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EU survey on possible future development of the FPR

Fields marked with * are mandatory.

Introduction

The purpose of this survey is to collect proposals to adapt the annexes of the Fertilising Products Regulation (EU) 2019/1009 ('FPR') to technical progress.
In accordance with Article 42 FPR, the Commission is empowered to adopt delegated acts.

The **scope** of the empowerment covers:

- Annex I, with the exception of cadmium limit values and the definitions, or other elements relating to the scope, of product function categories,
- Annexes II, III and IV.

The **purposes** of such amendments are:

- adapting those Annexes to technical progress and
- facilitating internal market access and free movement for EU fertilising products.

The EU fertilising products concerned by such amendments have to fulfil the following conditions:

1. they have the potential to be the subject of significant trade on the internal market, and
2. there is scientific evidence that they:

    a. do not present a risk to human, animal or plant health, to safety or to the environment, and
    b. ensure agronomic efficiency.

National authorities as well as any interested stakeholders (industry associations, economic operators, etc.) are invited to fill it in.
The Commission services will decide if to follow-up on any of the proposals submitted depending on the priorities of the Commission, the robustness of the data provided and the available resources. Proposals submitted by 16 September 2022 will be screened for possible inclusion in a study to support the Commission assessment. Proposals submitted after that date would be gathered and considered for future developments on the medium and long term.

All questions are mandatory and the contribution cannot be finalised without including replies to all questions.

The information provided in reply to this EU Survey becomes publicly available once the contribution is submitted, with the exception of **personal data included in the field marked with ****. Please, make sure not to include personal data outside the fields dedicated for personal data and marked accordingly.

Please, do not include any confidential information. If you find that sharing confidential documents in support of your proposal is necessary, please, send them by e-mail to GROW-fertilising-products@ec.europa.eu after having finalized your contribution in EU survey. Please, clearly indicate in your e-mail that the documents are shared in the context of the data collection via this EU survey and that they are confidential.

In case you require more information on how the Commission will treat confidential data/documents please check this document

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Section A – Who are you?

*** 1. I represent:**

- ○ An EU country
- ○ An Observer in the Commission expert group on fertilising products
- ○ A national industry association
- ◉ A University/research institute
- ○ A company
- ○ An NGO
- ○ Other

2. Details on the institution/entity you represent:

* a. Name of the institution/entity

Leibniz Institute of Vegetable and Ornamental Crops (IGZ) e.V.

* b. Address – at least the country where it is established

Theodor-Echtermeyer-Weg 1, 14979 Großbeeren, Germany

c. Main objective

Research at the IGZ contributes to understanding fundamentals of horticultural and plant science, to sustainability in production and use of plants, and to healthy nutrition and well-being of the population.

The project "Intermunicipal acceptance for sustainable valorisation from separately collected sanitary streams" - in short "zirkulierBAR" - is coordinated by IGZ. zirkulierBAR is an inter- and transdisciplinary research project working in Eberswalde, in the Barnim district, and funded by the Federal Ministry of Education and Research (BMBF) as part of the REGION.innovativ funding measure. Here, municipalities and future-oriented companies, together with universities and research institutions, are creating a real laboratory for sustainable regional circular economy in the field of agriculture and water management. The project started in May 2021 and will run for 3 years.
zirkulierBAR's vision is to "recover nutrients from consumed food and return them to agriculture in the sense of a sustainable regional circular economy."
To achive this vision, the mission of zirkulierBAR includes building an innovative and scalable recycling plant for the closed-loop treatment of contents from dry toilets. The end products are recycled fertilizers for agriculture and horticulture that are harmless to health, rich in nutrients and low in pollutants. Municipalities can plan and build a water-saving and resource-conserving alternative to linear water-dependent sewage treatment systems.

Links:
https://zirkulierbar.de/
https://www.igzev.de/projekt_type/zirkulierbar/?lang=en

*** 3. My name and contact details** (these are personal data and will not be published)**

Dr. Ariane Krause, krause@igzev.de, project coordinator of zirkulierBAR

Section B – what do you propose?

