Policy

STRUBIAS proposals for EU Fertilisers Regulation

ESPP has submitted comments to the European Commission's draft proposals for EU criteria for recovered struvite and phosphate salts, recycling of ashes and for biochars, as CE Fertilisers under the revision of the EU Fertilisers Regulation (STRUBIAS). ESPP's comments include input from stakeholder meeting in Brussels last week, organised by the platform, at which over 100 participants from industry, regulators, EU services, environmental and agricultural NGOs and research discussed the STRUBIAS proposals (slides). ESPP welcomes that progress is being made towards Europe-wide authorisation of these materials as fertilisers, because this will facilitate the Nutrient Circular Economy, and open the EU market for nutrient recycling technologies. ESPP fully supports the need to ensure that all recycled fertilisers are safe for health and the environment, and offer agronomic qualities for farmers, but suggests that the criteria for recycled products (in CMCs) should not duplicate criteria already applicable to all CE Fertilisers placed on the market (PFCs). ESPP also expresses concern about unnecessary complication and multiplication of criteria which will prevent innovation and confuse implementation. For example for process/time for biochars, instead of using simple indicators of process efficiency in degrading organics, or complex mineral ratios for types of ashes which are already widely used as fertilisers such as meat and bone meal ash. ESPP expresses particular concerns about the proposed criteria for recycling ashes into industrial fertiliser production. This can be expected to be an important phosphorus recycling route, as legislation comes into place in Germany and Switzerland requiring phosphorus recycling from sewage. In these countries 2/3 and 100% respectively of sewage sludge is currently incinerated. The wording currently proposed will exclude all phosphorus recycling routes from sewage sludge incineration ashes which are today operational, for example the Zurich process via phosphoric acid production, AshDec thermal recovery, Ecophos process via hydrochloric extraction, use of ash in existing phosphate rock processing fertiliser factories. That will not be for any reason of safety, but because of inappropriate wording excluding use of various chemicals in processing and because of the mechanism of criteria application. This problem is indicative of fundamental cracks in the architecture of the Fertilisers Regulation, similar to overlooking the use of industrial by-products in mineral fertiliser production: the current wording of the Regulation will exclude most phosphate fertilisers currently sold in Europe, because sulfuric acid used in their manufacture is a by-product of oil refining. A European Parliament amendment (IMCO 281) attempts to "patch over" this emission for industrial by-products, but the same flaw poses problems for processing ashes. ESPP believes that use of ashes in fertiliser production processes, to

replace imported phosphate rock, should be facilitated by applying the same criteria as for manufacture of fertilisers from virgin materials, subject to ensuring that possible incineration-generated contaminants (dioxins, PAH) are monitored in the ash and not introduced into the environment. This is an important route to accelerate the Nutrient Circular Economy and reduce EU dependency on imported phosphate rock, which is on the EU Critical Raw Materials List.

The European Commission's STRUBIAS proposals for EU Fertiliser Regulation criteria for struvite / phosphate salts, ashes and biochars, and ESPP's comments are available at www.phosphorusplatform.eu/regulatory

White phosphorus (P4) added to EU Critical Raw Materials list

The European Commission has published an update to the EU Critical Raw Materials list, identifying "*raw materials with a high supply-risk and a high economic importance to which reliable and unhindered access is a concern for European industry and value chains*". This third version of the list (first published in 2011, 2014) now lists 27 Critical Raw Materials, following a detailed assessment conducted by external consultants (TNO), Commission expertise and stakeholder consultation, and using a methodology which has been improved to take into account trade factors, different industry sector uses and substitution potential (possible nutrient recycling in the case of phosphate rock). The 2014 list included phosphate rock, representing phosphorus (in any form) essential for food production in mineral fertilisers, animal feed minerals and imported animal fodder. Phosphate rock is maintained in the 2017 list, and following input from ESPP and industry, the specific form white phosphorus (P4) is also added to the list. P4 is essential to a number of added-value chemical sectors, such as fire safety, lubricants, polymer additives, pharmaceuticals, agrochemicals, catalysts, metal processing and is produced in specific production installations. Europe's last such installation closed in 2012 (Thermphos, NL), leaving these sectors of EU industry totally dependent on imports of P4 or P4 derivatives from Vietnam, China or Kazakhstan. ESPP welcomes the inclusion of P4 onto the Critical Raw Materials list because this will stimulate development of processes to upcycle P4 from secondary raw materials, so contributing to the Nutrient Circular Economy, creating jobs in the EU and reducing import dependency of high-value EU industry sectors. ICL, for example, is developing industrial implementation of the RECOPHOS process, tested at pilot scale in Leoben, Austria, with EU FP7 R&D funding.

