ESPP comments on NMI 2nd report v2 (circulated 14/4/26) on new materials/processes for the FPR

Some comments were already submitted on v1 - NEW comments on v2 are highlighted yellow

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Proposals for new CMCs						
4.1	Vinasse from feed industry	-	21	YES – proposal = add to CMC11 (By-Products”)	Criteria proposal CMC11 2.1(h) ESPP requests modification of CMC6: • Change title to “Food or animal feed industry residues” • Add text specifying that if the same material is classified as a waste by a MS, it is also covered.	Proposed approach is problematic because it depends whether local regulator classes as “By-Product” or “Waste”. In that this is essentially the same material as “food” industry vinasse, it would be preferable to modify CMC6 to specify “*food OR FEED industry by-products*” NMI have taken in ESPP’s proposal for CMC6 as above. They also propose inclusion in CMC11. This is a viable second option if the modification of the scope of CMC6 is considered not possible by COM, but ESPP has doubts as the inclusion of organics-derived materials was deliberately excluded by JRC from CMC11 article 1 during the By-Products study process discussions (wording “that uses as input materials substances and mixtures”). However, both of these proposals still fail to address the problem that one national/regional regulator may class a vinasse as a ‘by-product’ whereas another may classify the same material as a ‘waste’.

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4.2	Lime mud, lime dust, and burnt lime from pulp and paper industry	YES	23	YES – proposal = add to CMC11 or to CMC15-1(2)	Two criteria proposals page 27 CMC11 and CMC15: CMC 15(2) says "recovered from waste" – but proposed wording says "derived as waste" = contradictory The proposed wording says the material must be a solid salt as a lime mud, burnt lime or lime dust - contradictory	The limitation to only calcium carbonate or calcium oxide is not justified, and causes duplication and confusion with the obligations of CMC15(1). Why allow such materials from "pulp and paper" industry (using plants and chemicals) but not from other biorefineries (using plants and chemicals) if these are producing fuels, chemicals, fibres for textiles … ? See proposed coherent rewording amendment of CMC15 below. JRC assessed and excluded pulp and paper residues (By-Products study final report page 137, STRUBIAS final report p349). These exclusions and the justifications developed by JRC should be referred in the NMI report. ESPP has doubts as to inclusion in CMC11 because inclusion of organics-derived materials was deliberately excluded by JRC from CMC11 article 1 during the By-Products study process discussions (wording "that uses as input materials substances and mixtures"). Also, inclusion in CMC11 would mean that the same material, authorised in one MS because classified as a "By-Product" could be non allowed in another MS if classified as "waste". ESPP's point above is not addressed: why limit to CaCO3 and CaO2, when CMC15(1) covers a wider list of salts ? This limitation will cause confusion with CMC15 point 1 and serves no purpose whatsoever given that CMC11 was specifically designed to cover a specified range of pure mineral salts. The proposal to put under CMC11 2-1 seems appropriate to ESPP, and includes limits on chromium, thallium, dioxins, PAH and C_{-org}. As already indicated, NMI's proposed wording for CMC15 does not work "*recovered from waste generated from calcium carbonate or calcium oxide or a mixture thereof, derived as solid waste residue from the Kraft (sulphate) pulping process as lime mud or lime dust*". This wording suggests that the CMC material should be recovered from waste from the calcium salts … See ESPP's proposals for modifications of CMC15, to coherently cover several materials, below this table