*** I propose to:**

- ○ Introduce new input materials in an existing CMC
- ○ Introduce a new material or amend the requirements for a material into an existing CMC
- ○ Add a new micro-organism into CMC 7
- ○ Introduce a new processing method or amend the requirements for processes into an existing CMC
- ◉ Introduce a new CMC
- ○ Other (choose this option for proposals concerning Annex I, III or IV)

Section C – description of your proposal

Section C5 - Introduce a new CMC

General questions

* 1. What is your material? How could you describe your material?

• We would like to highlight the agro-economic potential of separately recovered human urine from separative toilets, i.e. via the following collection principles:

Separately recovered human urine from separative dry toilets
Separately recovered human urine from separative water-saving toilets
Separately recovered human urine from urinals (pissoir/missoir)
Drained human urine from mixed collection
Products processed from separately recovered human urine

• Untreated urine typically has the following mineral nutrient concentrations (Larsen, Riechmann and Udert, 2021):

N-content of 4-14 g-N L 1
P-content of 0,35-2,5 g-P L 1
K-content of 0,75-2,6 g-K L 1
S-content of 0,6-1,3 g-S L 1

* 2. Does your material have a REACH registration dossier (submitted by your organization or other organisations)?

REACH stands for 'registration, evaluation, authorization and restriction of chemicals', in accordance with Regulation (EC) No 1907/2006.
If the material has a REACH registration, please, mention:

- *the tonnage band of the registration*
- *the level of assessment provided (Annex VI, VII, VIII REACH)*
- *if there is a safety report*
- *if the use as a fertilising product is covered.*

No registration with REACH yet. Registration shall be obtained in future; possible is a registration as UVCB „Unknown or Variable composition, Complex reaction products or Biological mate".

* 3. Is your material classified in accordance with the CLP Regulation?

Regulation (EC) No 1272/2008 on classification, labelling and packaging of substances and mixtures (CLP Regulation) lays down rules on the classification of substances in various categories depending on their hazards. Please, refer to self-classification or to harmonized classification, depending on the situation.

No classification with the CLP Regulation. Registration shall be obtained in future; possible is a registration as UVCB „Unknown or Variable composition, Complex reaction products or Biological mate".

*

4. What is a) the manufacturing process of your material or
b) the recovery operation that generates this material?
Please, include technical information on the input materials (waste and non-waste) used and processing requirements.

- Human Urine can be processed to urine-based recycling fertilizer (RF) in various ways (Larsen, Riechmann and Udert, 2021), of which we would like to highlight the following:
- Vuna-Process: An ex-situ process combination nitrification, purification and sanitization, resulting in a liquid RF: N in stored urine is present in the form of urea, hydrolyzed to NH4+ (which is in equilibrium with NH3) over time. In the process, both fractions are biologically oxidized to NO3- (Udert and Wächter, 2012; Fumasoli et al., 2016) via activated sludge process. The NH4+/NO3- ratio can thereby be adjusted by adding a base (increasing pH) (Bornemann et al., 2018), resulting in stabilized RFs suitable for different types of plant production. A subsequent activated carbon filter purifies the nutrient solution by absorption of micropollutantes. As a third step, a sanitization is usually performed via evaporation (including volume reduction), UV- or O3-disinfection.
- Alkaline urine dehydration: An in-situ process combination of pH-adjustment and convective air-drying, resulting in a solid RF: The toilet system is designed to add fresh human urine continuously to a mixture of wood ash and calcium hydroxide (to prevent enzymatic ureolysis) and to concentrate the urine to a crystalized product by hot air convective dehydration in the toilet or bathroom (Simha and Ganesapillai, 2017; Simha et al., 2020).