COM(2017)490 "Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the 2017 list of Critical Raw Materials for the EU", 13th September 2017
http://ec.europa.eu/transparency/regdoc/rep/1/2017/EN/COM-2017-490-F1-EN-MAIN-PART-1.PDF

Swiss Mineral Recycled Fertiliser Regulation

The Swiss Federal Offices for the Environment and for Agriculture presented in Bern, 30th August, proposals for a new category of "Mineral Recycled Fertilisers MinRec" to be added into the Swiss ChemRRV (Chemicals Risk Reduction Ordinance). This is expected to be put to public consultation in 2018 for implementation in 2019. The proposal does not address organic or organo-mineral recycled nutrient products, which already benefit from a specific category in the Swiss ChemRRV 2005, Appendix 2.6, (Paragraph 2.2.1 Organic Fertilizers, Recycling Fertilizers, Farmyard Manure). The presentation included proposed limit values for heavy metals, organic contaminants and pathogens and criteria for phosphorus solubility. The ChemRRV refers to the Fertilizer Regulation (Dünger-Verordnung, 2001) containing the definitions for products, nutrient concentrations and input materials. The definitions are more generic and new fertilizers (including recycled products) need to be licensed in a (simple) admission process. This is unlike the proposed EU Fertiliser Regulation revision where Annex II (CMCs = Component Material Categories) specify input materials and process parameters as well as quality and safety criteria for the final product (in addition to the product specifications in Annex I = Product Function Categories). The Swiss proposed contaminant limits are derived using the ALARA principle: (1) define levels necessary for no accumulation in soils (or safe and limited accumulation) after 500 years of application (for Cr, Pb, Cu); (2) identify processes (currently 8) able to achieve these levels; (3) define for each metal the lowest "technically possible" limit which can be achieved by all of these processes. The Swiss proposal does suggest that the proportion of recovered phosphate should be declared in the product labelling (wording not yet defined). Regarding phosphorus plant availability, minimum phosphorus content is specified in the DüV 2001: phosphorus solubility in NAC (neutral ammonium citrate) and in 2% citric acid are required in the product labelling. Proposed contaminant limit levels are proposed as mg/kgP, so are not directly comparable to levels proposed in the EU Fertilisers Regulation revision (which are mg/kg dry product, except for cadmium which is mg/kgP), see table.

Cadmium	Cd	25 mg/kgP
Arsenic	Sb	100 mg/kgP
Mercury	Hg	10 mg/kgP
Nickel	Ni	250 mg/kgP
Zinc	Zn	10 000 mg/kgP
Chromium	Cr	1 000 mgCrVI/kgP
Lead	Pb	250 mg/kgP
Copper	Cu	3 000 mg/kgP
Polycyclic Aromatic Hydrocarbons	PAH_{16}	25 mg/kgP
Polychlorinated biphenyls	PCBs	0.5 mg/kgP
Dioxins and furans	PCDD/PDCF	120 ng I-TEQ/kgP
Salmonella		Not detectable in 25g product
E. coli		1 000 CFU/g
Enterococcaceae		1 000 CFU/g

Swiss phosphorus recycling day 30th August 2017(in French and German) and slides (in German)
www.bafu.admin.ch/bafu/fr/home/themes/dechets/manifestations/phosphorrecycling-wie-weiter.html Swiss legislation: fertilisers DüV www.admin.ch/opc/de/classified-compilation/20002050/index.html and chemicals ChemRRV www.admin.ch/opc/de/classified-compilation/20021520/index.html

Stakeholder meeting on EU Fertiliser Regulation

The Fertiliser Regulation (FR) workshop organized by ESPP and the German Phosphorus Platform (DPP), held at the Bavaria Representation, Brussels, 5th September, brought together over 100 participants from industry, NGOs, Member States, the European Parliament and four European Commission (COM) directorates. Barbara Stretter, Director of the Bavaria Representation, underlined the importance of phosphorus for Bavaria's 110 000 farmers and support for phosphorus recycling, a key to supply stability. Johanna Bernsel, COM DG GROW, reminded that the FR's objective is to enable recycled phosphorus to reach 30% of the market. She explained that the amendments voted to the FR text at the European Parliament plenary (expected end October) and those proposed in the Council (Member States) position (still underway), will go to conciliation, that is trialogue between Parliament, Council and the European Commission. This process can only address questions raised by Parliament or Council adopted amendments, and is the last chance to resolve any outstanding questions. Issues identified by COM include: phosphorus solubility requirements and definitions, animal by-products, industrial by-products, certain contaminant levels (e.g. lead) and micronutrients (e.g. copper, zinc), and the definitions of mineral/low-carbon fertilisers.