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4.3	Vivianite from waste water treatment plants	YES	28	NO – agronomic efficiency as iron fertiliser considered NOT proven because studies used application rates 100 – 1000 x higher than real field rates. **NMI rejection based on «Inadequate data»**		Additional input provided by Aquaminerals, Kemira, Wetsus, Fertiberia, INCO attached: joint input 15/2/26: - Provides detailed arguments and list of references on iron fertiliser value of vivianite - Requests evaluation of vivianite as a phosphate fertiliser (not done in the NMI report), based on extensive evidence already submitted, including new evidence since the JRC STRUBIAS report. Input from Fertiberia 6/2/26 confirms fertiliser industry interest in vivianite as an iron fertiliser. We understand that further input has been provided by industry and stakeholders engaged in vivianite recovery and its use as a fertilising product, concerning doses used in trials, multi-year effects, further field trials, absence of any evidence of iron toxicity … We also understand that discussion is underway with NMI on how to move forward, with one possible option being to define what further information NMI consider to be needed on agronomic efficacy and potential market and to postpone conclusion on this material until a later date. ESPP supports this constructive approach. ESPP notes that the assessment of the agronomic value as a phosphate fertiliser (including the P take up by crops where used as an iron fertiliser) is important in consideration of the revised Urban Waste Water Treatment Directive 2024/3019 art. 20 requirement for phosphorus reuse and recycling rates.

4.4	Recovered ammonium salts from ABC extinguishers	NO	33	NO – data on agronomic efficiency and environmental safety “not available”. More data on recovery process, material composition, contaminants needed. **NMI rejection based on «Inadequate data»**		**This is a clear example of the problems with the current evaluation process.** • There have been several EU or national funded pilot projects (EU LIFE PHOSave, EnTRESS Regional Development, Phos Cycle UK RI, Firecompost EU FESR-FSE). Why is the EU wasting tax payers’ money on R&D projects which deliver no data ? • There are also companies recycling extinguisher material full scale: CWS, PHOSCycle • The basic materials in ABC extinguishers are ammonium phosphate and ammonium sulphate … so the agronomic efficiency is not worth discussing (and has been demonstrated:Tsigra et al. 2024) • Ecotoxicity has been tested PhosSave deliverable D6.2 See further discussion below Some information (re)submitted by ESPP is still not considered (Tsigra et al. EnTRESS, ecotoxicity study of PHOSave). NMI conclusions remain negative. It is thus confirmed that • EU and national/regional funded R&D projects are a waste of taxpayers’ money, as data developed is considered inadequate, and they cannot lead to implementation, • ABC recycling is “not established” resulting inevitably in little data, confidentiality … so is excluded. No innovative process is “established” so in effect any innovative process is excluded from the FPR. • This despite this example concerns ammonia salts (agronomic value well-known) with some additives to prevent caking. • If the material in the fire extinguishers were placed on the market “new” it would be allowed under CMC1. NMI note that the companies involved in fire extinguisher recycling have not responded. This is understandable in that clearly there is “no hope” in the FPR for any such innovative process/materials, and even they were optimistic nobody can tell them what data would be sufficient to obtain acceptance. ESPP understood from NMI’s answers at the 21 April workshop that their reason for rejection is inadequate information concerning the chemicals present in ABC fire extinguishers. We submit separately five MSDS from significant fire safety supplier companies. Further MSDS can readily be found online if wished. We also note that there is information on

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						extinguisher constituents in the already-submitted Gelsomino study, page 2. We hope that this resolves NMI's reasons for rejection. ESPP reminds that agronomic efficacy is known (widely used fertiliser salts) and that information already provided shows significant potential trade. If NMI consider that information is still insufficient, we request a clear list of what is needed: - What further data on ABC extinguisher powder composition ? From how many companies ? To what level of detail (components > 1% > 0.1% …?) - What further tox / ecotox data ? From how many samples ? From how many different processes ? From virgin ABC material, or end-of-life material, or after recycling-processing ? - What further agronomic evidence ?

