



<b>Input to policy</b> .....	<b>1</b>
For comment: Nitrates Directive recycled nutrient products from manure.....	1
For comment: proposals for ash-based products in the EU Fertiliser Regulation .....	1
EU consultation on micro-plastics .....	2
<b>New ESPP members</b> .....	<b>2</b>
Budenheim .....	2
<b>Policy and media</b> .....	<b>2</b>
Key Environmental Indicators for BAT .....	2
Sri Lanka acts for agricultural climate and phosphorus resilience .....	2
Water industry calls to address nitrate pollution and pharmaceuticals .....	3
World leaders address eutrophication at Ocean Conference.....	3
UNEP project for nutrient stewardship in Romania.....	3
<b>Research and innovation</b> .....	<b>3</b>
Networking nutrient recycling R&D .....	3
EU R&D funding opportunities .....	3
LIFE TL-Biofer nutrient recovery from sewage by microalgae .....	4
Budenheim ExtraPhos® pilot phosphorus recycling plant inaugurated .....	4
Italmatch LIFE-Trialkyl sustainable industrial phosphorus chemistry.....	4
SYSTEMIC project kick-off meeting .....	5
Ivaco piggery: biogas, fertiliser and nitrogen recovery.....	5
French phosphorus recycling conference conclusions .....	5
VTT container solution for small-scale resource and water recovery .....	6
Producing organo-mineral fertilisers from dried sewage sludge .....	6
UpLift marine nutrient recycling project wins innovation award.....	6
Phosphorus sorption by clay constituents of soils .....	7
Call for papers: phosphorus circular economy .....	7
<b>Agenda</b> .....	<b>7</b>
<b>ESPP Members</b> .....	<b>8</b>

## Input to policy

### For comment: Nitrates Directive recycled nutrient products from manure

The EU Nitrates Directive specifies application limits for manure “even in a processed form” which are lower than those for mineral fertilisers. This is currently implemented differently across EU Member States, e.g. digestate or compost where manure is only a trace input can be limited as “processed manure”, or mineral fertiliser products produced from manure such as precipitated phosphates or ammonia salts from gas stripping can be subject to lower limits than similar mineral fertilisers produced from virgin materials. This can discriminate against recycled nutrient products made from or partly made from manure, by creating regulatory uncertainty, incoherence between different countries and regions or by more favourable application limits for virgin mineral fertilisers. ESPP is developing [proposals](#) to address this, whilst continuing to support the Nitrates Directives objectives of environmental protection and prevention of nutrient losses to surface and ground waters. Input to ESPP’s proposals is invited by email: [info@phosphorusplatform.eu](mailto:info@phosphorusplatform.eu)

For further explanation see SCOPE Newsletter n° 100 - draft ESPP proposals concerning recycled nutrient products from manure (manure in a “processed form”) under the Nitrates Directive - for comments [www.phosphorusplatform.eu/regulatory](http://www.phosphorusplatform.eu/regulatory)

### For comment: proposals for ash-based products in the EU Fertiliser Regulation

The JRC ‘STRUBIAS’ proposed criteria for integrating ashes (as recycled nutrient fertilisers) into the revised EU Fertiliser Regulation effectively exclude sewage sludge incineration ash. The JRC proposals target only the use of ash directly on fields (e.g. after granulation or blending) but do not cover the use of ash as an input ingredient into a chemical / industrial process. The JRC proposals therefore fix contaminant limits and nutrient plant availability requirements which are appropriate for ash being used directly on fields, but are irrelevant if the ash is being chemically processed (contaminants can be removed, nutrients transformed into different forms). However, fertilisers using ashes as a production ingredient are currently excluded from the revised Fertilisers Regulations (CMC1 excludes wastes as inputs). ESPP has therefore developed [proposed criteria](#) for “ash as a process ingredient” to propose to the EU Fertiliser Regulation



process. These raise questions concerning End-of-Waste, REACH, fate of removed contaminants and intermediates (e.g. phosphoric acid is recovered from ash, then re-processed to produce fertiliser). Input and comments to these ESPP proposals are invited by email:

[info@phosphorusplatform.eu](mailto:info@phosphorusplatform.eu)

