Events

10-12 June 2025, Bergen, Norway: nutrients in aquaculture

ESPP workshop, with partners in Norway and UNEP uPcycle, on nutrient management in aquaculture: fish feed, seafood processing and fish sludge valorisation, Norway & online, 10-12 June 2025, covering nutrient flows, environmental best practice, phosphorus recycling, regulatory challenges. The workshop will contribute to the United Nations (UNEP) project uPcycle, leading to a UNEP white paper on phosphorus sustainability in aquaculture. Site visits to in-sea fish farm with sludge recovery, research installations, fish sludge processing.

Still open for registration online and for last few places left for workshop and fish farm sea boat site visit.
Programme, registration https://phosphorusplatform.eu/AquacultureFisheries

IChemE webinar on P sustainability implementation in wastewater treatment

100 participants joined the IChemE Water Special Interest Group Planetary Boundaries series webinar on phosphorus, targeting practical information for waste water professionals, 14th May 2025.

Amanda Lake, Jacobs, conference coordinator, outlined the Planetary Boundaries concept, showing that both phosphorus and nitrogen massively exceed sustainable limits. ESPP presented EU policy on phosphorus management and requirements for wastewater treatment of the recast Urban Waste Water Treatment Directive 2024/3019 (UWWTD).

ESPP underlined that without phosphate-rock based fertilisers we could feed maybe only one fifth of the world's population, but that phosphorus is the first (non-morphological) cause of water quality status failure under the EU Water Framework Directive 2000/60. The EU Green Deal Farm-to-Fork and Biodiversity Strategies require to reduce nutrient losses by -50%, and this target was also adopted at the global level in the United Nations Kunming-Montreal biodiversity convention. Phosphorus "reuse and recycling" from urban wastewater will be required across the EU to targets to be defined by the European Commission by end 2027, under art. 20 of the recast UWWTD.

Paul Roeleveld, Haskoning, gave the view of a water treatment technology supplier: around half of EU sewage sludge currently goes to agriculture, but maybe up to 80% of phosphorus in sewage sludge is not crop-available, and the inevitable presence of PFAS, microplastics and other contaminants in sewage sludge could limit or prevent this agricultural use. He suggested that to be viable, phosphorus recovery processes must generate a product with the form and quality users (farmers and others) want, should enable wastewater treatment plant operating savings and compatibility with existing infrastructure and should ensure that co-products are valorised (not generate significant new waste streams). Ultimately, he stated that successful

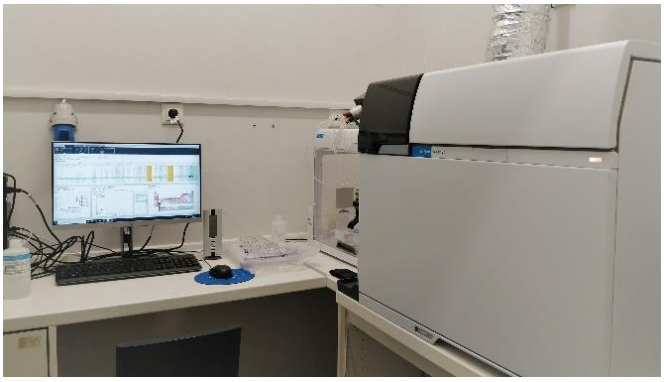
P-recovery demands strategic foresight, cross-sector collaboration, and the courage to prioritize resource recovery from the outset—not as a retrofit, but as a design principle.

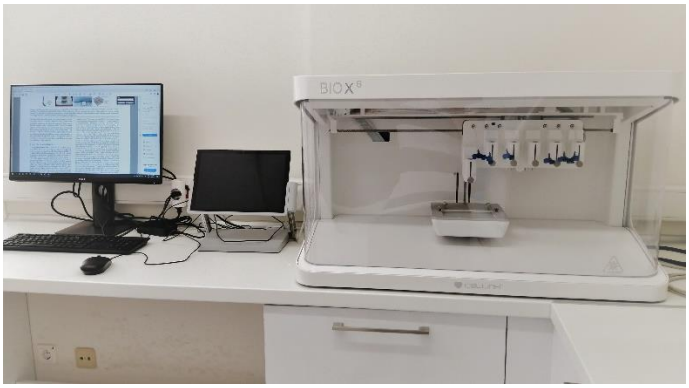
Webinar discussions concluded that phosphorus recovery technologies are today operational but that roll-out is limited, although developing, and that some recovered products (precipitated phosphates, ash-derived phosphates) are today authorised under the EU Fertilising Products Regulation. Discussions noted that the UWWTD phosphorus "reuse and recycling" requirement will accelerate implementation of phosphorus recycling.