Agronomic efficiency

* 5. Is your material agronomically efficient? Or how does it contribute to the agronomic efficiency of fertilising products ?
Depending on the situation, please, include information on:

- *nutrient content of the input material, or other characteristics which will ensure that the resulting component material in the final product will fulfill any of the functions described in the products function categories 1 to 6 in Annex I to the FPR (meaning, the function of a fertilizer, liming material, soil improver, growing medium, inhibitor or plant biostimulant); or*
- *how it improves the safety or the agronomic value of an EU fertilising product (in case it could be used as a technical additive)*

- Human urine or feces are well suited nutrient-rich raw materials for fertilizer production and their positive fertilizing effect is well established. Urine-based recycling fertilizers usually have a balanced N to K ratio and a high nutrient availability. N in particular is readily available resulting in a good short-term fertilizing effect (Martin et al., 2020; Krause et al., 2021).
- A positive fertilizing effect, based on content and availability of plant nutrients, has been demonstrated for products derived from human urine. Empirically, urine-based RFs are comparable to mineral fertilizers containing urea, NH4+ or NO3- or PO43- (Simons, 2008; Arnold and Schmidt, 2012; Meyer et al., 2018; Martin et al., 2020) and have been proven to be suitable substitutes for synthetic fertilizers in the cultivation of crops such as tomatoe, maize, beans, wheat, barley, winter rye, ryegrass or miscanthus (Kirchmann and

Pettersson, 1994; Simons, 2008; Winker et al., 2009; Esrey et al., 2010; Richert et al., 2010; Andersson, 2015; Bonvin et al., 2015; Andreev et al., 2016; Krause et al., 2016; Viskari et al., 2018; Halbert-Howard et al., 2020). Urine derived concentrated alkaline P Fertiliser performs nine times better than rock phosphate on alkaline soils, works as soil conditioner for acidic soils as well (Meyer et al., 2018) and has high acceptance (Lienert and Larsen, 2010; Simha et al., 2018).

- Simons (2008) showed that urine derived fertilizers show significantly lower NH3-emissions (N losses) and thereby higher N-efficiencies compared to animal slurries.
- Overall, the carbon footprint for urine fertilizer production via a process combination of partial nitrification, granular activated carbon (GAC) filtration, and distillation can be as low as 2 kg $CO_{2,eq}$ $kg\text{-}N^{-1}$ (Faust et al., 2022), which represents approximately 60 % of the $CO_{2,eq}$ currently emitted by the EU28 nitrogen synthetic fertilisers production (Menegat, Ledo and Tirado, 2022). The emissions of N_2O from wastewater treatment plants as well as from soil are likely to be drastically reduced by reduced ammonia loads, respectively, by applying a partly nitrified product to soils.

(List of references is provided as supporting document.)

Safety

* 6. Is the material safe for the use as fertilising product?

Please, refer to the information available on the safety for humans, animals, plants and environment (soil and aquatic ecosystems).
More precisely, add information on:

- *contaminants (heavy metals)*
- *pathogens*
- *persistent organic pollutants*
- *substances with maximum residues limits (MRLs) for food or feed or other impurities (e.g. glass, plastic, metal) which could present a risk to humans, animals and environment (soil and aquatic ecosystems)*

- Separate collection of human excreta followed by targeted treatment of urine and feces most likely allows for a more efficient way to prevent environmental pollution by pharmaceutical compounds, compared to the treatment of mixed wastewater in centralized treatment plants (Köpping et al., 2020a).
- Hammer and Clemens (2007)showed that input of heavy metals, hormones and antibiotics by (unfiltered) urine was roughly one magnitude lower compared with animal slurry. Fluxes of Cu, Ni and Pb were more than two magnitudes higher by slurries.
- Potential risks when using urine-based recycling fertilizers are the high salt content and NH3 volatilization. Increased salinity can have negative effects on soil and plants. However, the negative effects can be offset in different ways depending on the cultivation system, such as soil-based systems or hydroponics, and the crop selection. NH3 volatilization is possible, when urine is not treated before application. The nitrification process with its biological acidification is a resource-efficient process to lower the pH value and thereby strongly reducing or even eliminating the risk of NH3 volatilization or NH4 + toxicity (Krause et al., 2021)
- The product Aurin®, a liquid mineral RF from nitrified and purified human urine, has been tested extensively. Pathogens are removed by a combination of anaerobic storage, biological treatment, filtration, and most effectively by heating to more than 80°C during distillation. Micro pollutants are partially removed

during anaerobic storage and aerobic biological treatment but most efficiently by adsorption on granular activated carbon. Aurin® has been licensed as a fertilizer by Swiss, Liechtenstein and Austrian authorities, which therefore assessed Aurin to be safe.