JRC proposed Fertiliser Regulation criteria ("nutrient recovery rules") for struvite (and other phosphate precipitates), biochars and ash (STRUBIAS) and ESPP proposals for "ash-as-an-ingredient" in the revised EU Fertilisers Regulations, for comment [www.phosphorusplatform.eu/regulatory](http://www.phosphorusplatform.eu/regulatory)

## EU consultation on micro-plastics

The European Commission has opened a public [consultation](#) (to 16<sup>th</sup> October 2017) on policy options to reduce microplastics release to the environment. This question is of relevance to nutrient recycling because questions are today asked about the possible impacts of microplastics present in sewage biosolids where these are recycled by land use, for example impacts on soil fauna or plants, or possible release to surface or ground water. Although it seems likely that microplastics particles will be of less concern in soil (which is made up of particulate matter) than in the marine environment, this needs to be assessed. The EU consultation particularly addresses release of microplastics by wear (abrasion) of tyres, plastics production, textiles, artificial sports turfs, and also mentions agricultural mulch films, plastic bags, fishing nets (wear) as well as cosmetics, detergents and industrial abrasion products (deliberate production and use of microplastic particles). ESPP will submit a response underlining the importance to reduce emissions of microplastics to municipal sewage and the need for research to assess the possible risks and impacts of microplastics in sewage biosolids recycled to agriculture.

EU public consultation on microplastics [www.eumicroplastics.com](http://www.eumicroplastics.com) open to 16<sup>th</sup> October 2017

## New ESPP members

### Budenheim

Budenheim is a global specialty chemicals company with long-term phosphate expertise. The company has production sites in Budenheim (Germany), Shanghai (China), Monterrey (Mexico), Columbus (USA), La Zaida and Valencia (Spain). Building on an innovative portfolio of products and services, [Budenheim](#) offers sustainable solutions for a broad range of applications. These include the fields of nutrition, health, safety, and preservation of resources. Budenheim generated revenue of several hundred million over the past year and has a worldwide workforce of around 1.100 employees. Budenheim has joined the European Sustainable Phosphorus Platform (ESPP) because it brings together companies and stakeholders to address the need to secure phosphate resources for the future. In this community of like-minded partners, Budenheim is setting a new benchmark in raw material recycling by re-introducing phosphorus in the nutrient cycle, through the ExtraPhos® process (see below). As a member of ESPP, Budenheim acts to save global resources and to help secure the basis of our existence.

See for more information [www.budenheim.com](http://www.budenheim.com)

## Policy and media

### Key Environmental Indicators for BAT

In the context of the development of [BAT BREF](#) (Best Available Technology) criteria under the Industrial Emissions Directive, the EU is discussing "Key Environmental Indicators" (KEIs). These will orientate the definition of future BAT criteria, applicable to all installations covered by operating authorisations. ESPP has input in response to draft KEI discussion document that the KEIs should specify reference to the EU Critical Raw Materials list under consideration of consumption of materials (not refer only to solvents), specify that recycling or materials recovery is taken into account, and should include in assessment criteria levels of consumption of materials (loss to waste or emissions, as opposed to recycling or recovery) as well as pollution.

EU Industrial Emissions Directive BAT BREFs <http://eippcb.jrc.ec.europa.eu/reference>

### Sri Lanka acts for agricultural climate and phosphorus resilience

Sri Lanka's agriculture has launched a major transformation driven by concerns about widespread kidney disease (CKD) and the President's "toxic free nation" objectives, including a national ban on the herbicide glyphosate, support of organic fertiliser use and of organic farming. Climate change and phosphorus scarcity have been identified as key risks, because agriculture is largely based on rain-fed rice and soils are phosphorus deficient. The PACSA (Phosphorus And Climate Smart Agriculture) policy is being developed, with support from University of Technology Sydney (Dana Cordell) and Sabaragamuwa University Sri Lanka (Mohammed Esham). Win-win [actions](#) identified include combining waste-to-energy with production of fertilisers from household wastes, developing crop varieties that are both drought resistant and have low phosphorus requirements, diversifying crops and recycling agricultural wastes.