IchemE (Institute of Chemical Engineers) https://www.icheme.org/ and IWA (International Water Association) Climate Smart Utilities http://iwa-network.org/projects/climate-smart-utilities/ Webinar organised by iChemE Water Special Interest Group with support from IWA Climate Smart Utilities initiative. Recording here.

ESPP new members

QLAB





QLAB is an analytical and consulting laboratory. Since 2012, we support farmers, agri-cooperatives, and public bodies through reliable soil, plant, water, and wastewater analyses, as well as developing research and consultancy. QLAB's laboratory, based near Thessaloniki, Greece, is ISO 17025-accredited. Our work focuses on promoting sustainable farming practices by delivering scientifically sound advice on fertilisation and irrigation, particularly in Organic and integrated crop management systems. In relation to phosphorus, we provide detailed assessments of soil phosphorus levels, potential runoff risks, and nutrient-use efficiency. These analyses underpin customised fertilisation recommendations that support yield goals while mitigating eutrophication risks. Our team also engages in research and pilot projects on soil health and nutrient cycling, exploring innovative materials such as zeolites for phosphorus retention and recovery. By joining ESPP, we aim to share our expertise and learn from a diverse network of practitioners, researchers, and policymakers working toward phosphorus sustainability. We believe that harmonising field-level practices with European-level strategies is essential to addressing nutrient-related environmental challenges.

Photos: Agilent ICP-MS 7850, Cellink BIO X6 3d-bioprinter

https://www.q-lab.gr/en/

Policy

EU consultation on BioEconomy Strategy

EU Public consultation to accelerate innovation, sustainability, and competitiveness in the bio-based sectors. Open to 23rd June 2025. The strategy will address barriers to scale-up, promote circularity, and support rural economies while ensuring environmental protection. ESPP is preparing a contribution highlighting the need to address nutrient recovery, regulatory barriers to recycling (e.g. ABPs), strategic supply risks for phosphorus, and the role of nutrients in supporting a resilient, circular bioeconomy.

Towards a circular, regenerative and competitive bioeconomy, open to 23rd June 2025, https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/14555-Towards-a-circular-regenerative-and-competitive-bioeconomy_en

EU consultation on CAP simplification (Common Agricultural Policy)

The EU Commission is collecting feedback on proposed adjustments to the CAP legal framework, to reduce administrative burdens and improve the effectiveness of CAP implementation by Member States. **Open to 1st August 2025.** Modifications focus on simplifying and streamlining CAP requirements to make them more practical and accessible for farmers, including: on-farm simplification of rules; simplified support for smaller and medium-sized farms; easier rules on financial tools and support schemes; more flexibility for Member States in managing and amending CAP Strategic Plans. Environmental NGOs and think tanks (EEB, IEEP, ARC2020) have warned that the proposal risks weakening environmental

safeguards and climate ambition, while the organic sector has welcomed the recognition of the green benefits of organic farming. Nutrient management is not directly addressed in the proposal, except in the context of exempting organic farmers from certain GAEC standards—such as GAEC 1, 3, 4, 5, 6, and 7—on the grounds that organic practices inherently protect against soil degradation, water pollution, and other environmental risks.

Simplification of the implementation of CAP Strategic Plans, feedback on Commission adoption open to 1st August 2025, https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/14704-Simplification-of-the-implementation-of-CAP-Strategic-Plans_en

EFSA concludes that ABP Cat.1 ash is not 100% safe

EFSA Opinion on Category 1 animal by-products incineration ash says that it is impossible to conclude (99% certainty) that there is zero TSE infectivity (no prions).