ESPP and key industry stakeholders (see list below) presented their priorities for issues remaining to be resolved in the Fertiliser Regulation. The following appeared as shared concerns:

- Maintain delegation to COM to modify annexes (Art. 42.1), to allow to take into account new recycled products and processes.
- Engagement of COM DG SANTE to rapidly include animal by-product (ABP) recycling into the FR and clarify interactions with the ABP regulations, to take into account ABP recycling which is already widespread in Europe (700 000 t/y), including enabling development of manure recycling.
- Avoid reductions in contaminant limits which would limit recycling without environmental or safety justification (e.g. Pb, As)
- Widen and clarify terminology for processing of raw materials (CM2), for acceptance of food industry by-products (CMC6) and of "crop residues" in digestate (CMC4).
- Clarification of limit values (should be vs. dry matter), nutrient limits in PFC, phosphorus solubility requirements (in water, citric acid "OR" in NAC neutral ammonium citrate).
- First opening to recycling of nutrients from sewage through STRUBIAS criteria for phosphate salts, ashes.
- FR should ensure safety, product quality and efficiency, and full information of farmers/users.

Denis Bonvillain, Suez, outlined key points for effective advocacy for the FR, underlining the complexity of the dossier and its multiple aspects: water, agriculture, circular economy, etc. He underlined the importance of presenting joint positions between industry and stakeholders, in order to be listened to by Council and in trialogue. Anders Nättorp, FHNW, presented the Swiss mineral recycled fertilisers regulation proposal (MinReg, see above). Dries Huygens, European Commission JRC introduced the STRUBIAS proposals for FR categories for phosphate salts, ash-based materials and biochars, see further above.

Stakeholder presentations, breakout session conclusions and meeting slides DG GROW, JRC, FHNW/Switzerland, ESPP, Fertilisers Europe, ECOFI (European Consortium of the Organic-Based Fertilizer Industry), EFPRA (European Fat Processors and Renderers Association), EBA (European Biogas Association), ECN (European Compost Network), Eureau (EU drinking water and waste water service operators), ELO (European Landowners Organization) are available at our website www.phosphorusplatform.eu/regulatory

ESPP input to EU consultation on microplastics

ESPP has responded to the European Commission public consultation on policy options to reduce microplastics release to the environment (consultation open to 16th October 2017). ESPP notes that although current concern is principally about microplastics in surface waters and oceans, some microplastics will also be found in organic recycling streams such as sewage biosolids or compost or digestate from food waste. Possible impacts on terrestrial ecology should therefore be studied in order to avoid future obstacles to the nutrient Circular Economy. ESPP suggests to collect data on microplastics in organic recycling streams, develop monitoring methods for microplastics in organic streams and in soils, study their fate and possible impacts in soil/crop systems, investigate possibilities for removing microplastics in organic waste treatment and recycling processes, and develop risk assessments of microplastics in nutrient recycling, in particular to support the EU Fertiliser Regulation.

EU public consultation on microplastics www.eumicroplastics.com open to 16th October 2017. ESPP input at www.phosphorusplatform.eu/regulatory

Media and conferences

German Phosphorus Platform: new board and national conference

On September 11th the German Phosphorus Platform (DPP) held its general meeting in Berlin. Amongst actions of wide interest: in 2017 the amended German sewage sludge ordinance will be adopted, making phosphorus recovery mandatory from sewage sludge and sewage sludge ash. The German Phosphorus Platform alongside its members gave statements to the leading ministry, resulting in a close relation between Ministry and DPP. Twelve new members joined DPP in 2017, making the national platform a relevant player in the phosphorus community. As member of the European STRUBIAS working group (criteria for phosphorus salts, ash-based materials and biochars/pyrolysis materials under the EU Fertilisers Regulation revision), DPP worked together with ESPP on fundamental statements to the STRUBIAS' interim report, proposing to widen the criteria, in order to make phosphorus recovery actually possible and not limit from the beginning to a narrow line of possible materials. During the general meeting, a new board was elected, consisting of 7 members, of which 5 were part of the old board (which had reached the end of its 2 year mandate). Dr. Rainer Schnee, Budenheim is chairman, Michael Spitznagel, former Bavarian State Ministry for the Environment, deputy chairman and Dr. Christian Kabbe, KWB, acts as treasurer. Additional board members are Burkard Hagspiel, city of Nuremberg, Prof. Dr. Peter Leinweber, University of Rostock and Science Campus Phosphorus Research Rostock, Siegfried Klose, Klose GmbH and EuPhore, and finally Anthony Zanelli, ICL Fertilizers. On September 12th took place the DPP-FORUM, the platform's annual stakeholder conference, with more than 100 participants. Topics this year were the adopted sewage sludge ordinance and the different Länder's point of view on this regulation. The afternoon looked at recent technology updates and the municipalities' different approaches to implementing the upcoming P-recovery obligation.