"Towards phosphorus and climate smart agriculture (PACSA) in Sri Lanka", UTS, 14 Feb. 2017 [www.uts.edu.au/research-and-teaching/our-research/institute-sustainable-futures/news/towards-phosphorus-and-climate](http://www.uts.edu.au/research-and-teaching/our-research/institute-sustainable-futures/news/towards-phosphorus-and-climate)



## Water industry calls to address nitrate pollution and pharmaceuticals

The European water industry federation EUREAU has [published](#) an 80 page summary of the successes and challenges facing the water sector, which employs over 500 000 people with over 80 billion euro annual turnover and nearly 40 billion euro annual investments. "Water Matters" includes articles by the European Commissioner for the Environment, the President of the Rhône-Mediterranean Water Basin and national and thematic perspectives from EUREAU presenting the sector's vision in anticipation of expected review of key EU water policy regulations in coming years (in particular, the Urban Waste Water Treatment Directive 1991/271, and the Drinking Water Directive 1998/83 and the Water Framework Directive 2000/60). The industry emphasises its support for the EU Circular Economy package, in particular water reuse and nutrient recycling from sewage biosolids, but notes that to date sewage derived products are not yet included in the draft EU revised Fertilisers Regulation and that incentives are needed to ensure a market and so enable investment in recycling. The industry identifies key challenges including: protecting surface and groundwater quality, sustainable funding and water service pricing, long-term asset management and innovation, the Circular economy and jobs, climate change, resource efficiency in water treatment, source control of micro-pollutants (pharmaceuticals and veterinary drugs, microplastics, consumer and cosmetic chemicals, nano-particles and pesticides), governance and public understanding. EUREAU particularly emphasises the need to reduce agricultural nitrogen excesses, to reduce nitrate pollution, and to address the challenges of pharmaceuticals.

"Water Matters", 80 pages, EUREAU 2017 [www.eureau.org/administrator/components/com\\_europublication/pdf/37ad5aa917274354636c27938924de66-eureau-layout-for-web.pdf](http://www.eureau.org/administrator/components/com_europublication/pdf/37ad5aa917274354636c27938924de66-eureau-layout-for-web.pdf)

## World leaders address eutrophication at Ocean Conference

The [UN Ocean Conference](#), United Nations Headquarters New York, 5-9 June, brought together high level world leaders to discuss implementation of Sustainable Development Goal 14 "Conserve and sustainably use the oceans, seas and marine resources for sustainable development". A [joint text](#) adopted by world leaders calls to "accelerate actions to prevent and significantly reduce marine pollution of all kinds, particularly from land-based activities, including nutrient pollution". ESPP member and Baltic Nutrient Platform, BSAG, organised a meeting on "Private-Public cooperation to combat eutrophication and climate change in the Baltic Sea region".

OceanConference <https://oceanconference.un.org> "Our ocean, our future: call for action" <https://oceanconference.un.org/prjune9> and [www.un.org/pga/71/wp-content/uploads/sites/40/2015/08/The-Ocean-Conference-Call-for-Action.pdf](http://www.un.org/pga/71/wp-content/uploads/sites/40/2015/08/The-Ocean-Conference-Call-for-Action.pdf)

## UNEP project for nutrient stewardship in Romania

The Romania Integrated Nutrient Pollution Control [Project](#), funded by the United Nations Environment Programme (UNEP) Global Environment Facility (GEF), 2008-2022, 170 million euro, is supporting equipment, training and infrastructure for some 30 000 small farms. To date, results show a 10% reduction in nutrient losses in 60% of implementation areas, with an objective of reducing nitrogen losses to water by a total of 600 t/y to the Danube and to the Black Sea. In particular, improved manure management is targeted, with support for manure collection and composting or biogas production, as well as sewage treatment installation. Impacts also include improving small farm economics and reducing health risks from manure, sewage and nitrates.

