EDITORIAL

# Circular economy assumptions in the phosphorus management

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Phosphorus is a non-renewable resource, non-substitutable for food production and therefore essential for agriculture and directly linked to food security. It is also important in a range of other industrial and technical uses, e.g. flame retardants, industrial water treatment, emulsifying agents, etc. At the same time, phosphorus has the so-called "dark side": its losses pose major environmental issues. Phosphorus is the substance, together with nitrogen, contributing to eutrophication and water impairment of many surface and coastal water bodies.

Phosphate rock is the main source of phosphorus from the earth's crust. It was first assessed and included on list of critical raw materials (CRMs) for EU in 2014 (COM, 297, 2014). White phosphorus was assessed and included into the reviewed list of CRMs in 2017 in addition to phosphate rock (COM, 490, 2017). Nevertheless, the primary input material to produce phosphorus is also phosphate rock.

The main parameters used to determine the criticality of the material for the EU are their economic importance and supply risk. In case of phosphorus and its importance, there is no substitute for use of phosphorus in food chains. Up to 86% of global end uses of phosphate rock go for mineral fertilizers, 10% are used for food additives, and just 4% - other uses, such as fire distinguishers, detergents and other chemicals. Without access to phosphorus, Europe would be unable to feed its population. Regarding availability of supply, current production of phosphate rock is concentrated in a limited number of countries, none of which is in the EU. Just Finland has a very small amount of production. Globally, the dominant producer is China (44%), although most phosphate rock reserves (73%) are located in Morocco. In EU, import reliance rate, according to estimate of 2017, was 88% for phosphate rock and 100% for white phosphorus. Most of phosphate rock imported to EU were supplied from Morocco (31%), and most of phosphorus was from Kazakhstan (77%), which operates elemental phosphorus facilities.

Increasing world population and welfare (dietary habits) results in growing demand for phosphorus. Therefore, for Europe its dependency on raw phosphorus from outside endangers access to this vital raw material and threatens future food security. This leads to the clear need for recycling and using less phosphorus, whenever possible. Phosphorus as such is recyclable, however, its input material phosphate rock is not. Nevertheless, for its applications in agriculture phosphate rock can be replaced by secondary sources of phosphorus. According to CRMs list of 2017, other sources of P currently replace 17% of phosphate rock. Flow analysis shows that there are a number of points, e.g. animal manure, human excreta or organic waste, in the phosphorus cycle where significant quantities are being lost.

Yet there are techniques that can recover phosphorus or improve the efficiency of its use. Regarding the latter issue, efficient crop production means having

enough plant-available phosphorus in the soil to meet the requirements of the plant throughout its development, but not more. Regarding recovery, there is a high potential for phosphorus from such waste streams as wastewater, sewage sludge, sewage sludge ashes, biomass, pig slurry, meat and bone meal.

The inclusion of phosphates in the EU CRMs drives further EU policies and actions to promote sustainable phosphorus management in line with the circular economy model, in particular concentrating on data gathering on phosphorus sources and use, phosphorus recovery and recycling policies, research and development for further advancement of technical solutions. Horizon 2020, LIFE, EIT Raw Materials are examples of financial support for research, and a number of projects have been implemented and are still being implemented. Project "Sustainable Management of Phosphorus in Baltic countries" (InPhos), No. 17022, is financed by EIT Raw Materials, and has the main goal to develop a phosphorus strategy for the Baltic region. It will be developed by a working group of experts from developed countries (Germany, Italy, Sweden, Finland, Poland) and the Baltic countries (Lithuania, Latvia, Estonia), who will transfer knowledge and design of solutions for the sustainable use of phosphorus.

In last years, some European countries have already taken actions in order to achieve phosphorus security. An example of already developed strategy is Bavarian phosphorus strategy. In Switzerland and Germany, a regulatory framework relating to the recovery of phosphorus has been introduced. Switzerland was a first country in the world to make phosphorus recovery and recycling from sewage sludge and slaughterhouse waste obligatory (2016). German sewage sludge ordinance (AbfKlärV) makes phosphorus recovery obligatory for most of Germany's WWTPs by phosphorus recovery either from the sludge or by mono-incineration and recovery from sewage sludge incineration ash (2018). It can be expected that in other countries similar regulatory frameworks will be introduced in the future. Collaboration at the regional and national level in the area of phosphorus management is another important field. In 2013, European Sustainable Phosphorus Platform (ESPP) was formed, aiming to ensure knowledge sharing and experience transfer, facilitate discussion between the market, stakeholders and regulators, address regulatory obstacles, contribute to policy proposals, circulate information, and contribute to define a long-term vision for phosphorus sustainability in Europe.

## References

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