ESPP notes that the question put to EFSA (European Food Safety Agency) by the European Commission (DG SANTE) is conservative: a high level of certainty of no residual TSE/BSE hazard (transmissible spongiform encephalopathy / mad cow disease) after incineration. ESPP supports this conservative approach: recycled nutrient materials entering the food chain should be guaranteed safe, to avoid risks and for farmer and consumer confidence.

EFSA note that this conservative question is not the same as the threshold applied for "alternative processing methods" for Cat.1 ABPs (10^{-6} reduction in TSE agents) and that DG SANTE specifically requested this distinction.

EFSA conclude that TSE agents are difficult to inactivate completely, with considerable variation in heat resistance between different strains. They note that there is very little experimental data on TSE inactivation in incineration, with only four studies identified, none of which used the conditions required by the EU IED Industrial Emissions Directive (850°C for 2s or 1100°C for 0.2s). Because of this lack of data, EFSA consider that it is not possible to exclude, with 99% certainty, the presence of TSE hazards in Cat.1 ash after incineration under IED conditions.

ESPP notes that this means that this ash cannot be considered "safe" and should therefore be handled as a TSE bio-hazardous waste and disposed to monitored landfill for hazardous material, or to further processing to ensure its safety. To our understanding, this is generally today not the case.

EFSA does not deliver an opinion on the TSE bio-safety of co-combustion of Cat.1 ash in cement kilns, considering that because this does not produce ash it is not covered by the Commission's request. ESPP notes however that temperatures are considerably higher in cement kilns.

The EFSA Opinion addresses Cat.1 ash as such (in particular, use of such ash directly as a phosphate fertiliser) and does not cover chemical processing of the ash to e.g. phosphoric acid or inorganic phosphates. ESPP questions whether the same question "99% certainty of zero prions" might lead to the same conclusion, unless there was experimental data showing complete elimination of different strains of prions in the chemical processing.

The EFSA Opinion cites several times the various inputs submitted by ESPP (publications retrieved from various sources, SAFOSO "risk appraisal report" commissioned by ESPP – see ESPP eNews 90) but this input has not resulted in positive conclusions, perhaps unsurprisingly given the formulation of the question "99% certainly of zero prions".

EFSA recommends that experimental data be developed on prion inactivation in Cat.1 material, in particular experimental tests at IED incineration conditions, using meat and bone meal spiked with different prion strains (including C-BSE) and bioassay or PCMA (Protein misfolding cyclic amplification) to quantify prion infectivity reduction and look for residual prion infectivity if any.

ESPP notes that this negative conclusion is likely to prevent authorisation of Cat.1 ash as an input material for fertilisers under the EU Fertilising Products Regulation (Cat. 2 and 3 ashes are today authorised, under appropriate conditions, but Cat.1 ash is excluded), be it for ash used as such or after chemical processing. This despite 70 000 t/y of Cat.1 ash having been used on farms as fertiliser in the UK from over a decade, with Cat.1 ash also being used as a forest fertiliser in Portugal, with no suggestion of BSE concerns

ESPP ask the European Commission requesting act on the conclusions of this EFSA Opinion: if Cat.1 ash is not certainly safe (no TSE risk) then it should be handled and disposed of as a bio-hazardous material. This could significantly increase Cat.1 material incineration costs, so pushing the rendering industry to invest in the experimental studies requested by EFSA to prove that the ash is in fact safe. ESPP will also request that the European Commission put in place a Horizon Europe R&D call for such studies.

ESPP notes that Cat.1 rendered MBM contains around 30 000 t/y of phosphorus* and estimates that this is worth over 60 M€/y for fertiliser use, compared to the cost of developing the experimental data requested of maybe 500 000 € *****.**

** EFPRA, the EU rendering industry, indicated 10 – 30 000 tP/y for Cat.1 MBM currently going to incineration only, that is not including Cat.1 MBM currently going to cement kilns (Martin Alm in ESPP eNews n°91). ** taking an estimated price for P in bulk mineral phosphate fertilisers of 2 200 €/t. *** a very approximate expert guess, compared to lab prices for complex in vivo toxicity trials.*

EFSA (European Food Safety Agency) Scientific Opinion "Effect of incineration, co-incineration and combustion on TSE hazards in category 1 animal by-products", EFSA Journal 2025;23, e9435, DOI.