"Making Romania a Healthier Place by Controlling Nutrient Pollution", World Bank News, 1 November 2016  
[www.worldbank.org/en/news/feature/2016/10/26/making-romania-a-healthier-place-by-controlling-nutrient-pollution](http://www.worldbank.org/en/news/feature/2016/10/26/making-romania-a-healthier-place-by-controlling-nutrient-pollution)

## Research and innovation

### Networking nutrient recycling R&D

ESPP is developing network of R&D projects addressing nutrient recycling and a network research and of PhD students working on phosphorus sustainability. If you are involved in an R&D project addressing nutrient recycling, verify that this is included in the list online at [www.phosphorusplatform.eu/R&D](http://www.phosphorusplatform.eu/R&D) and email us any additional information ([info@phosphorusplatform.eu](mailto:info@phosphorusplatform.eu)). ESPP is also developing a listing of research and PhD students working on phosphorus sustainability: if you wish to be included, or have research students to include please email to us. ESPP with Phos4You is organising a meeting of nutrient recycling R&D projects (presentations and posters), technology supplier stands, and R&D project consortium brokerage at Thursday 19th October in Basel (plus workshop on implementation of the new German and Swiss legislations requiring phosphorus recovery from sewage, 18th October): registration is now open at [www.nweurope.eu/phos4you](http://www.nweurope.eu/phos4you)

### EU R&D funding opportunities

An EU "demonstration" plant funding call is currently open to 7<sup>th</sup> September 2017 on "Innovative bio-based fertilising products to increase the sustainability of fertilising practices in agriculture" (Bio-based Industries Innovation action, BBI-IA-DEMO, BBI.2017.D4). The project should contribute to make fertilisers for arable crops more sustainable and resource efficient. Specific challenges indicated are to develop and demonstrate biodegradable slow-release fertiliser coatings, effective biostimulants to improve fertiliser efficiency, and sustainable fertilisers produced from local bio-based waste streams. Also, ESPP network contacts indicate that a Horizon 2020 call on "closing nutrient cycles" is expected in 2017-2018 to address nutrient recovery by conversion of agro-food and forestry by-products into novel

fertilisers. The project should develop a knowledge base to support policy decisions concerning new fertilisers based on organic resources, including environmental and agronomic performance, analytical methodologies and an analysis of regional nutrient flows and imbalances in Europe, and so viability (including logistic costs) and sustainability of transfers of recovered nutrient products.

To be put into contact with other ESPP network R&D institutes and companies interested in preparing submission to these calls contact [info@phosphorusplatform.eu](mailto:info@phosphorusplatform.eu)

### LIFE TL-Biofer nutrient recovery from sewage by microalgae

On 28<sup>th</sup> June, Cordoba, organised by EMPROACSA- Empresa Provincial de Aguas de Cordoba, the TL-BIOFER LIFE [project](#) conference brought together around 60 wastewater treatment experts and 12 R&D projects relevant to nutrient recovery from wastewater (8 LIFE, 4 other). TL-BIOFER is led by BIOMASA PENINSULAR and addresses "Nutrients and regenerated water recycling in waste water treatment plants through twin-layer microalgae culture for biofertilizers production". The project includes a 6 m<sup>3</sup>/day pilot plant for microalgae nutrient removal and recovery in a 64 m<sup>2</sup> greenhouse at El Viso-Villaralto Sewage Treatment Plant (Cordoba) and pilot production of granulated solid and liquid bio-fertilisers from the harvested microalgae. The *Scenedesmus* sp. microalgae develop on an array of c. 2 m<sup>2</sup> vertical flat plates, from which they can be harvested by scraping, then centrifuged and lyophilised to process into solid bio-fertiliser. The objective is to achieve 90% removal of both N and P from the wastewater in the microalgae installation. Final project results will be presented in Brussels in June 2018.