DPP activities report www.deutsche-phosphor-plattform.de/rueckblick-mitgliederversammlung-2017 (in German) and DPP FORUM documents www.deutsche-phosphor-plattform.de/dokumentation-dpp-forum-2017 (in German)

EEA blames big livestock farms for ammonia emission violations

The European Environment Agency (EEA) has published a summary report on atmospheric emissions (2015 data), reporting under the UNECE Convention on Long-Range Transboundary Air Pollution (LRTAP), showing that three Member States (Germany, Spain, Sweden) and the EU (total) exceeded ammonia emission ceilings. EU total emissions for sulphur dioxide, nitrogen oxides and volatile organic carbons were below the ceilings. The EEA states that agriculture produces 94% of EU ammonia emissions, and that the 5% largest farms produce 80% of total EU ammonia emissions.

"Air pollution from agriculture: ammonia exceeds emission limits in 2015", European Environment Agency 2017
www.eea.europa.eu/highlights/air-pollution-from-agriculture-ammonia

ECN Biowaste in the Circular Economy conference

This workshop, 6th September 2017 Brussels, brought together around 80 participants at the Committee of Regions. Babette Winter, Thuringian State Germany, opened the meeting indicating that the Committee of Regions wants a ban on landfill and on incineration of municipal waste and reinforced separate collection of biowaste. Henrik Lystad, ECN (European Compost Network) Chair noted that the first priority must be to avoid food waste. Today around 40 Mt/y of biowaste is recycled in Europe, but an estimated 56 Mt/y is not collected or not recycled. If all biowaste was recycled, this would generate over 90 000 direct jobs (70 000 of which in rural areas), and 230 000 indirect jobs. The revision of the Waste Framework Directive is currently in 'triologue'. Silvija Aile, DG Environment, explained that key issues under discussion include whether separate collection of biowaste should be obligatory or whether Member States should be able to maintain derogations (Art. 22 TEEP = Technically, Environmentally and Economically Practicable); rules on calculation of organic recycling (should only separate collection be counted, or also mechanically sorted?); home composting; quality standards; landfill rules. ECN's position is separate collection should be obligatory without derogations, a target of 65% should be fixed for biowaste recycling with a clear definition of what is recycling, need for specific waste codes for separately collected biowastes and incentive schemes for separate collection, and need for harmonised EU compost quality criteria (this is addressed by the EU Fertiliser Regulation). Industry (Municipal Waste Europe) on the other hand considers MBT (mechanical-biological treatment) should be considered as well as separate collection and that home composting should be included in recycling targets. Success stories from Italy, Catalunya and Germany showed that separate collection and recycling rates can be considerably improved, with economic tools playing a key role including PAYT "pay as you throw", landfill and incineration tax, and funding of municipalities as a function of collection rate and quality.

Conference "Biowaste in the Circular Economy", ECN and European Committee of the Regions, Brussels, 6th September 2017. ECN press release www.compostnetwork.info/wordpress/c/28-i-3r-p3 and workshop presentations www.compostnetwork.info/wordpress/c/28-i-3r-p4

Circular use of by-products in the fertiliser industry

Fertilizers Europe has published a report summarising the use of by-products in Europe's mineral fertiliser industry. "The fertiliser industry has always been circular" says the industry federation's Director, Jacob Hansen, and the industry's has been using by-products in production of nitrogen and phosphate fertilisers for over a century. Case studies of symbiosis and by-products recycling are presented: use of caprolactum by-product from nylon production in ammonium fertiliser production, use of by-product sulfuric acid from petroleum refining and from metal smelting in phosphate fertiliser production, use of residual heat and by-product heat from fertiliser production in greenhouse heating, use of CO_2 from ammonia production in horticulture and CO_2 in food and beverages and integrated production of fertilisers (ODDA process see below). The report includes a list of 75 examples of fertiliser industry symbiosis, where by-products are used in fertiliser production or fertiliser industry by-products are used in the fertiliser or in other industries. This report demonstrates the importance of resolving the current issue with the EU Fertilisers Regulation proposal, which excludes the use of by-products as input materials (CMCs).

"Circular Economy. Re-recycling and symbiosis. Use of by-products within the mineral fertilizer industry", Fertilizers Europe, September 2017
www.fertilizerseurope.com

Nutrient circular economy success stories

As presented in eNews n°14, Business Europe's "Circularly" website presents company success stories and challenges in the circular economy. Examples relevant to the nutrient circular economy already on the Circularly website include: EuroChem ODDA process to produce NPK fertilisers from phosphate rock using nitric acid, ammonia and waste CO_2 (so that the rock calcium is converted to lime for use in industry, instead of generating phosphogypsum); Suez Chartres de Bretagne eco-hub to improve waste collection, sorting and recycling from businesses and local authorities (including biowaste which contains nutrients); Yara recovery of nitrogen from biogas from municipal waste anaerobic digestion VEAS Oslo (scrubbing with nitric acid to produce ammonium nitrate solution); North Sea Resources Roundabout, creating a market for secondary raw materials including struvite, bottom ash and compost. The Circulary website identifies challenges, added value, job creation and regulatory barriers for each case study presented. **If you wish to propose your company's nutrient recycling success story to Business Europe Circulary website, please contact ESPP as we are developing a set of nutrient circular economy examples**.