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4.5	Recovered Mn, and Zn from battery recycling	NO	37	P41: says NMI rejection based on «Inadequate data». But p42 proposes criteria to add to CMC15-2	Criteria proposal p42 – CMC15. Current proposal would read "the … material shall be recovered from waste generated from a recycling process destined to recycle nutrients from waste". This is incoherent (recovery from waste from recovery from waste …). We do not see why the process must be "*designed to recover nutrients*": the nutrients could be a by-product of a process designed to recover rare earths, on condition that they meet the CMC15 safety criteria. We request to remove the limitation that the nutrient recovery process be "*hydrometallurgical processing*": this is vague so does not add clarify or added value, such "technology limiting" criteria are obstacles to competition, innovation and technical progress.	ESPP supports taking this forward, because safety criteria (as NMI indicates) are ensured by CMC15-1 and -3. Wording should be corrected – see proposal below the table. ESPP regrets that only Zn and Mn sulphates are considered, not phosphates or other (micro)nutrients from batteries. In particular, phosphates are an EU Critical Raw Material (Phosphate Rock) and are included in the list of elements which must be taken into account in battery recycling (Regulation 2025/606). Because LFP (Lithium Iron Phosphate) batteries are today the most used technology for vehicle and energy storage batteries, the recycling potential will be considerable. This "one-by-one" approach (only Zn and Mn) seems be the basis of the NMI studies. It prevents 'obvious' widening of proposed criteria, to be more open to different technologies, in particular to innovations which are known to already be underway. It means that the FPR is failing to adapt to technological progress. See joint industry statement on need for a criteria-based approach. NMI have not modified the proposed wording. ESPP maintains our comments already made (above and left).
4.6	N and K recovered from digestate sludge liquor - Aqua2N EasyMining	-	43	EasyMining process: Considered covered as CMC12 "derivate".		This is OK in so far as the intermediate precipitated struvite can be sampled for Certification, has <3% organics… NMI proposal unchanged. No ESPP comment.
	- Fraunhofer Newtrient	NO		Fraunhofer process: NO - no data **NMI rejection based on «Inadequate data»**		Agree NMI proposal unchanged. No ESPP comment.

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4.7	Sludge from paper, pulp, and cardboard industries	NO	47	NO – Rejected by JRC during STRUBIAS. No new data since then **NMI rejection based on «Inadequate data»**.		Agree NMI proposal unchanged. No ESPP comment.
4.8	Recovered mineral oils used as anti-dust and anti-caking additives	NO	52	NO – No relevant data provided by industry **NMI rejection based on «Inadequate data»**		Agree NMI proposal unchanged. No ESPP comment.
4.9	Plant biomass recovered from waste water treatment	NO	57	NO – NMI rejection based on «Inadequate data», processes still under development. **NMI rejection based on «Inadequate data»**		Despite a number of EU-funded Horizon, Interreg, LIFE projects However, difficult to proceed given the wide range of processes (e.g. different stage of wastewater treatment, leading to different contaminant and pathogen risk). NMI proposal substantially unchanged. ESPP suggest that NMI develop a clear (1/2 to 1 page) proposal as to what information is needed from the algae industry to take this forward: - Define covered input materials ? What limitations are significant ? - Define algae production process ? What specifications are needed ? - Define nutrient extraction or algae to fertiliser use route, processing, etc ? - List of specific contaminants to test ? - Would an EFSA Opinion be helpful ? or peer-reviewed publications ? This should provide indications necessary to enable the algae industry to take this forward, by proposing criteria (processes, contaminant limits, …) and building an evidence base to show agronomic value and safety under these conditions, and possibly also submitting to EFSA for an Opinion ?

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4.10	Source separated human urine	YES	61	NMI proposed YES in v1 of this report, but now propose "**NO**", considering: • hygienisation would be necessary for pathogen safety -> not economically viable given scale or production, • data lacking on removal of pharmaceuticals and other organic contaminants **NMI rejection based on «Inadequate data»**	**Why no draft criteria ?**	NMI initially concluded that two specific products, derived by processing source-separated urine (Aurin/Vuna, Granurine/Sanitation360), show adequate data on agronomic efficiency, have significant potential trade, are already in one case authorised in several European countries, and are "likely" to be safe … NMI then stated that they "*are unable to propose safety criteria for pathogens and pharmaceuticals*" sufficient for protection and trust. It is correct that the FPR nowhere provides guidance on this. However, ESPP notes that art. 42.1(b) requires safety for human, animal, plant health and the environment, but does not require "trust" (which is subjective and unpredictable). Pathogen limits are specified in the FPR for a number of CMCs: we suggest that these should be applicable and sufficient (after possibly appropriate adaptation for dose rate and use). Pharmaceutical limits are specified for no FPR CMC or PFC at present. However, we would suggest that pharmaceutical (human and veterinary) residue limits do exist for other sectors (food, animal feed, sewage sludge in some countries …) so NMI could reasonably propose a limit based on these. This might be overly precautionary but could be starting point for discussion with concerned companies and stakeholders. More widely, NMI state that "it would be great to have CMC criteria which cover a broad range of technologies". This is absolutely correct. Criteria should be open to innovation and technology neutral. After 2 years of study and exchanges with stakeholders, and the conclusion that the two products today on the market respect the art. 42 criteria (subject to pharmaceutical and pathogen limits) why cannot such criteria be proposed? ESPP requests that criteria be now proposed for "Sanitised separately processed urine and derivates", including: - Criteria of purity of urine "separation" (separation process designed to ensure X% separation, suspended solids limit) - Processing intended to ensure concentration and sterilisation, defined as per "derivates" in other CMCs - Stability (maximum ammonia loss in final product) - Pathogen limits - Pharmaceutical limits