TL-BIOFER website: [www.life-tlbiofer.eu](http://www.life-tlbiofer.eu) Other LIFE projects presenting at the workshop: BioSolWaRe [www.life-biosol.eu](http://www.life-biosol.eu) ADNATURE [www.adnatur.com](http://www.adnatur.com) IntegralCarbon [www.integralcarbon.eu](http://www.integralcarbon.eu) WOGAnMBR [www.life-woganmbr.eu](http://www.life-woganmbr.eu) ALGAECAN - EMPORE [www.life-empore.org](http://www.life-empore.org) ECODIGESTION [www.ecodigestion.com](http://www.ecodigestion.com) LO2X [www.lo2x.com](http://www.lo2x.com) and other projects: SABANA Sustainable Algae Biorefinery for Agriculture & Aquaculture [www.eu-sabana.eu](http://www.eu-sabana.eu) WATINTECH. Smart Decentralized Water Management through a dynamic integration of technologies [www.watintech.eu](http://www.watintech.eu) ALL-GAS Project [www.all-gas.eu](http://www.all-gas.eu) INCOVER Project [www.incover-project.eu](http://www.incover-project.eu) Workshop slides are online at: [www.dropbox.com/sh/27imim4uw9zr9pv/AACILuFun3jXp9p5or4QnzgQa?dl=0](https://www.dropbox.com/sh/27imim4uw9zr9pv/AACILuFun3jXp9p5or4QnzgQa?dl=0)

### Budenheim ExtraPhos® pilot phosphorus recycling plant inaugurated

On 13<sup>th</sup> June, ESPP and the German phosphorus platform DPP member and chemistry specialist company Budenheim commissioned a [first pilot scale installation](#) of the ExtraPhos® phosphorus recycling process. Situated at the Mainz-Mombach municipal sewage works (45 Mio litres/day wastewater, using iron salts for chemical phosphorus removal), the pilot plant has a capacity to treat around 50 000 litres/day of sewage sludge after anaerobic digestion. This is considered big enough to test the process and prepare upscaling to full scale commercial and roll-out. The pilot installation was inaugurated by the German federal state Minister for the Environment, Ulrike Höfken, and the Secretary General of the German Federal Environment Foundation (DBU), Dr Heinrich Bottermann. The ExtraPhos process (see SCOPE Newsletter [n°95](#)) uses pressurised carbon dioxide (without high temperatures) to dissolve phosphate from sewage sludge solids, then by controlled release of pressure and lime dosing, fractionally precipitates dicalcium phosphate (DCP) which can be used as a recyclable fertiliser in agriculture, so closing the loop for phosphorus. The carbon dioxide can be mainly recovered and recycled. The technology will enable sewage works operators to respond to Germany's new federal legislation requiring phosphorus recycling from sewage for sewage works > 50 000 p.e.

Link on Budenheim website [www.budenheim.com/en/themes/securing-resources-for-the-future](http://www.budenheim.com/en/themes/securing-resources-for-the-future)

### Italmatch LIFE-Trialkyl sustainable industrial phosphorus chemistry

On June 27<sup>th</sup>, the LIFE-Trialkyl mid-project conference presented results achieved in the first two years. The [project](#) is developing a new production route for trialkyl phosphites, which find various uses as e.g. plastics additives. This will lead to 100% less water usage, 20-30% less energy consumption, and a large reduction in the use of solvents. Because of these environmental benefits, the budget is partially supplied by the EU LIFE program. After successful lab-scale trials, the challenge is scale-up to industrial production. If successful, this line



of products will once again be produced in Europe after an absence of over a decade, with currently all products coming from Asia. At the conference, project partners presented technical progress, sustainability, and the market potential for the products. The WSSTP water platform, Cefic's SusChem platform and ESPP provided a broader context. The Italian chemical industry federation Federchimica explained how the EU's LIFE program can contribute to innovation in industry through development of sustainable processes. A tour of the pilot facilities showed that plant construction is finished, and will be commissioned this summer. This will allow to study the product and by-product quality, reactor, capacity, energy use, water consumption, and overall operability, while producing quantities of the products sufficient for customer testing.