Business Europe – Circular Economy Industry Platform www.circulary.eu

SPA Webinar on Water Quality Trading In North America

Sustainable Phosphorus Alliance

The Sustainable Phosphorus Alliance (North America) hosted a webinar on the topic of Water Quality Trading Programs in North America (video). The 90-minute webinar featured Doug Myers, Maryland Senior Scientist for the Chesapeake Bay Foundation, and Victoria Pebbles, Program Director of the Great Lakes Commission. The speakers described a few water quality trading programs that require collaboration among multiple jurisdictions and stakeholders then answered audience questions. Water quality trading programs are voluntary programs, perhaps numbering about 100 throughout the US and Canada, that create cap-and-trade markets. They allow entities who emit a particular pollutant (e.g. phosphorus) to purchase credits generated by other entities that have reduced their own emissions below some legally specified threshold. The financial cost of purchasing these credits may weigh less on emitters than achieving an equivalent level of pollution reduction themselves. Trades might take place among entities within a given industry (e.g. among wastewater treatment plants) or between entities in distinct industries (e.g. animal feeding operations trading with wastewater treatment plants). For example, a wastewater treatment plant might find it more cost effective to pay a farmer to install buffer strips around his fields than to install its own phosphorus recovery equipment to achieve an equivalent reduction in emissions. A water quality trading program can valorise farmers' interventions and create a trade mechanism by which the water treatment plant can subsidise farm-level interventions in lieu of installing unit operations at the plant. In addition to cost savings, such programs tend to offer more flexibility in timing capital investments, so buying time to await coming technological improvements. Furthermore, the kinds of interventions that are incentivised by these programs can achieve ancillary benefits. For example, a constructed wetland might provide both nutrient pollution reductions and habitat for local species. Although widespread, such markets in North America are not particularly robust, and the webinar included some discussion of how to bring them to scale.

SPA webinar Water Quality Trading Programs in North America, 24th August 2017 https://youtu.be/NFci0_HIDDY
The next SPA webinar "Extreme Climate, Extreme Phosphorus" will take place 16th November, register at www.eventbrite.com/e/sustainable-phosphorus-webinar-3-registration-38049774901

Research and projects

RAVITA post-precipitation, phosphorus and nitrogen recovery from sewage

The RAVITA process, developed by Helsinki Region Environmental Services HSY (Water Utility of the Helsinki Metropolitan Area), has been selected as one of three "key projects" for nutrient recovery in the Finland Environment Ministry "Clear Waters"

nutrient circular economy R&D initiative (see SCOPE Newsletter n°121). The RAVITA process has been developed as a spin-off from the RAKI Kiekkosuodatus (disc filtration), RAKI Jälkifosfori (post-precipitation of phosphorus) and RAKI rejektityppi (side stream nitrogen removal and recovery) processes, which have already been tested at the pilot scale. RAVITA involves using chemical post-precipitation of all phosphorus (using aluminium or iron salts), as a tertiary phase so reducing sludge generation and phosphorus content of the sludge compared to co-precipitation. Biological phosphorus removal is not needed if phosphorus is post precipitated by this process. The resulting phosphorus-rich post-precipitation sludge is treated using phosphoric acid as a solvent, to enable recovery of the phosphorus as surplus phosphoric acid, and of the metal salt which is recycled in the post-precipitation. The phosphoric acid can be used as such in various industrial processes or as acid needed for nitrogen stripping process, to generate ammonium phosphate for fertiliser applications. A 1000 p.e. chemical sludge pilot plant is already implemented at Viikinmäki WWTP and a demonstration plant for phosphoric acid production is planned and should be commissioned late 2018. Areas where further research is needed are identified as fate of heavy metals in the process, ensuring reliable low total phosphorus discharge by the post-precipitation.