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4.11	Unprocessed composted or digested sewage sludge	NO		Considered inappropriate as regulated by Sewage Sludge Directive		No comment
Assessment of new input materials for existing CMCs						
-	CMC 3: Sewage sludge (input to compost)		-	Not considered		
-	CMC5 : biorefinery streams as inputs to digestates		-	NMI stated in the workshop that biorefineries cover too wide a range of processes and inputs.	This should be assessed, included as a chapter in the report, with conclusions, justifying rejection if rejected. This would then enable industry and stakeholder to move to better define the proposal, develop further information, as appropriate.	This was input to the 2022 survey (n°44, listed page 135 in the NMI 1st report) and ESPP specifically requested it be studied in our input of September 2025. but is still not studied.
5.1	CMC 3: Human excreta and residues of dry toilets/ECO-toilets or diapers	NO	73	NO – no market / trade No data supplied on agronomic effectiveness or safety **NMI rejection based on «Inadequate data»**		Stakeholders have provided further input which NMI should take into consideration. Documents attached from P2GreeN and from Valoo. What is the interpretation of “potential significant trade” in art. 42? Significant part of total EU fertilising products market ? Or significant for the SME producing companies ? See additional note below. NMI report should be updated taking into account additional information input. NMI report should clarify: - What additional data would be needed - What are the criteria used to define whether or not a material has significant potential trade.

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5.2	CMC 3 and CMC5: Sludges from food and feed processing industry (156, 161, and 181)	YES	76	YES (as inputs for compost CMC3 and digestate CMC5)	Proposed criteria p84 The NMI proposed text is confused: - refers to "feed" in $1, but then not in $2 ESPP proposes to combine $1 and $2 into one paragraph citing: "*production and processing of food and beverages and animal feeds, including dairy products*"	Why only "sludges" – the term 'sludge' has no clear legal meaning. If a sludge is dried it becomes a solid … and is then excluded, or if diluted it becomes a liquid and is excluded. Replace "sludge" by "residue". ESPP's comments are not taken: proposed criteria remain confused ("feed" cited but then contradicted by wording of 2nd paragraph, limitation to "sludges" is not justified nor appropriate).
5.3	CMC 12: Food additive wastewater for P precipitation (136)	-	87	Considered already covered by CMC12-1(b) because "food additive production" is covered under "food processing"	Add to FAQ	It would be a strange interpretation to consider that a factory purifying phosphoric acid and making calcium phosphate animal feed additives, or a factory processing acrylonitrile to produce sodium glutamate, or a factory which reacts acetophenone and the ethyl ester of monochloroacetic acid to produce artificial strawberry flavour (ethyl methylphenylglycidate) … is "processing food". NMI persist with this very strange interpretation. However, precipitated phosphates from wastewater from such a site would fit under CMC**15**(2)(a) If the site was producing the food additives from edible plants, then it could be considered to fit under CMC12. This should be clarified in the FAQ.
5.4	CMC 12: Source-separated urine for production of calcium phosphate	-	87	Considered already covered by CMC12-1(a) "*wastewaters and sewage sludge from municipal wastewater treatment plants*"	NMI's analysis is in our view wrong. ESPP proposes to add to CMC12-1(b) "from … treatment plants <u>and from source-separated human urine</u>"	Source separate urine is, by definition, NOT from a municipal waste water treatment plant (the separative toilet is not owned by a municipality and is not a "plant". This will NOT be resolved by the current "Clarifications" amendment of (replace "municipal" by "urban") does not address the current exclusion. NMI have responded to this by indicating that "in some MS, source-separated urine is covered by the definition of domestic wastewaters". This is irrelevant in that CMC12-1a reads "from municipal wastewater treatment plants" [should be changed to "urban", as already discussed by the FEG], so that (as indicated by NMI themselves just above) source-separated urine is NOT covered by CMC 12-1-a even in these MS. And anyway, it does not resolve the situation in other MS. So why do NMI not make a proposal to resolve this? (see ESPP's proposal, left)

