3R TECHNOLOGY FACT SHEET

RECYCLE - RECOVER - REUSE - Original invention for

Zero Emission and Energy Independent Pyrolysis and Phosphorus Recovery

RECYCLE
RECOVER
REUSE

High added value valorisation of agricultural and food industrial byproducts for bio-based fertilisation and water purification

Quick facts

- **Core process**: Thermochemical (pyrolysis) nutrient upcycling combined with integrated agro-biotechnological processes.
- **Technology Principle:** 3R (Recycle - Recover - Reuse) upcycling model: Zero emission & energy independent circular valorization of unexploited biomass into new and high added value products.
- **Renewable input:** Food grade grade animal bone meal and grist.
- **High value product portfolio:** (1) ABC-BioPhosphate and its BIO-NPK-C compounds bio-fertilizers, (2) environmental & industrial water treatment adsorbents and (3) bioenergy.
- **Industrial scale capacity:** 20,800 t/year. **Technology status:** Pre-commercial stage.
- **Geographical coverage**: EU (IT, ES, FR, DE) UK, USA, AU, JP.
- **EC/MS Authority permits** for Industrial pyrolysis plant installation & operation.

What makes 3R Technology & BioPhosphate Products so Unique

The 3R Zero Emission and Energy-Independent Pyrolysis & Phosphorus Recovery Technology offers an advanced circular solution for upcycling food-grade animal by-products into safe, high-value materials. Through an innovative combination of high-temperature thermal and biotechnological recycling methods, the system transforms low-value bone grist—primarily cattle bones pre-treated at 133°C, 3 bar for 20 minutes—into premium products with multifunctional applications. The core of the process is a high-efficiency pyrolysis treatment, operating at material core temperatures of up to 850°C, significantly exceeding standard biomass processing levels. This reductive thermal environment eliminates all volatile and protein-based substances, resulting in a macro-porous mineral matrix composed predominantly of hydroxyapatite (70–76%), $CaCO_3$ (7–13%), and carbon (8–11%).

The primary output, ABC (Animal Bone Char) BioPhosphate, is a versatile product line designed for:

1. **High-phosphorus organic fertilizers (BIO-NPK-C formulations)**, tailored for organic and low-input farming;
2. **High-performance bio-based adsorbents**, designed for environmental uses like industrial water purification, heavy metal removal, and nutrient recovery. ABC BioPhosphate's unique porosity and surface chemistry make it ideal for advanced filtration, further enhanced by AI-driven materials optimization.

Cutting-Edge 3R Technology for Phosphorus Recovery & Water Treatment

High-Temperature Precision Processing: Operates at 850°C in a controlled, oxygen-free environment, delivering advanced material transformation with unique surface structures and superior adsorption capacity.

Energy-Independent & Surplus-Producing: Fully self-sufficient energy system with surplus output of up to 3 MWe/h, ideal for powering greenhouses and integrated on-site operations—supporting decarbonized, circular industry.

Net-Zero Emissions | Carbon-Negative Impact: A next-generation circular economy solution that not only eliminates harmful emissions but actively sequesters carbon—contributing to climate resilience and environmental protection.

Versatile Feedstock Flexibility: Capable of processing a wide variety of organic inputs, with particular expertise in animal by-products—maximizing added economic and environmental value through modular 3R processing and bio-formulation.

Original, High-Value Innovation: The proprietary 3R deep-tech system, uniquely designed for recovering high-purity phosphorus and producing advanced bio-adsorbents for water purification.

Advanced Engineering, Real-World Impact: Revolutionary design delivering unmatched efficiency, scalability, and certified sustainability for industrial phosphorus recovery and clean water solutions.

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Bio Phosphate