LIFE-Trialkyl is led by Italmatch Chemicals and also involves Sviluppo Chimica (Italy) and RiSe (Sweden) [www.life-trialkyl.eu/en](http://www.life-trialkyl.eu/en)

## SYSTEMIC project kick-off meeting



The [SYSTEMIC](#) project (see ESPP eNews [n°11](#)) will demonstrate, evaluate and model five commercially viable business cases of anaerobic digestion (AD) plants in 5 countries (BE, DE, IT, NL, UK). The plants use different substrates to produce biogas for supply to industry, to the gas grid or to convert to electricity and are equipped with different technologies to recover and recycle nutrients (nitrogen, phosphorus and potassium) and organic carbon. The evaluation includes legal and societal framework conditions as a foundation for policy recommendations and the development of 10 outreach plants to be developed in other countries. During the kick-off meeting the project work-packages were discussed and boundaries were determined: operation of the digestion plants including all flows in and out of the facilities including substrates, chemicals, energy, products, by-products, waste, effluents and emissions. It was decided to pay particular attention to providing concise and ready-to-use information for policy makers and public stakeholders as well as delivering tools for developers interested to set-up new AD businesses in rural areas. It is anticipated that anaerobic digestion with including nutrient recycling should become widely used in all EU member states with thousands of new facilities to be installed in the next fifteen years.

Summary by Proman Management and more information at [www.systemicproject.eu](http://www.systemicproject.eu)



## Ivaco piggery: biogas, fertiliser and nitrogen recovery

The Ivaco pig farm, Gistel, Belgium, is [treating manure](#) from its 11 000 pigs to produce biogas for electricity production, a solid fertiliser and a liquid nitrogen fertiliser. Around 20 t/day of pig manure is separated by centrifuge into solid and liquid. The 7 t/day of solid, along with around 3 t/day of horse and cattle manure and 3 t/day of biowastes, feeds an anaerobic digester. The resulting methane is burnt to generate electricity and the waste heat input to composting of the digestate, producing a solid fertiliser product which is exported to France. From the liquid fraction of the pig manure, 50-90% of the nitrogen is extracted by stripping and nitric acid scrubbing, producing 18% ammonium nitrate in water, using the process developed in the EU project [DIGESMART](#). The remainder of the liquid fraction is purified.

European Biogas Association (EBA) News [www.european-biogas.eu/2017/06/22/belgium-biogas-manure-11000-pigs](http://www.european-biogas.eu/2017/06/22/belgium-biogas-manure-11000-pigs) Erik Meers, Gent University video [www.biogaschannel.com/en/video/livestock/4/biogas-belgium-manure-11000-pigs/1310](http://www.biogaschannel.com/en/video/livestock/4/biogas-belgium-manure-11000-pigs/1310) DIGESMART project documents, including final reports on technology and trials of nitrogen fertiliser product [www.digesmart.eu/eng](http://www.digesmart.eu/eng)

## French phosphorus recycling conference conclusions

The French national committee on rational fertilisation (COMIFER) has published in [French](#) (and ESPP in [English](#)) conclusions of the first national conference on recycled phosphorus in agriculture, which brought together three Ministries and over 150 participants from science, stakeholders and industry. The conference showed a strong interest in France in recycled phosphorus and in use of organic

residuals (MAFOR) in agriculture, as part of the Circular Economy. Priorities identified include: maintaining the use of sewage biosolids on farmland (currently around 75% of sewage sludge), addressing organic contaminants, improving separate collection and valorisation of municipal organic wastes and food wastes, the need for further scientific understanding of how organic recycled materials react with the soil matrix to contribute to soil carbon retention and crop productivity, the importance of dialogue between policy makers and different stakeholders, and the need to work with the agri-food sector on the social acceptance and the positive sustainability aspects of recycling of organic residuals in farming.

Conference summary in French (COMIFER) [www.comifer.asso.fr/index.php/fr/groupe-de-travail/journees-thematiques/151-journee-phosphore-recycle-en-agriculture.html](http://www.comifer.asso.fr/index.php/fr/groupe-de-travail/journees-thematiques/151-journee-phosphore-recycle-en-agriculture.html) and in English <http://www.phosphorusplatform.eu/scope-in-print/scope-in-press/1474-france-conference-on-phosphorus-recycling-in-agriculture> (SCOPE Newsletter in press)

## VTT container solution for small-scale resource and water recovery

The Finland Technical Research Centre VTT is developing the “[Resource Container](#)”, a small-scale wastewater treatment solution using physico-chemical processes to recover nutrients, bio-carbon and purified water (hygienised to end-user requirements). Because the unit uses membrane filtration, evaporation and other non-biological treatment processes, it can be flexibly implemented at different scales or with seasonally varying loads. The project includes identifying optimal treatment processes and implementing in a mobile test container unit, in order to assess technical performance and economic costs (investment, operation).