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5.5	CMC 13 KCl recovered from fly ash from municipal household waste incineration (EasyMining)	YES	89	Conclusion is positive	**Why no draft criteria ?** These criteria should be technology neutral (note exclude one company's process = NOAH but allow another company's process = EasyMining). ESPP suggests the following criteria: Add to CMC13 $1 (combustion input materials list): *"1(e-bis): municipal solid wastes, excluding industrial hazardous wastes, subject to the conditions of point $6"* *Add to $6 (derivates):* *"An EU fertilising product may contain derivates, as above, of materials under 1(e-bis) only if the derivate is a high purity material respecting the criteria of CMC12 (1) and (3) (4) (5) and (6)"*	**Why no draft criteria ?** NMI have not modified conclusions which are positive (process ensures safey), yet there are still no proposed criteria. Why not ?
5.6	CMC 15 KCl recovered from gypsum slurry derived from fly ash from municipal solid waste incineration (NOAH)	NO	93	NO **NMI rejection based on «Inadequate data»**		NMI say insufficient data to evaluate agronomic efficiency. This is incomprehensible. KCl is a widely used fertiliser (as NMI themselves point out p95). NMI say insufficient data to evaluate environmental safety. This unjustified: • The material is produced from ash, so no risks of organic contaminants from the input waste • Heavy metals are in any case limited by PFC criteria • Incineration contaminants (dioxins, …) can be limited as per CMC13 Environmental safety could thus be ensured by application of the criteria of CMC13 and CM15. Why is this Noah KCl from mixed household waste ash excluded … when the EasyMining KCl from household waste ash is concluded positive. The FPR is supposed to be technology neutral. NMI have not taken in ESPP's comment that they contradict themselves by claiming that evidence of agronomic efficiency of potassium chloride is insufficient. NMI requested at the 21 April workshop that ESPP suggest criteria. ESPP notes that we already did this in our input on v1 of the NMI report (see column left) and we refer again to these proposed criteria, which we suggest ensure safety and are technology neutral. Please consider the following additional data on agronomic efficiency: Nutrient Recovery Strategies and Agronomic Performance in Circular Farming: A Comprehensive Review and Edgardh-H-20260108.pdf This additional data submitted does not seem to be considered by NMI.

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5.7	CMC 14 Sewage sludge biochar	**YES**	**101**	NO **NMI rejection based on «Inadequate data» on PFAS** Conclusion: - $5.7.5 p99: YES for agronomic value. Notes that biochar >600°C has little nutrient fertilising value (soil improver only) - Removal of pharmaceuticals, PCBs, PAH, dioxins, microplastic = good - NMI rejection based on «Inadequate data» on PFAS removal and PFAS levels in sewage sludge biochars	**Consensus criteria have been proposed by industry (EBI). Why are these not considered ?**	NMI conclude that other questions are positive and the proposed rejection is ONLY because of PFAS risk. This is despite most studies suggesting at least 90% PFAS removal in pyrolysis. … and that on the other hand there is PFAS in most if not all other secondary materials currently authorised in EU FPR: biowaste compost and digestate, ash materials (CMC13), and in some commercial chemical fertilisers (see Dunsin Saliu 2024). It is not coherent to exclude sewage sludge biochars because of possible PFAS (when most PFAS is removed in the pyrolysis process) when there is no consideration of PFAS in other CMCs. Additional data on PFAS elimination has been submitted by stakeholders (BCE Biochar Europe, 6/2/26, attached) and recent exchanges have taken place with NMI. ESPP requests that this material be further evaluated by NMI taking into account recently submitted information and considering that the same levels of PFAS safety should be achieved with sewage sludge biochar as with other CMCs. NMI have considered the additional data provided by stakeholders, and conclude that evidence is insufficient regarding PFAS removal and consequent risks related to PFAS. ESPP does not see how this can further proceed in within the NMI – DG GROW – FPR process. We suggest that the biochar industry submit to EFSA a request for an opinion on the safety of sewage sludge biochar, under the proposed processing and contaminant control conditions.
Proposals for new materials for existing CMCs						