See also:

"Risk appraisal of use of Category 1 animal by-products ash as fertiliser", SAFOSO for ESPP, September 2024
www.phosphorusplatform.eu/regulatory

"Assessment of Alternative Phosphorus Fertilizers for Organic Farming: Meat and Bone Meal", K. Möller et al., ImproveP – FiBL, 2015 https://www.fibl.org/en/shop-en/1693-meat-and-bone-meal

Joint industry proposals for animal feed circularity

Industry and stakeholders propose joint 'Catalogue of Measures to Enhance Animal Feed Circularity' in Europe, with 17 case studies of which 2 from ESPP: purified minerals from incineration ashes, algae grown in wastes. Eight European organisations, led by FEFAC (European Feed Manufacturers' Federation) and including ESPP, have worked together to propose measures aimed at creating a supportive legislative environment that stimulates and increases feed circularity whilst maintaining safety, traceability and farmer and consumer confidence. This has the potential to increase the use of secondary nutrient streams in animal feed, reduce competition for land use with food production, reduce imports of feed materials and reduce livestock system net greenhouse gas emissions. This would support the Nutrient Circular Economy, contributing to food sovereignty, competitiveness and farm system resilience. The organisations call for the development of an EU Feed Circularity Roadmap.

The Catalogue proposes nine principles for a legislative framework to support feed circularity, including:

- ensure animal feed and food chain safety by traceability, producer responsibility and emergency procedures,
- respect the waste and food waste hierarchies,
- base regulatory decisions on science,
- improve coherence between different EU regulations, circularity and Member State implementation,
- facilitate and harmonise End-of-Waste,
- develop methodology to measure sustainable animal feed circularity.

The 17 case studies illustrate regulatory restrictions which currently limit use of secondary materials in animal feeds and which should be re-examined. Of these, two were proposed by ESPP:

- Use in feeds of purified mineral nutrients from incineration ashes (n°12), requiring amendments of the Feed Regulation (767/2009 Annex II) and of the Animal By-Products Regulation (1069/2009, arts. 9 and 10).
- Biomass grown in or fertilised by wastes (n°14), for which clarification of legal status is needed and possibly amendment of the Feed Regulation (767/2009 Annex II) and development of End-of-Waste criteria.

Other case studies proposed include facilitating safe animal feed use of fish meal, PAP (processed animal protein), dicalcium phosphate produced from bones and other animal by-products.

The Catalogue has been submitted to the European Commission and the eight author European organisations call for consideration of the proposed measures in the EU Critical Raw Materials Act.

"EU Feed Circularity Catalogue", version 1.0, 23rd May 2025, 8 EU industry federations and stakeholder organisations, initiative led by FEFAC (European Feed Manufacturers' Federation), with ESPP, CEFIC (European Chemical Industry Council), FFOP (European Fishmeal and Fish oil Producers), EFFPA (European Former Foodstuff Processors Association), EFPRA (European Fat Processors and Renderers Association), FEDIAF (European Pet Food Association) https://fefac.eu/newsroom/news/eu-feed-circularity-catalogue-outlines-barriers-and-solutions-for-advancing-circular-animal-feed/

CEN standards for Life Cycle Assessments (LCAs) of bio-based products

New EU standard defines how to make LCAs comparing bio-based products to fossil-based equivalents. Existing CEN standards EN 16760 and EN / ISO 225626-1 to 22526-4 describe specific methodology for LCAs of bio-based products, completing EN ISO 14040 and 14067 for all types of products. This new standard defines general principles for LCAs comparing bio-based to fossil-based products, relevant definitions, approach to biogenic and fossil carbon flows, requirements for interpretation and reporting.