RAVITA, HSY (Helsinki Region Environmental Services Authority) website
www.hsy.fi/fi/asiantuntijalle/tapahtumat/seminaarit/ilmastoseminaari/Documents/Ilmastoseminaari_2017/Ravita_Fred_%20ilmastoseminaari.pdf

Low heavy metals in secondary nutrient products

Within the BONUS PROMISE project, early seventy organic materials were sampled in Finland, Sweden and Germany: manures and manure digestates, sewage sludge after composting or digestion, sewage-recovered struvite, and AshDec recovered phosphates. Heavy metals were analysed (Zn, Cu, Cd, Pb, Ni, Hg and Cr) and loadings to soil calculated at 10 kgP/ha application rate and compared to EU (Directive 86/278) and national (for these three countries) sewage sludge or compost heavy metal limits. Based on this application rate, only one Swedish pig manure sample (for zinc) and one German sewage sludge sample (for chromium) exceeded any of the limits. The struvite heavy metal levels were very low and the AshDec sample only exceeded some limits for chromium and zinc because of erosion of steel in the process equipment, an issue which can be resolved. It can be noted that lead levels in some of the organic materials reached 30 mg/kg, well within the initial European Commission proposal limit for the EU Fertilisers Regulation revision, but higher than the European Parliament IMCO proposed amendment. The authors conclude that these secondary nutrient materials have heavy metal limits mostly well below requirements for environmental safety of sewage sludge spreading.

"Report on compliance of recycled product with present EU fertilizer regulations", M. Sarvi et al. 2017 (note title is misleading, the report refers to sewage sludge regulations not fertiliser regulations)
www.researchgate.net/publication/319036840_Report_on_compliance_of_recycled_product_with_present_EU_fertilizer_regulations

Pharmaceuticals in secondary nutrient products

In a second part of the BONUS PROMISE project, eight antibiotics pharmaceuticals from three classes (sulphonamides, fluoroquinolones and tetracyclines) were analysed in 43 samples of manures and sewage sludge, before and after anaerobic digestion. Antibiotics were detected in all of the sewage sludge samples, 88% of pig slurry, 67% of poultry manure and 50% of cattle manure samples. The highest concentrations were found in chicken and pig manure (c. 8 000 µg/kg individual antibiotic substance). Antibiotic presence and concentrations were similar in digestate, suggesting that little degradation was taking place in the digesters studied. Pathogens were significantly reduced in the anaerobic digestion process, but to different extents depending on which type of micro-organism was considered: 39% of digestate samples contained Salmonella, 18% Giardia, 4% Cryptosporidium but none Campylobacter (E. coli was not detected in the input materials). The project suggests that post-treatment of digestates should be considered to eliminate organic contaminants and pathogens. Note that a review paper on contaminants in organic nutrient sources, summarising information today available especially concerning antibiotics and pathogens in manures and sewage sludge, has recently been published by Bloem et al.

BONUS PROMISE project (1.4.2014 – 31.3.2017) "final publishable summary report" 31.5.2017
www.bonusportal.org/files/5700/BONUS_PROMISE_final_report.pdf
"Contamination of organic nutrient sources with potentially toxic elements, antibiotics and pathogen microorganisms in relation to P fertilizer potential and treatment options for the production of sustainable fertilizers: A review", E. Bloem et al., Sci. Total Env. 607-608 (2017) 225-242
http://dx.doi.org/10.1016/j.scitotenv.2017.06.274

Adjusting pH of organic materials to improve nutrient availability

A study tested, in 76 day rye grass pot trials, sewage sludge, biochar and spent wetland filters, after pH adjustment using compost leachate and acetic acid (pH 4) or concrete waste and lime (pH 11). The sewage sludge was from a Norway municipal works using iron and aluminium salts in secondary nutrient removal, after composting. The biochar was mixture of phosphorus-rich sewage sludge biochar and wood biochar. Results showed that the biochar offered better phosphorus uptake and plant dry mass production than the composted sewage sludge, and that the pH treatments of the organic wastes (both acid and alkali) increased these parameters for the organic materials, to varying extents and in some cases by more than 50%. The study also showed that DGT (diffuse gradient thin film samplers) provided a good indication of plant phosphorus availability as measured by the pot trials.

"Phosphorus recycling from wastes", K. Haarstad & J. Bavor, J. Env. Protection 2017, 8, 831-843 http://dx.doi.org/10.4236/jep.2017.88052

1 million US$ for marine macroalgae projects

The US Department of Energy (ARPA-E) has awarded 1 million US dollar to two University of Southern Mississippi projects, including the AdjustaDepth system for attached-growth seaweeds, using the same system as the UpLift marine nutrient recycling project (see eNews n°13). A circular structure of up to 9 km will provide suspended surfaces for development of seaweed which can be harvested, to process to bioenergy or fertilisers and/or to remove nutrients from eutrophied seawater. The structure can be sunk or raised in the water to optimise light exposure for macroalgae growth but avoid shipping or storms.