- A high product quality has been monitored over the past two years by repeated analysis of the humus providing recycling fertilizer product according to the product standard DIN SPEC 91421 (see confidential data provided as attachment; this attached data collection was prepared by the working group agricultural use of products from resource-oriented sanitation system of Deutsche Vereinigung für Wasserwirtschaft, Abwasser und Abfall e.V. (DWA); Web-Link: https://fachgremien.dwa.de/details.php?id=137; Contact: Dr. Martina Winker winker@isoe.de and Dr. Ariane Krause krause@igzev.de PLEASE NOTE: THIS TABLE INCLUDES UNPUBLISHED SCIENTIFIC RESULTS AND MUST BE TREATED AS CONFIDENTIAL !!!!)
- Analysis showed that all relevant pollutants, i.e. pathogens and contaminants such as heavy metals or persistent organic pollutants, substances with maximum residues limits (MRLs) for food or feed or other impurities (e.g. glass, plastic, metal), which could present a risk to humans, animals and environment (soil and aquatic ecosystems), have been below the limit of detection or below threshold limits (where available; cf. DIN SPEC 91421 (Deutsches Institut für Normung, 2020)).

(List of references is provided as supporting document.)

* 7. Has a national authority of an EU country assessed the use of such an input material in the production of a fertilising product? If yes, had the respective authority gave a positive or a negative opinion?

The human urine derived fertilizer product Aurin® has been assessed and granted by the Austrian authorities (Shop: https://vuna.bexiocommerce.ch/).

Market data

* 8. Is the material already marketed in more than one EU country?

- Urine-derived products are marketed in Austria and Sweden.
- The product Aurin®, a liquid mineral RF from nitrified and purified human urine, is licensed as fertilizer in Switzerland, Liechtenstein and Austria.

* 9. What are the volumes involved?

Please, estimate current trade and/or use volumes (EU total or in specific EU countries, tonnes/year, if relevant specify dry matter or fresh matter)

- Currently an estimated volume of 10.000 m^3 a-1 is collected by event toilet service providers in Germany (assuming 20 Million toilet visits at events with a donation of 0.5 Liters of urine). The service providers are generally forced to release the collected material into the sewer system at additional cost both for the provider and the municipalities; further, no N is recycled from this valuable material flow, and only little P, depending on the sewer used.
- Currently Vuna reactors treat around 100 m^3 of urine per year in Switzerland which represents about 7 m3 of fertilizer per year. With the upcoming installations in 2023 and 2024 this will increase to at least 1,000 m^3 of treated urine per year or about 70 m3 of fertilizer per year. The current demand for urine based NPK fertilizer is much bigger than the current supply, showing its market potential.

*

10. Do products containing such materials have the potential to be subject to significant trade in the internal market?

Please, estimate possible future trade and/or use volumes (EU total or in specific EU countries, tonnes/year, if relevant specify dry matter or fresh matter)

- The potential of human urine derived fertilizers to substitute mineral fertilizer products depend on the macro element, for Germany they are estimated to be between 17-25% (Hammer and Clemens, 2007; Winker et al., 2009). Theoretic nutrient recovery potential from urine for Germany, with 80 Million people is ~ 20.000 t P a-1 and ~ 200.000 t N a-1
- Based on ESTAT data on the consumption of inorganic fertilizers for EU27, 12 % of P and 22 % of N consumption could potentially be substituted by humane urine recycling (based on numbers for 2018 and on data for stored urine from (Larsen, Gruendl and Binz, 2021).
- The global potential is estimated to be between 7-19 % with a total potential revenue of 9 billion USD based on nitrogen amounts and values as of 2018 (Wald, 2022).
- Nitrified urine fertilizers can be used to replace mineral N fertilizer by 80-100% and P fertilizer by ~1/3 in hydroponic tomato cultivation while maintaining yield (Halbert-Howard et al., 2020).

Section D – broader context

* 1. Does your proposal follow the logic of Circular Economy?

