Products from Waste Water
- Minerals -

Need for EU End of Waste (EoW) status

Waste water has a huge potential for resource recovery. This factsheet, which is one of three on this subject, presents **minerals** that can be recovered from **municipal waste water*** and their possible non-fertiliser applications**. The technologies used for the recovery of these materials, are at least at the industrial demonstration stage.

A lack of End of Waste (EoW) status inhibits the marketability of these materials. Creating EoW criteria will increase the amount of reused waste in the EU. This can increase the self-sufficiency of the EU and decrease the need for waste disposal.

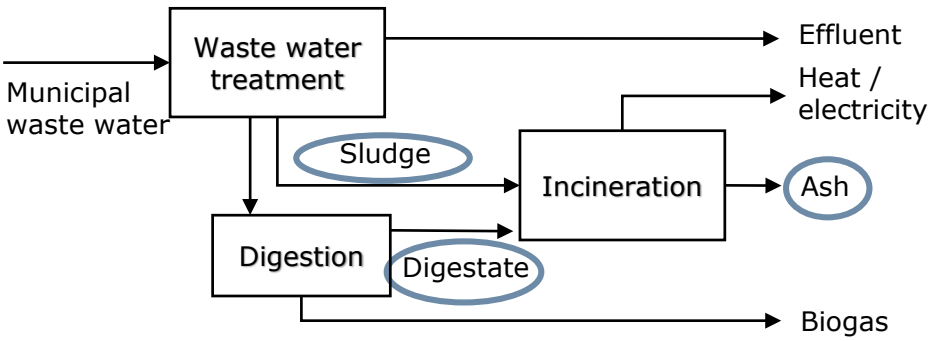
- Over **100 stakeholders** were consulted for this factsheet
- There are proven technologies (pilot scale and above) for the recovery of **a number of minerals** from municipal waste water in use
- There are over **50 recent EU projects** on waste water resource recovery (Horizon 2020, Horizon Europe, LIFE, InterReg), with **hundreds of partner organisations**
- The estimated chemical recovery potential for recycled minerals in the EU is **67 ktonnes P / year and 75 ktonnes N / year**

Waste water is a resource.

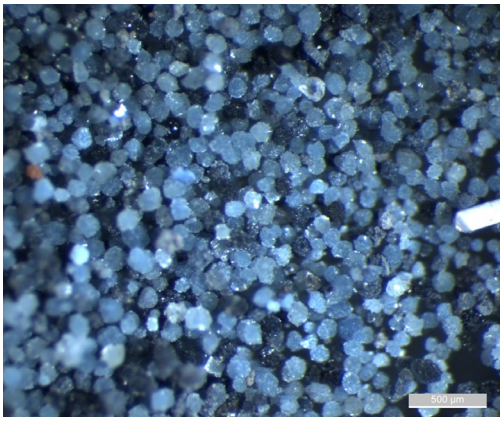
* Similar products can be recovered from other waste waters such as from food and dairy industry.

** Fertilising product applications are excluded, because the EU End-of-Waste procedure for these is covered by the new EU Fertilising Products Regulation (EU)2019/2009.

Waste water treatment and streams for recovery



Streams for the resource recovery of minerals are indicated with blue circles.



Vivianite crystals in dried digestate. Photo: Vivimag.

Materials

Recovered material	Possible applications (excl. fertiliser)	Existing market**
Phosphoric acid, technical grade	Commodity chemical used in the production of: Flame retardants - Fire extinguishers - Metal treatment - Ceramics - Cleaning agent	Yes
Ammonium salts (e.g., ammonium sulfate, ammonium nitrate)	Commodity chemical used in the production of: Pesticides - Flame retardants - Disinfectants - Pulp additives - Textile additives - Explosives	Yes
Struvite	Flame retardants	-
Di calcium phosphate and precipitated calcium phosphate	Animal feed	Yes
Gypsum*(calcium sulphate dihydrate)	Used in the production of: Building materials - Cement - Plaster	Yes
Al/Fe Chloride solutions*	Coagulants for waste water treatment	-
Vivianite	Pigment - Flame retardants	-
Ca/Mg Chloride solutions*	De-icing product - Dedusting - Oil drilling	Yes

*These materials are by-products of the phosphoric acid recovery
**For the same mineral but not recovered from waste water (the commodity chemical)

Examples

The table above exclusively presents materials that have proven technologies for its recovery from municipal waste water. You will find more information on ammonium sulphate, phosphoric acid (technical grade) and vivianite (Iron Phosphate) on page 3 of this factsheet.

Ammonium sulphate

Air stripping is the most common method used to extract ammonia from centrate of (digested) sludge. The air is then passed through a solution where the ammonia reacts with sulphuric acid to produce ammonium sulphate.

Phosphoric acid (technical grade)

Several technologies exist to recover phosphoric acid; it can be extracted from sewage sludge incineration ash and other materials. A number of full-scale facilities (producing 20 - 135 ktonne/y ash) are under commission or construction. In Germany and Switzerland, these facilities will contribute to the legal obligation to recover phosphorus.

Vivianite

The recovery of vivianite from digestate is a relatively new technology. A magnetic separation process is used to recover this iron-phosphate mineral from waste water treatment plants that use chemical phosphate removal.

Market potential (non-fertiliser applications)

	Unit	Phosphoric acid (technical grade)	Ammonium sulphate
Price	€/tonne	1000 €/tonne P_2O_5	300 €/tonne N
Full-scale	-	Yes	Yes
Recovery potential	% of EU demand	20-25%	20-30%

Environmental aspects

Resource recovery from waste water has environmental benefits. It decreases the amount of waste being landfilled or incinerated and it replaces fossil resources such as phosphate rock (a listed EU Critical Raw Material). Furthermore, resource recovery can in some cases be more energy efficient than conventional resource extraction.

Examples of such benefits:

- By-products generated during phosphoric acid recovery have reuse potential.
- Energy consumption for recovered phosphoric acid production from waste water is comparable with the industrial production of comparable products.
- Greenhouse gas emissions associated with ammonia recovery are lower than Haber Bosch and nitrogen removal from digestate.

Quality aspects

Ash that is used for phosphoric acid production is free of organic contaminants (pathogens and micropollutants) because of the incineration step. The phosphoric acid produced can meet industry quality specifications for a.o. industrial applications or animal feed applications.

Ammonia present in centrate from (digested) sludge is stripped and reacted with an acid solution, therefore the end-product is expected to have few impurities and could meet industry quality requirements.

Additional comments

- Exporting to other Member States is relevant for all the 3 examples
- There are no existing national EoW criteria

"EoW status is needed to get recovered products REACH approved and marketable"
- Marie-Edith Ploteau, Coordinator Phos4You -

"End-users should be considered when creating EoW criteria"
- Christian Kabbe, CEO EasyMining -

This factsheet was created by LeAF for EurEau

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Our members are 34 national associations of water services. At EurEau, we bring national water professionals together to agree European water sector positions regarding the management of water quality, resource efficiency and access to water for Europe's citizens and businesses. With a direct employment of around 475,000 people, the European water sector makes a significant contribution to the European economy.

This factsheet is reviewed and updated periodically, to present the most recent information. This is version 1 (October 2021).

Over one hundred stakeholders were consulted, see here.

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