“Resource Container as a Seasonal Solution for Water Reuse and Substances with Value”, VTT, within the Finnish Ministry of the Environment’s Nutrient recycling programme and with the Baltic Sea Action Group (BSAG) [www.vttresearch.com/media/news/production-of-nitrogen-phosphorus-and-carbon-from-waste-water](http://www.vttresearch.com/media/news/production-of-nitrogen-phosphorus-and-carbon-from-waste-water)

## Producing organo-mineral fertilisers from dried sewage sludge

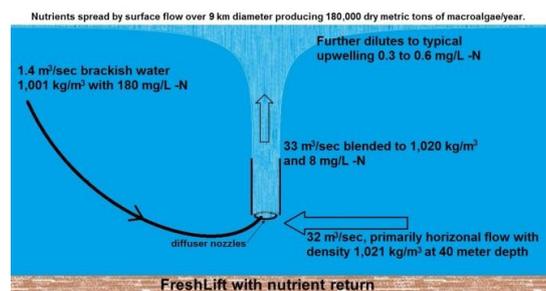
Kominko et al., Crakow, Poland, present analysis [results](#) from organo-mineral fertilisers produced by drying anaerobically digested sewage sludge from the Kędzierzyn-Koźle municipal waste water treatment plant and combining with mineral fertilisers (potassium chloride, DAP di ammonium phosphate) and chicken litter combustion ash. This 15 – 100 000 p.e. plant operates biological phosphorus removal (Bardenpho process) reducing phosphorus from around 9 – 12 mgP/l inflow to 0.3 mgP/l discharge. The sewage sludge contained 2.5% P and 4.5% N. Phosphoric and nitric acids were used as binding agents to combine the dried sludge with the mineral fertilisers. The resulting products mostly showed pH>6, considered good for agricultural use, and high phosphorus solubility (63-90% solubility in water, 73-100% in neutral ammonium citrate (NAC). Granulation enabled production of a product with grain size 8-10 mm and bulk density around 0.5 kg/l. Tests showed mechanical strength of the granules as 78N. Trials in fertiliser spreading equipment are planned. The authors note that most of the heavy metal contaminants present in the product come from the phosphoric acid used as a binding agent.

“Sustainable Management of Sewage Sludge for the Production of Organo-Mineral Fertilizers”, H. Kominko, K. Gorazda, Z. Wzorek, K. Wojtas, Crakow University of Technology, Waste Biomass Valor, 2017 <http://dx.doi.org/10.1007/s12649-017-9942-9>

## UpLift marine nutrient recycling project wins innovation award

The American Society of Civil Engineers (ASCE) has named OceanForesters marine nutrient project as Innovation [winner](#) (Business Models and Technologies) in its 2017 Innovation Contest. OceanForesters are proposing a large-scale macro-algae harvesting system to restore eutrophied marine areas and/or remove and recycle nutrients from discharge waters draining into the sea. The proposed 9 km ring system would have a nozzle and tube nutrient spreading system (FreshLift see diagram), mixing 6 m<sup>3</sup>/s fresh or brackish water (such as river water, drainage water, sewage works discharge, with lower density than seawater) with 100 m<sup>3</sup>/s seawater (at 200 m depth). This results in water with density lower than seawater, which will rise to near the surface and spread out carrying nutrients over a large area. A 9 km diameter structure of concentric inflatable AquaDam polyethylene tube rings supports a network of polyethylene ropes between to which are attached 2 m wide polyethylene ribbons on which seaweed (macro-algae) grows, planted or naturally, consuming the nutrients in the uplift water. Energy recovery is possible in the rising water flow. Because it is inflatable, the whole structure can be constructed on land then inflated once in place in the sea. Smart buoyancy compensation devices (SBCDs) allow the system to be maintained a few metres below the sea surface (to allow navigation and avoid wave impacts) or to be raised to the surface for maintenance or sunk lower to avoid storms. Nutrients can be removed and/or harvested as macroalgae (e.g. seaweed such as Asparagopsis family) or shellfish and finfish which feed on the seaweed and slime growing on the ribbons. A 9 km diameter system is estimated (based on marine experiments using single ropes and tests of an earlier concept, Finley 1991) to potentially produce 180 000 tonnes/year dry matter of macro-algae, which could be used for energy or fertiliser production or as animal or fish feed.