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	CMC12: P leached from sewage sludge, biochars …			Not considered.	This should be assessed, included as a chapter in the report, with conclusions, justifying rejection if rejected. This would then enable industry and stakeholder to move to better define the proposal, develop further information, as appropriate	This was input to the 2022 survey (n°44, listed page 135 in the NMI 1st report) and ESPP specifically requested it be studied in our input of September 2025. but is still not studied. **Still not assessed by NMI.**
	CMCs 13, 14: pre-processing of input materials			Not considered.	This should be assessed, included as a chapter in the report, with conclusions, justifying rejection if rejected. This would then enable industry and stakeholder to move to better define the proposal, develop further information, as appropriate	This was input to the 2022 survey (n°44, listed page 135 in the NMI 1st report) and ESPP specifically requested it be studied in our input of September 2025. but is still not studied. **Still not assessed by NMI.**
6.1	CMC 2: Buffered coir (23, 56, and 109)	YES	107	YES Proposed to add to CMC2	We do not understand the reference to "*calcium and magnesium salts … CMC1 or CMC11*" ? It is confusing that the material must belong to two CMCs	Agree with NMI that most appropriate route is modification of CMC2. "*buffering with … a salt solution*" is too vague. Some salts are highly toxic. Suggest to limit to "solution of salts of ….. (certain ions)". NMI have addressed ESPP's comment by limiting to calcium or magnesium salts. No further comment

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6.2	CMC 2-6-11: Oil meals and cakes when a solvent was used in extraction (47(1) and 122)	YES	111	YES via CMC11	Add to CMC2 not CMC11. Suggest to modify proposal to not limit to hexane but to specify - *Hexane if >99.9% recovery* - *Any solvent subject risk assessment showing no significant risk, for fertilising product use, to crop health, human health or the environment at levels remaining in the product* - *Solvent recovery is < 0.1% then the solvent itself is considered a CMC* See also proposals under 6.5, 7.1.	CMC 11 is not appropriate –concerns industrial by-products not biorefinery by-products. Also, these materials may be classified by local regulators NOT as by-products but as wastes or products, so excluded from CMC11. We suggest instead to add to CMC2 Why only hexane solvent ? This is NOT technology neutral. Criteria should apply to any solvent for which the residues are low and safe. NMI proposed criteria not modified. ESPP comments above are maintained. NOTE: the wording should not suggest limitation to certain specified list of seeds, but should concern any solvent extraction from any grains or seeds, or from any plant materials.
6.3	CMC 6: Binary salt by-products from food industry	YES	115	YES – CMC6		OK. CMC6 is not same wording as CMC12. CMC12 is "*food processing*" which would exclude MSG production. CMC6 is "*Food industry by-products*" which can, at a pinch, be considered to include this. No further comment
6.4	CMC 11: Iron(hydr)oxide Fe2O3.6H2O from the production of drinking water (de-ironing process).	NO ?	121	YES – as a digester additive -> already OK under CMCs 4 and 5. NO – for use as fertiliser (iron hydroxide not considered plant available.		Agree No further comment