"Novel Seaweed Growth Systems to Drastically Reduce Cost of Biofuels", U.S. Department of Energy Advanced Research Projects Agency – Energy (ARPA-E) award, 20 September 2017
https://arpa-e.energy.gov/sites/default/files/documents/files/MARINER_ProjectDescriptions_FINAL.pdf

Water2REturn: nutrient recycling from slaughterhouse wastes

The Horizon 2020 project Water2REturn will use slaughterhouse wastewater as substrate to recover phosphorus and nitrogen based on a Circular Economy approach. The outcomes will be three agronomic products, concretely one organic fertiliser and two agricultural biostimulants (to enhance fertiliser efficiency and crop growth). To achieve this, the project proposes an integrated full-scale demonstration process in a real Spanish case study that combines innovative technologies (such as specific fermentation to produce biostimulant products) and conventional processes like membrane technologies, anaerobic digestion and algal technologies. The Water2REturn consortium has 15 members, including technology SMEs, the livestock and meat industry, R&D institutes and the European Landowners Organization. It is led by Bioazul, Spain, and will run from 2017 to the end of 2020 (42 months).

Website www.water2return.eu under development. Contact: pzapata@bioazul.com

Review of agronomic effects of phosphites

A review paper summarises knowledge on the effects of phosphites on plants and possible use as a herbicide, fungicide, biostimulant or fertiliser, referencing some 140 publications. Potassium phosphite has been shown to have a fertilisation or biostimulant effect on some crops (e.g. citrus fruit, avocados) but to inhibit root or shoot growth or germination of other plants (including mustard, tomato, pepper, maize, spinach, pumpkin and cabbage species), but also certain weed species enabling its use as a herbicide in some cases. Conversion of phosphite to plant available inorganic phosphate by soil micro-organisms is slow, so that phosphites cannot fulfil the plant nutrition functions of phosphate fertilisers.

"Phosphite: a novel P-fertilizer for weed management and pathogen control", V. Achary, Plant Biotechnology Journal 2017
http://dx.doi.org/10.1111/pbi.12803

Review of nutrient recovery technologies from digestate

A 20 page review, based on over 160 publications, updates on different technologies for nutrient (nitrogen and phosphorus) recycling from biogas production. Routes considered include application of digestate to land, solid-liquid separation (the solid fraction is generally phosphorus rich, whereas nitrogen and potassium are mostly in the liquid fraction), Anammox biological nitrogen removal, absorption of ammonium in the digester medium, ammonium gas stripping, phycoremediation (e.g. growth of microalgae fed by the liquid fraction in a photoreactor), membrane separation, struvite precipitation, and biological treatment (EBPR using polyphosphate accumulating organisms). The review concludes that processing digestate can improve its properties for land application. After solid-liquid separation, the solid fraction is generally adapted for use as fertiliser after simple finishing, whereas treatment of the liquid fraction is more complex, with nitrogen removal/recovery increasingly being necessary. Obstacles to implementation are identified as cost (energy and chemicals consumption), market image of digestate products and competition with mineral fertilisers. Elsewhere, a review of biogas production potential in Europe notes that production increased from 0.7 to 13.5 Mtoe/year (million tonnes oil equivalent) over 1995-2013. A potential of up to 67 Mtoe/year is estimated from animal manure, grass and straw only if these resources were fully mobilised, that is up to 4% of total EU energy consumption. The importance of biogas production in nutrient recycling via digestate is emphasised.

"Nutrient recovery technologies for anaerobic digestion systems: An overview", M. Romero-Güiza et al., rev.ion. 2016;29(1):7-26
http://dx.doi.org/10.18273/revion.v29n1-2016001
"The potential of animal manure, straw and grass for European biogas production in 2030", A.Meyer et al., 24th European Biomass Conference, 6-9 June 2016 www.etaflorence.it/proceedings/index.asp?detail=12749

Success stories

Dutch struvite shipped to cacao plantation Dominican Republic

Worldwide the fertile soils on which cocoa grows is becoming nutrient depleted. The raw materials and nutrients that are taken from the soil by cacao beans in the producing countries are eaten in the developed countries in the west. As a result, nutrients do not come back to where they come from and are presently not applied in other ways. Chocolate Makers have made a unique

plan with the help of the Dutch Waterboards and the historic and environmentally friendly (engineless) sailing cargo ship Tres Hombres. Normally the ship transports cacao beans to their chocolate production plant in Amsterdam, the Netherlands. Now the ship sails back to the Dominican Republic loaded with struvite (phosphorus) recovered from Dutch wastewater treatment Omzetpunt Amersfoort, so returning nutrients to the cocoa plantations. A first shipment has arrived, and as soon as the rainy season is over field trials of the recovered struvite fertiliser will begin, in cooperation with soil scientists. The goal is also to improve the yield of the cocoa plantations.

