

TRAINING MATERIAL

Title:

3R Recycle-Reuse-Reduce zero emission pyrolysis technology for phosphorus recovery from food grade animal bone grist for production of Bio-Phosphate products

Training:

What is the technology?

High nutrient dense Phosphorus fertiliser and adsorbent recovery aiming safe food for less cost. The specific objective of 3R Recycle-Reuse-Reduce zero emission pyrolysis and Phosphorus recovery key enabling technology is the added value upgrading and valorisation of food grade animal bone by-products into safe and high value recovered organic Phosphorous fertilizer by integrated thermal and biotechnological recycling means.

Who is the vendor of the product?

3R-BioPhosphate Ltd. (since 1989) is a **technology intensive company**, playing international leading role in the RTD, engineering and full industrialization of the zero emission pyrolysis technology for recovery of BioPhosphate/biochar products and it's applications. **The main specialization is the ABC (Animal Bone Char) BioPhosphate recovery and high quality biochar processing.** The core competence **of the company is the ecological recycling and added value reuse of unexploited biomass by specific and advanced high material core temperature 3R Zero Emission pyrolysis** and biotech means. By now the 3R-BioPhosphate Ltd. is the only one vendor in the EU who is specialized on high nutrient dense ABC-BioPhosphate recovery from food grade animal bones.

Which other product/technologies are provided by the vendor?

Linked product: High nutrient dense Bio-Phosphate products recovered from food grade animal bone grist over 30% P₂O₅ content by "3R zero emission pyrolysis" process (https://nutriman.net/farmer-platform/product/id_192)

Technology features:

Which are the advantages of the technology and the problems addressed?

The 3R pyrolysis process is recovery of economically concentrated Phosphorus from food grade animal bones that could potentially provide an abundant alternative source of the nutrient that show similar agronomic efficiencies as the mined P-rock and chemosynthetically processed P-fertilisers.

No emissions during processing and all material streams are fully recovered. The 3R technology is a zero emission/pollution solution for primary designed where all and any material streams are recycled and reused (converted into safe and valuable products). The 3R process does not produce harmful emissions (including greenhouse gases) and the product is safe to use.

Energy self-sufficient and auto-thermal process. Pyrolysis bio-oil (a by-product of the treatment process) will be used to provide heat and power to the plant, with any surplus sold to create an additional revenue stream for the plant owner.

How does the technology work? Describe the process.

3R proprietary pyrolysis technology treats the cattle bone grist at as high as 850 °C material core temperatures (that is a unique special technical solution) in absence of oxygen, that unique processing condition requirement is absolute necessary for the bone processing. The result is a specific Bio-Phosphate fertilising product with <35% P₂O₅ content and unique material character, which is about the same concentration as P-rock based chemosynthetically processed mineral fertilisers and considerably higher than all other organic sources. The process also produces bio-gas and pyrolysis bio-oil for auto-thermal energetic utilization.

How/where to use the technology?

The Animal Bone Char (ABC) **Bio-Phosphate product is made of food grade animal bone grist**, most importantly cattle bones, which mono feed basic material is already processed at 133 degree Celsius for 20 minutes under 3 bar processing conditions. The **high Phosphorous content animal bone grist** input feed streams are low value utilized by-products. The output products are high quality and safe **Bio-Phosphate** and its wide range of BIO-NPK-C bio-formulated variations used for wide range of organic/low input farming and environmental (adsorbent) applications.

Which are the authority permits and in which EU countries?

Industrial scale pyrolysis plant installation/operation permit: FES/01/0851-33/2015 in Hungary.

How much does it cost? Describe the cost of the technology. The 3R technology is open for licensing and franchise replications for medium/large industrialists and financial investors with rapid return expectations and high market growth potential in the EU, USA, Australia and Japan. The 3R technology is supporting rapid financial and non-financial returns.

- a) **Regional scale** business opportunity with **2,000 t/y** throughput capacity
- b) **Large scale** business opportunity with **20,800 t/y** throughput capacity (that is the international replication model).



Picture 1: 3R Pilot Plant

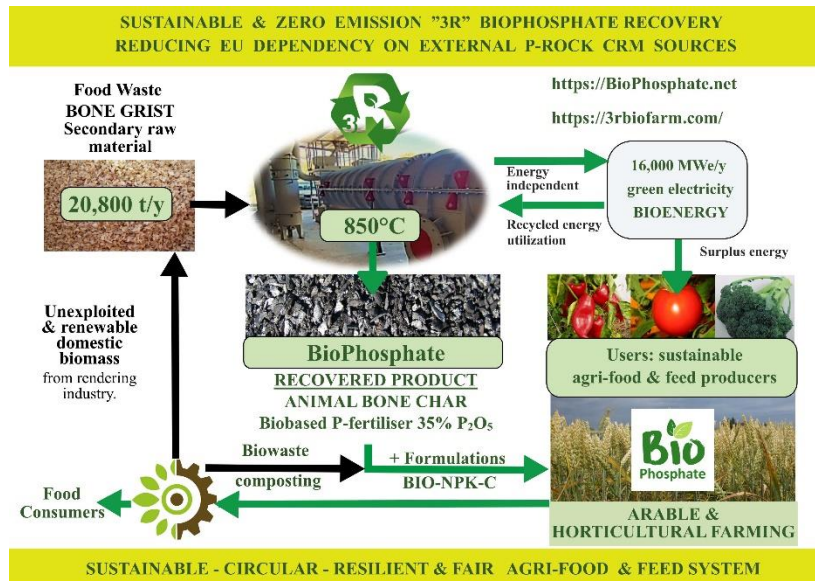
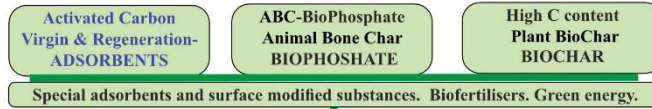


Figure 1: 3R Recycle-Reuse-Reduce zero emission pyrolysis technology flow chart

"3R" zero emission and energy independent carbon refinery technology
Application map 2023

3R reductive thermal processing in any range up to <850°C material core temperature.

High temperature reductive thermal processing <850°Celsius material core temperature processed



... and many other application areas, incl. petroleum jelly, coatings, preservative...



Low temperature reductive thermal processing <450°Celsius material core temperature processed

<https://BioPhosphate.net> <https://3rbiofarm.com/>

Figure 2: 3R Recycle-Reuse-Reduce zero emission pyrolysis technology application map

For more information: https://nutriman.net/farmer-platform/technology/id_193