- The production of recycling fertilizers from human uring is the very core of circular economy, recycling low energy-value wastes to valorize contained nutrients and soil-function supporting product.
- Achieving sustainable food production requires significant improvement of current agricultural nutrient management and recycling practices (Gerten et al., 2020). Hence, circular economy is a key strategy for regulating the environmental impact of food production (FAO - Food and Agriculture Organization of the United Nations, 2015; Springmann et al., 2018). Policies and laws have been enforced in the past to increase circularity, including the European Union circular economy action plan under the Green Deal of the European Commission (2020).

* 2. Is it environmental friendly?

- Separate collection of human excreta followed by targeted treatment of urine and feces most likely allows for a more efficient way to prevent environmental pollution by pharmaceutical compounds, compared to the treatment of mixed wastewater in centralized treatment plants (Köpping et al., 2020b).
- N and P discharge from WWTPs largely contributes to eutrophication of rivers and coastal zones (Tuholske et al., 2021). Reducing N and P loads in wastewater, e.g. by implementing urine source separation, could therefore lower the risk for eutrophication and associated losses in aquatic biodiversity. Recovering N and P from source-separated urine can consume considerably less energy than N and P recovery from WWTP efflux (McCartney, Watanabe and Yip, 2021).
- Research over the last decade has demonstrated that source separation of human excreta is a viable path for the integrated recycling of plan nutrients, including N and P, and more environmentally friendly compared to the wastewater-sewage-path (Larsen et al., 2013; Harder et al., 2019; Larsen, 2020). In particular, the benefits of separate collection of human urine are numerous: i) decreased energy requirements of sewage plants, ii) decreased greenhouse gas emissions from wastewater treatment, iii) increased stability of plant operation due to lower daily loads of N and P, iv) improved quality of effluent, v) reduced harm to aquatic environments through high nutrient loads or dilution of trace substances, vi)

decreased use of freshwater, which is most relevant in the face of the current global drought, and vii) significantly increased nutrient recovery of P and N (Remy and Jekel, 2008; Bisinella de Faria et al., 2015; Bradford-Hartke et al., 2015; Ishii and Boyer, 2015; Kjerstadius et al., 2017; Hilton et al., 2021; Larsen et al., 2021; McCartney et al., 2021).

• Overall, the carbon footprint for urine fertilizer production via a process combination of partial nitrification, granular activated carbon (GAC) filtration, and distillation can be as low as 2 kg $CO_{2,eq}$ $kg\text{-}N^{-1}$ (Faust et al., 2022), which represents approximately 60 % of the $CO_{2,eq}$ currently emitted by the EU28 nitrogen synthetic fertilisers production (Menegat, Ledo and Tirado, 2022). The emissions of N_2O from wastewater treatment plants as well as from soil are likely to be drastically reduced by reduced ammonia loads, respectively, by applying a partly nitrified product to soils.

* 3. Will this initiative contribute to the reduction of dependency on critical raw materials, such as phosphate rock?

- N and P recycling of high interest for fertilizer production in regional circular economies;
- P: scarcity, high import rates, increasing heavy metal pollution levels in phosphate rock.
- N: crises with factories closing due to high dependency on natural gas.
- Human excreta is a key source for 'urban mining' of N and P (Mihelcic et al., 2011; Chowdhury et al., 2014; Esculier et al., 2019). However, this potential often remains untapped, and nutrient cycling in agriculture and horticulture is primarily based on recycling of nutrients from livestock farming, biogas production or composting of agricultural and domestic residues. This must change.
- About 3.1 Tg (i.e. 109 kg) N and 0.6 Tg P are excreted every year by the EU's population (Fowler et al., 2013; Garnier et al., 2015), corresponding to 30% and 55% of the amount of mineral fertilizers applied on agricultural fields in the EU (https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Agri-environmental_indicator_-_mineral_fertiliser_consumption

Section E – supporting documents

Please, attach supporting documents such as:

- Documents from the national authorisation process
- REACH registration dossier
- Studies, scientific literature
- Statistical data, market data
- Your amendment proposal
- Other

Attention! The documents will become publicly available. Please, make sure they do not contain any personal or confidential data.

Only files of the type pdf,txt,doc,docx,odt,rtf are allowed

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Contact

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