OceanForesters are organizing 5 related proposals to the U.S. Department of Energy Advanced Research Project Agency’s MARINER funding opportunity <https://arpa-e-foa.energy.gov>. Ocean Foresters [www.oceanforesters.org/implementation.html](http://www.oceanforesters.org/implementation.html) AquaDam: [www.aquadam.net](http://www.aquadam.net) “Upwelling Tests on FLIP Used to Develop Energy Technology”, Finley & Jones, Sea Technology 46.7 (2005): 15-18. ASCE 2017 Innovation Awards winners: <http://news.asce.org/innovation-contest-winners-showcase-forward-thinking-ideas>



## Phosphorus sorption by clay constituents of soils

An [assessment](#) of literature on phosphorus sorption over the last 70 years identified relevant studies relative to phosphate binding on clay minerals and metal oxides (iron and aluminium) in soils, of which only 10 (dating from 1973 to 2014) directly compare metal oxides with clay minerals (kaolinite, montmorillonite and illite). The available data shows that experimental work has largely neglected the phosphate sorption capacity of clay minerals. This property varies with their crystallinity and specific surface area. The pH dependency of phosphate adsorption on clay minerals can differ significantly from that of Fe/Al oxides, depending on phosphate loading. Simple calculations show that the sorption capacity of clay minerals can exceed that of Fe/Al oxides in most soils according to their clay content. This finding could have significant implications for understanding phosphorus availability to crops and defining fertiliser use.

"Clay minerals, iron/aluminum oxides, and their contribution to phosphate sorption in soils — A myth revisited", F. Gérard, *Geoderma* 262 (2016) 213-226  
<http://dx.doi.org/10.1016/j.geoderma.2015.08.026>

## Call for papers: phosphorus circular economy

Sustainability journal (sustainable engineering and science section) is calling for papers for a special issue "Phosphorus circular economy: closing loops through sustainable innovation". The special issue indicates that it will address innovation, technology, raw materials and intermediates, covering the full phosphorus supply chain including recycling, valorisation of sewage biosolids, mining and beneficiation, with emphasis on interrelations between different stages of the supply chain to close the loop for phosphorus. Manuscript submission deadline: 30<sup>th</sup> December 2017

See more information at [www.mdpi.com](http://www.mdpi.com)

## Agenda

- 5th September, Brussels, ESPP stakeholders meeting on **EU Fertilisers Regulation** revision and **STRUBIAS** proposals (struvite, biochar, ash). Contact [info@phosphorusplatform.eu](mailto:info@phosphorusplatform.eu) if not already registered.
- 18-19 October, Basel, ESPP - Phos4You, European Nutrient Event, meeting of **nutrient recycling R&D projects**, technology supplier stands, and **R&D project consortium brokerage**, workshop on implementation of the new German and Swiss legislations requiring P-recovery from sewage [www.nweurope.eu/phos4you](http://www.nweurope.eu/phos4you)
- 27-28 November, Eindhoven (NL), **ManuREsource 2017** - International [conference](#) on manure management and valorisation. Stakeholder discussion on processed manure in the EU Nitrates Directive. 29th November: site visits to manure processing installations.
- Tuesday 12 December, Brussels, ESPP General Assembly 2017, with IFOAM, on the **use of recycled nutrient products in organic farming**: implementation of EU Fertilisers Regulation, assessment of recycled products under EU Organic Farming Regulation, issues with contaminants, quality, safety, image and confidence. Register by email to ESPP.

See more events at [www.phosphorusplatform.eu/upcoming-events](http://www.phosphorusplatform.eu/upcoming-events)



ESPP Members

Up to date list of members: [www.phosphorusplatform.eu/members](http://www.phosphorusplatform.eu/members)

