, FOG and trace contaminants**
- **Single-supplier responsibility for performance and delivery**

Soneco® x BioDisk® Overview

To validate performance and integration, the packaged solution was trialled by integrating Soneco® with an existing BioDisc® unit through a recirculation loop.

Configuration

- 50–100 PE office block in Aylesbury
- Fully integrated hybrid system
- Decentralised packaged treatment

Key Outcomes

- Stable biological performance with no impact on nitrification
- Phosphorus reduced to 0.2–0.3 mg/L
- Stable operation without chemical dosing
- Iron concentrations within permit limits (<1.5 mg/L)
- Low maintenance, with electrode servicing intervals every 60–90 days
- Average electrical energy consumption: 1.44 kWh/m³

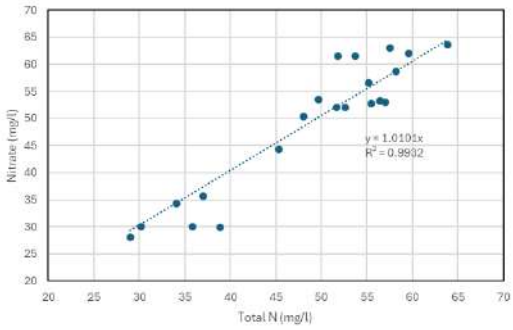
Results demonstrate a practical, scalable route to high-quality effluent across multiple parameters, while maintaining operational simplicity.

SONECO® x BIODISK® TRIAL RESULTS

- The integrated Soneco® x BioDisc® system delivered consistent, reliable performance following initial stabilisation, validating the combined approach.
- Phosphorus concentrations reduced progressively and **stabilised at 0.2–0.3 mg/L**, below typical regulatory thresholds.
- Biological treatment remained stable throughout, with effective nitrification confirming Soneco® integration enhanced treatment without disrupting core processes.
- Maintenance requirements were low, with servicing intervals of ~60 days, with optimisation indicating **60–90 days** aligned with typical service schedules.
- Average energy consumption was **1.44 kWh/m³ treated.**
- Iron remained **within permit limits (<1.5 mg/L)**, confirming compliant operation.

Overall, the integrated technologies demonstrate a robust, low-complexity treatment solution capable of delivering high-quality effluent across multiple parameters while maintaining operational simplicity.

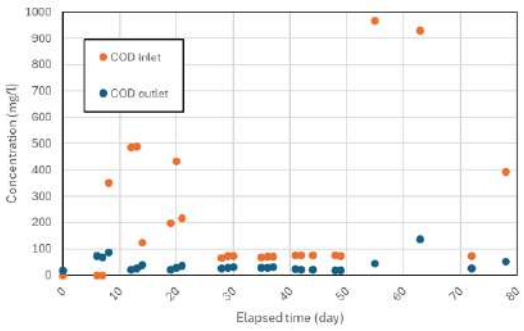
Figure 1: Relationship between Nitrate and Total Nitrogen at the Outlet



The BioDisc® provides stable nitrification, with outlet data confirming effective ammonia conversion to nitrates.

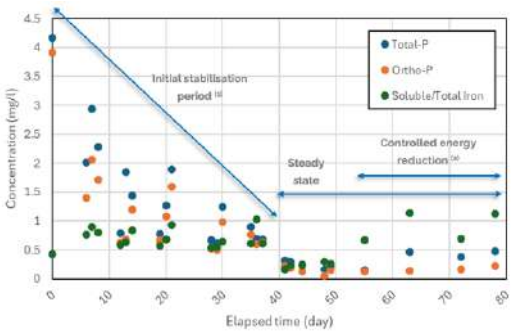
Integration with Soneco® enhances performance without disrupting biological treatment, supporting consistent compliant operation.

Figure 2: COD Concentrations at the Inlet and Outlet



COD concentrations at the outlet remained consistently low, despite variations in influent COD, demonstrating the effectiveness of the combined treatment system in removing organic matter.

Figure 3: Phosphorus and Iron Concentrations at System Outlet



(1) For future retrofits, this initial lag phase can be reduced by temporarily increasing dosing and/or operating at higher flow rates through the Soneco® unit.

(2) There is an inherent trade-off between achieving ultra-low phosphorus concentrations and maximising electrode lifespan, enabling optimisation of operating conditions based on compliance requirements and maintenance considerations.

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Soneco® vs Chemical Dosing

SONECO®

- No chemical storage, handling or dosing
- Continuous, self-regulating treatment process
- Controlled in-situ coagulation with no overdosing or pH correction risk
- Lower maintenance and reduced operator input
- Compact, integrated footprint
- Predictable sludge generation and lower carbon impact

CHEMICAL DOSING

- Requires chemical supply, storage and dosing systems
- Operator-dependent and typically single-pass dosing
- Prone to overdosing and often requires pH adjustment
- Ongoing chemical and maintenance costs
- Larger footprint with additional infrastructure
- Variable sludge production and higher carbon impact

WHAT THIS DELIVERS

Integrated Nutrient Compliance

Ultra Low Phosphorus (<0.5mg/L) Chemical Free

Flexible Deployment (Complete package or Retrofit)

Lower complexity and lifecycle cost

WHAT THIS ENABLES

- Unlocking development in nutrient-constrained catchments where projects may otherwise stall due to discharge limits
- Provides a practical pathway to support housing and commercial growth
- Create additional effective treatment capacity within existing assets without major upgrades.
- Reduce reliance on interim treatment measures such as tankering; and future-proof decentralised systems against increasingly stringent phosphorus and nitrogen requirements.

TYPICAL DEPLOYMENT SCENARIOS

The system is designed for flexible, scalable deployment across a wide range of applications:

- **Small commercial sites (10–50 PE):** Compact, low-maintenance solution
- **Housing developments (50–300 PE):** Supports compliance and planning requirements
- **Modular systems (300+ PE):** Scalable for phased developments
- **Retrofit upgrades:** Enhances existing BioDisc® installations
- **Capacity-constrained sites:** Improves performance without major upgrades.