European Standard, EN 18027, April 2025 "Bio-based products - Life cycle assessment – Additional requirements and guidelines for comparing the life cycles of bio-based products with their fossil-based equivalents', CEN/TC 411 "Bio-based products". Available from the Estonian Standards Organisation for 32€ https://www.evs.ee/en

ESPP calls for public access to R&D project outcomes

ESPP has written to the European Commission suggesting that all EU-funded project (non-confidential) reports and deliverables should be made permanently available on the Commission's CORDIS website. At present, project outcomes are published on project websites which are set up for the duration of the project but then disappear when project funding stops at the end of the project, meaning that the information is effectively lost and no longer accessible. ESPP suggests that the European Commission should systematically publish and archive all project outcomes on a single, shared, permanent EU website (non-confidential deliverable reports, papers, slide sets, project Newsletters), covering Horizon, InterReg, LIFE and Agri-Research projects. The EU should include in R&D funding contracts an obligation that the project partners should themselves put these documents online onto this website. ESPP understands that the European Commission is aware of and is looking to address this problem, and for more recent Horizon projects some outcomes are on Cordis. However, this seems to be not systematic and to not concern all EU-funded projects (only Horizon).

Calls

Sign the joint stakeholder call for nutrients in the EU Circular Economy Act

Joint call text now finalised. To sign contact ESPP, specifying your organisation name, signatory contact, logo.

The EU Circular Economy Act is currently under preparation. This will be the first EU legal Act (Parliament and Council) for circularity and recycling, replacing the Commission's Circular Economy Action Plans 1 and 2, and is has been announced as part of the new Commission's Clean Industrial Deal (see below).

Now is the time to input to this proposed Act, which is expected to include changes to Waste legislation, Public Purchasing, producer responsibility, and aims to boosting consumer demand for recycled materials.

ESPP has also prepared detailed technical input, addressing nutrient circularity in a wide range of regulations and policies *www.phosphorusplatform.eu/regulatory*

All organisations are invited to co-sign the 1-page "joint call for nutrients in the EU Circular Economy Act" *www.phosphorusplatform.eu/regulatory*

UK government looking to recruit Senior Environmental Analyst - Nutrients

Civil service short term contract with possibility of extension. UK Office for Environmental Protection, working on nutrients in England and Northern Ireland.

Application deadline 12th June, 11h55 UK time. Application information and submission: LINK.

DPP P-recycling German thesis prize

DPP, the German Phosphorus Platform, is for the third year offering a 1000 € prize for a German bachelor or master thesis on phosphorus recycling. The degree must have been obtained in Germany. The prize will be attributed at DPP's annual meeting (DPP Forum), Frankfurt-am-Main, 8th October 2025. The first (2023) DPP thesis prize was awarded to Jannik Mühlbauer (TU Dresden) for his thesis on thermochemical sewage sludge treatment. The second (2024) DPP thesis prize was awarded to Marcia Beste of Braunschweig Technical University for her thesis on phosphorus recovery by struvite precipitation after biological phosphorus remobilisation.

Application (letter of motivation max. 1 page, CV, diploma, supervisor's report, in one pdf file) plus the final thesis (separate file), must be sent by 1st September to info@deutsche-phosphor-plattform.de

DPP Forum, 8th October 2025 https://www.deutsche-phosphor-plattform.de/aktuelles-forum/

Phosphorus supply chain

Phosphate and rare earths recovery from iron ores designated EU 'Strategic Project'

LKAB Sweden's initiatives to extract phosphate and rare earths from iron mine tailings is one of 47 projects listed as EU 'Strategic Projects'. LKAB has announced plans to invest 75 million € in a pilot plant (capacity not specified) in Luleå, Sweden, to test recovery of phosphates (for phosphate fertilisers) and rare earth elements from iron ores and iron mine tailings. The pilot aims to be operational by 2026. The overall project includes recovery of phosphates and rare earth metals from iron ore tailings at the established Gällivare iron ore mine, opening of a new phosphate rock mine in Kiruna (apatite with high rare earths content) and development of the recovery process at the Luleå industrial park. The overall project aims to produce around 6% of the EU's current demand for phosphates in agriculture.