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6.5	CMC 11: Fibrous insoluble residue obtained after alkaline and/or acid extraction of seaweed (114)	NO	123	NO **NMI rejection based on «Inadequate data»**	Coherent with 6.2 above, suggest to add to accepted processing methods in CMC2: • *Acid or alkali extraction* • *Subject to risk assessment showing no significant risk, for fertilising product use, to crop health, human health or the environment at acid or alkali levels remaining in the product* • *If acid/alkali recovery is < 0.1% then the acid/alkali itself is considered a CMC* See also proposals under 6.2, 7.1.	Common sense says there should be no question. The seaweed is OK under CMC2. Subject to the acid or alkali being OK under CMC1, CMC11, CMC15 NMI proposed criteria not modified. ESPP comments above are maintained.
6.6	CMC 13: P recovered from ash of incineration of food and feed by-products, fish sludge, digestate, and ABPs (35, 52, 91)	-	124	Outside scope because ABPs	Modify CMC13.1(b) to "~~vegetable waste~~ plant-based materials from the food, animal feed or pet food processing industry …."	The NMI text contradicts DG SANTE (see SCOPE Newsletter 159) by suggesting that fish sludge is not an ABP. Fish sludge contains fish scales, possibly dead fish, so is an ABP. This should be corrected. Stating that ABPs are out of scope makes no sense because ABPs are ALREADY allowed in CMC13 point 2 and ABP amending regulation 2023/1605 art 3(a). Fish sludge, manure digestate and ABP containing food and feed industry wastes are therefore already covered by CMC13 (except Cat1 ABPs). This should be clarified in FAQ if NMI confirm that it is not clear to them. Also, vegetable waste from food processing is already allowed under CMC13 1(b). However, it is unclear what "vegetable" means – does this include e.g. cakes remaining after solvent extraction of oils (vegetable plus traces of solvent) ? ESPP comments above are not addressed by NMI. ESPP maintains these comments.
Assessment of new processes and treatments						

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7.1	CMC 2 Wood fiberisation without temperature limit (135, 183, 184, 188, 192, 193, and 194)	YES	130	YES – under CMC2, up to 160°C, with N, without dyes See also no.8	Coherent with proposal above, suggest to specify that processing additives can be used in wood fiberisation to improve the C:N ratio: • *Subject to risk assessment showing no significant risk, for fertilising product use, to crop health, human health or the environment at acid or alkali levels remaining in the product* • *If the additive remains in the fiberised wood at > 0.1% then the it is itself considered a CMC* See also proposals under 6.2, 6.5.	Proposed criteria suggest to allow "*additives … compound which meets the criteria of CMC1, CMC11 or CMC15".* We believe that this is legally doubtful (it is not how additives are specified in CMCs 3-5) and will cause confusion (CMCs are supposed to be included into the final fertilising product, not used as reactants). ESPP comments above are not addressed by NMI. ESPP maintains these comments.
7.2	CMC 3: Aged bark / bark hummus (7, 24, 57, 58, 59 110, and 111)	YES	134	YES – under CMC2, with wide criteria. See also no.8	For coherence with CMCs 3-4-5, modify to read "*5% of the total <u>input</u> material weight*"	Agree NMI proposal is modified and additives are now NOT allowed for the bark ageing process. Is this OK for GME ?
7.3	CMC 3: Tunnel composting with alternative process requirements (140)	YES	138	YES – but unclear if excludes ABPs (so de facto biowaste, catering waste) … or not. Specifies particle size < 200 mm		Should include ABPs (the EFSA Opinion positively concluded considering ABPs for these methods). The NMI report is misleading because it suggests that ABPs, inc. biowaste or catering waste, are not covered. It is ESPP's understanding that these will covered (by NMI's proposed criteria = new CMC3-3a, taken with CMC3-1b if the 'Tunnel' composting process is added into the ABP daughter regulation 142/2011, subject to appropriate modification of 2003/1605 art. 3(c). This should be clarified in the NMI report and in the FAQ.
7.4	CMC 5: Thermal hydrolyses as an alternative process to standard pasteurisation	-	142	NO - Considered not relevant (concerns sewage sludge, which is not currently authorised)		Agree No further comment