More information at www.chocolatemakers.nl/chocolatemakers/nederlands-afvalwater-voedingsbron-voor-cacaoplantages-in-dominicaanse-republiek (in Dutch)

Parisette: sustainable public loos for Paris

In 2016 Paris City's public consultation for ideas to improve the city, installation of sustainable toilets obtained the second highest vote (behind the installation of shelters for homeless people). A range of solutions are proposed by a group of associations, R&D (IRSTEA) and companies, led by ECOSEC, including temporary "overnight" urinals, autonomous separating public toilets and installations for festivals. Nutrients and organic carbon are recovered or recycled by various routes, including pyrolysis to produce biochar fertiliser or use of a specific volcanic rock (chabazite, an aluminium tectosilicate zeolite) to trap nitrogen (ammonia) and store it for use by plants. Maintenance and servicing of the installations combines hi-tech (users can communicate servicing needs or problems) and ecology, with special tanker-cycles for collection of wastes adapted for cities.

"Projet de sanitaires écologiques pour Paris" ECOSEC 2017 www.parisette.fr (in French)

Food waste to protein wins BBC food & farming award

Agriprotein, who use black soldier fly larvae *Hermetica illucens* (maggots) to convert food waste to insect protein, have won the UK BBC's first "International Food and Farming Award". Agriprotein already operate a 40 000 t/y full-scale factor in South Africa (see SCOPE Newsletter n°118), and have projects underway in the UK, USA, Vietnam, Saudi Arabia and UEA. The fly larvae convert one tonne of organic waste to around 50 kg of MagMeal (55% protein feed product), 20 kg of MagOil (omega-rich oil) and a compost soil amendment. EU regulations authorise the use of insect proteins in aquaculture feed since July 2017, so opening the route for implantation of Agriprotein fly farms in Europe. MagMeal and MagOIl are adapted for use in feed for poultry, pigs, pet food and aquaculture, subject to appropriate authorisations. A second company using black soldier fly larvae to process food waste full-scale is Enterra (Langley, British Columbia), processing pre-consumer food waste to animal feed (dried larvae, ground larvae meal), oil and nutrient and microbe rich fertiliser (used in organic farming). Enterra obtained in 2017 Canada regulatory approval for their larvae products in aquaculture feed.

Enterra website www.enterrafeed.com "Enterra Receives CFIA Approval to Sell Insect Larvae to Aquaculture Industry" www.marketwired.com/press-release/enterra-receives-cfia-approval-to-sell-insect-larvae-to-aquaculture-industry-2196209.htm "Insect protein start-up scoops BBC farming Award" FDI Magazine 22/9/2017 http://fdiforum.net/mag/insect-protein-producer-scoops-bbc-award "BBC award for protein that will feed the world" www.agriprotein.com/press-articles/bbc-award-for-protein-that-will-feed-the-world Agriprotein www.agriprotein.com

Bioenergy wood ash recycling closes nutrient cycle

Askungen Vital AB Sweden today recycles nearly 30 000 tonnes/year of wood ash from bioenergy plants back to forests, that is around ¾ of the total wood ash currently being recycled back to land. Some 4/5 of Sweden's wood ash are estimated to be not today returned to land, instead going to landfill or the cement industry. Some is also sold as a garden soil amendment. Returning ash to forest soils to cycle nutrients is important because today nearly all of harvested trees are taken off the soil, not only wood for timber, but also tops, bark and even stumps for bioenergy. Askungen Vital matures ash for at least three months, during which time it loses alkalinity and hardens, before crushing and sieving to ensure optimal grain size and verifies contaminant levels. The hardening slows dissolution rate on soil, preventing the ash posing risks to plants or animals, and ensuring release of nutrients over a 5-25 year period adapted to forest growth and reducing risk of nutrient leaching. Spreading is usually at 3 tonnes/ha, using appropriate equipment to avoid dust, and is managed under Forestry Board permitting.

"Wood ash-recycling completes the nutrient cycle", Advantage Environment, 23 May 2017 www.advantage-environment.com/workplace/wood-ash-recycling-completes-the-nutrient-cycle and Askungen Vital www.askungenvital.se

Agenda

- 18-19 October, Basel (CH), **European Nutrient Event**, ESPP - Phos4You 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. Register www.nweurope.eu/phos4you

- 7 November, Brussels, **2nd EU annual Critical Raw Materials Event**, includes presentation of new EU network of experts on critical raw materials (SCRREEN) and RMIS (JRC Raw Materials Information System), as well as projects on metals recovery (Chromic, Equinox, Platirus, Scale). Part of EU Raw Materials Week 6-10 November http://ec.europa.eu/growth/tools-databases/newsroom/cf/itemdetail.cfm?item_id=9140

- 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. Register: www.manuresource2017.org

- 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 info@phosphorusplatform.eu

See more events at www.phosphorusplatform.eu/upcoming-events

ESPP Members

Up to date list of members: www.phosphorusplatform.eu/members