NOTE: several rare earth metals are recognised as "Strategic" under the EU Critical Raw Materials (CRM) Act 2024/1252. Phosphate rock and white phosphorus (P_4) are on the EU CRM Act list of 'Critical' raw materials but are not recognised as 'Strategic' in this Act ('Strategic' in this Act means for electronics, aerospace, renewable energies).

"LKAB's future initiatives designated as Strategic Projects by the EU", LKAB press release, 25th march 2025 https://lkab.com/en/press/lkabs-future-initiatives-designated-as-strategic-projects-by-the-eu/

European Commission decision C(2025) 1904 final "recognising certain critical raw material projects as Strategic Projects under Regulation (EU) 2024/1252" (the EU Critical Raw Materials Act) and European Commission press release, 25th March 2025 "Commission selects 47 Strategic Projects to secure and diversify access to raw materials in the EU" https://ec.europa.eu/commission/presscorner/detail/en/ip_25_864

Environmental Product Declaration (EPD) Product Category Rules (PCR) for fertilisers

Updated PCR for fertilisers published by International EPD System covers inorganic and organic N, P, K and other fertilisers, considering production and distribution emissions, but also agronomic efficiency and nutrient uptake. This fourth version published 25/4/25 replaces the 2010, 2015 and 2020 versions. It aims to support generation of consistent and comparable Environmental Product Declaration data for fertilisers, based on ISO 14025 and 14040/14044. The PCR provides rules for LCA methods, including system boundaries (raw materials, transport, fertiliser production, transport, direct and indirect emissions related to use). Specific PCR rules define for example default emissions factors (if specific product or regional

emissions factors are not available) for NH_3, NO, N_2O, nitrate and phosphorus losses to waters, for different mineral fertilisers. The EPD PCR rules support calculation of Scope 3 emissions for fertiliser producers and grants a marketing label if implemented.

A validated EPD for six mineral and one organo-mineral fertiliser formulations produced at Ripalta Arpina, Italy, is published 24/3/2020 by Timac Agro Italia SpA, including agronomic efficiency and uptake indexes for N and for P, data for use of resources, waste production, climate change and other environmental impacts

"Product Category Rules (PCR). Fertilisers. Product category classification: UN 3461, 3462, 3463 & 3465. Publication dates 2025-04-05", International EPD System (Environmental Product Declaration), and "Environmental Product Declaration In accordance with ISO 14025 for: Mineral Fertilisers from TIMAC AGRO Italia S.p.A.", EPD Registration n° S-P-01960, Publication date: 2020-03-24. https://environdec.com/library and search for "fertiliser"

Fire extinguisher powder recycling

Tens of thousands of tonnes of end-of-life fire extinguisher powder are generated annually in Europe, consisting mainly of ammonium phosphates and ammonium sulphates, and are today treated as waste (see SCOPE Newsletter n°123). This is because fire extinguishers must be emptied and refilled every three years to ensure that they function effectively when needed. The following recent studies suggest the end-of-life powder can be safety recycled to fertilisers, so significantly contributing to nutrient circularity and waste prevention.

Spent fire extinguisher powder a safe and effective fertiliser after composting

Pot trials in Italy show that co-composted fire extinguisher powder delivers nutrients, increases plant growth and is not phytotoxic. Livestock and crop wastes were composted for three months with or without 5% addition of commercial ABC fire extinguisher powder (not pre-treated). Lettuce was grown for 28 days from 4-week seedlings, in pot trials using a 1:1 soil:sand mixture at 1, 2 or 3 t/ha of compost (typical rate to maintain Mediterranean soil carbon). The powder was 95% ammonium phosphate and ammonium sulphate and the composts containing the powder showed heavy metals well below Italy national fertiliser limits. The powder increased soil N, P and S (as expected) but also soil Ca, Mg and Na. The compost provided K, ensuring appropriate K/Na balance). The compost with fire extinguisher powder showed no phytotoxicity to lettuce, and increased photosynthesis and shoot biomass, so showing to be an effective fertiliser.

"Exhausted fire-extinguishing powders: A potential source of mineral nutrients for reuse and valorisation in compost enrichment for soilless cultivation", A. Gelsomino et al., Science of the Total Environment 906 (2024) 167633, https://doi.org/10.1016/j.scitotenv.2023.167633

Spent fire extinguisher powder a safe and effective fertiliser when applied directly

In pot trials in Greece, with lettuce and spinach. Fire extinguisher powder mixed directly into acid and alkaline soils shows no toxicity and is an effective fertiliser. End-of-life extinguisher powder was analysed as 47% ammonium sulphate, 40% mono ammonium phosphate, 10% mica (silicates) and 1.5% methyl polysiloxane. The powder was tested at 0, 1 or 2 % in two different soils (slightly acidic, slightly alkaline) in pot trials of 48 days (spinach) and 35 days (lettuce). At 2% dose, lettuce and spinach foliage growth both increased by around +50% compared to control (no fertiliser). Root length, chlorophyll, leaf and root phosphorus and nitrogen and total antioxidant capacity also increased. No phytotoxicity was observed for either plant

"Investigating the Potential Use of End-of-Life Fire Extinguisher Powder as a Soil Amendment in Different Soil Types: A New Approach Following a Circular Economy Model", I. Tsigka et al., Sustainability 2024, 16, 8913. https://doi.org/10.3390/su16208913

EU-funded PHOSave project shows safe recycling from fire extinguishers to fertilisers

The Horizon2020 PHOSave project demonstrated (5 000 t/y scale) purification and granulation of end-of-life fire extinguisher materials to fertilisers. Published data shows absence of phytotoxicity of the recycled nutrients. The project is presented in EU SCOPE Newsletters n°127 and 123. The process cleans, removes silicones and processes the contents removed from fire extinguishers (ammonium phosphate and ammonium sulphate) to fertilisers. The published reports (here) include a presentation of the pilot processing plant and a first agronomy report, which covers phytotoxicity only. This agronomy report presents tests of phytotoxicity of the recovered nutrient material on maize, rice, melon and tomato, from seed germination to plant development, showing no phytotoxicity in any case. Contaminant levels in the material are presented, showing heavy metals levels below or well below EU and Italian fertiliser regulation limits. This first agronomic report indicates that field trials with maize, melon and tomato were underway to assess agronomic fertiliser value, and that results will be published on the project website – but this site no longer exists and the EU does not archive project outcomes.

"PHOSave Deliverable D6.2 Chemical, phytotoxicity, phytotron and greenhouse tests report", Ref. Ares(2018)2788214 - 30/05/2018 https://www.fabiodisconzi.com/open-h2020/projects/204572/deliverables.html

PHOSave on EU CORDIS website: https://cordis.europa.eu/project/id/724586/fr

Research

Coagulant-free P removal bio-struvite process wins funding

Project by Cranfield University, UK, and US biotech company Microvi, develops bio-mineral P removal (BMPR) technology to use microorganisms to remove phosphorus as bio-mineral struvite. The use of Microvi biocatalysts enables microorganisms to be effective in mixed-culture real wastewater systems**.** The process has to date been tested in continuous small pilot-scale reactor of 4L, operated for 5 months in real wastewater. The project aims to scale up testing to an 80L pilot scale, treating up to 350 L/day of centrate from a Severn Trent wastewater treatment plant. The small pilot-scale tests fed with real centrate showed that the combined microorganism - reduce phosphorus by 96% to below 2 mg P/L. The bio-mineral process concentrates nutrients, producing struvite crystals that are released to the wastewater and grow to 0.2-0.5 mm size. These are separated from the wastewater by sedimentation and filtration. The struvite shows high purity and trace levels of contaminants. The project has been awarded 500 000 UK£ as one of ten winners of the OFWAT Innovation Fund (OFWAT: Water Services Regulation Authority) "Water Discovery Challenge".

"Innovative coagulant free phosphorus removal technology", OFWAT Innovation Fund, 20th February 2024.

"Biomineralisation for resource recovery", Cranfield University, LINK.

See also separate work on bio-mineral struvite: "Nutrient Removal and Recovery from Urine Using Bio-Mineral Formation Processes", R. Colston et al., ACS Sustainable Resour. Manage. 2024, 1, 1906−1918, DOI

ESPP members

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