	Material (2022 survey refs)	**1st report**	**Page**	**2nd report v2**	**ESPP comments on criteria wording**	**ESPP comments on approach**
7.5	CMC 5: Plasma treatment of digestate (141)	NO	144	NO - Considered will not be traded on EU market, production and use at farm level only.		Agree No further comment
7.6	CMC 13: Two stage combustion, including post oxidation of ashes	YES	148	YES Proposed amendments to modify articles 1 and 4 of CMC13.	For CMC13 point 1: Proposed amendment: modify existing CMC-1(d): *“(d) materials resulting from a controlled microbial ~~or thermochemical~~ conversion process using only input materials referred to in sub-points (a), (b) and (c);* *(dd) materials resulting from a controlled ~~microbial or~~ thermochemical conversion process using only input materials referred to in sub-points (a), (b), (c), e) and (f);”* For CMC point 4: Proposed amendment: modify: *“The thermal oxidation shall take place in an incineration or combustion ~~chamber~~ installation. The ~~chamber~~ installation may only process input materials …”*	For CMC13 point 1: Why limit to sewage sludge ((CMC13-1(e)) and exclude à priori less polluted wastewaters from food etc industries? This will lead to complexity and confusion : some thermal processes can accept some materials, others not ; prevent operators taking several waste flows (improve operation and economics). For CMC13 point 4: Why limit to two stage processes where stage 1 is gasification ? CMC13 should cover thermal oxidation processes, irrespective of how many chambers … No other criteria specify the number of chambers. A precipitation “reactor” for CMC12 could have any number of chambers … Limiting to one or two chambers, one of which is gasification, in a specific order is NOT technology open, excludes innovation and progress. ESPP’s comment (above and left) is not considered: why only for sewage sludge, not for other ‘less polluted’ inputs? Comment maintained. The proposal in the previous version of the NMI report to remove the current narrow process definition (one “chamber” has disappeared. This should be restored. See proposal already made by ESPP (left).

	Material (2022 survey refs)	**1st report**	**Page**	**2nd report v2**	**ESPP comments on criteria wording**	**ESPP comments on approach**
7.7	CMC 15: Ammonia recovered from digestate supernatant by zeolite ion exchange plus membranes	NO	151	NO. Refused because “not at sufficient technological level for implementation”, no data on agronomic efficiency, no data on environmental safety. **NMI rejection based on «Inadequate data»**		There exists data on ammonia salts recovery from offgas, which is widely operational full scale. But agree regarding recovery by ion-exchange or membranes. No further comment
7.8	Lime treated biodegradable materials (including sewage sludge but excluding ABP)	NO	155	NO. Concerns sewage sludge which is excluded. No clear need for liming of other biowastes.		Agree. No further comment
New proposal						
8	Proposed new CMC from growing media materials	YES	130	YES Alternative to 7.2, 7.3		This limits use of the added materials (aged bark, fiberised wood) to CMCs 3 and 4 only (soil improvers, growing media). Why exclude these from Fertilisers, Biostimulants and from Blends (CMCs 1, 6 and 7). If safe in Growing Media, then even safer in these uses (diluted). ESPP’s comment (above) is not considered. Comment maintained.

ESPP proposal for rewording of CMC15 (NMI chapters 4.2, 4.5, 7.1)

The NMI proposals for including several materials into CMC15 are not coherent because of the current wording of CMC15(2) – leading to recovered from waste generated from recovery from waste …

ESPP proposes to reformulate CMC15(2), without modifying its meaning for materials currently covered, as follows:

(2) The high purity material shall be recovered ~~from waste generated from~~

(a) from waste generated from a production process …

(b) from waste generated from a gas purification or emission control process …

(c) [NMI 4.2.7] ~~calcium carbonate or calcium oxide or a mixture thereof, derived as solid waste~~ as lime mud, burnt lime or lime dust ~~residues~~ from the Kraft (sulphate) pulping process

(d) as Mn and Zn sulphate salts ~~by hdrometallurgical processing~~ from a process ~~designed to recover nutrients from waste~~ that uses as input materials:

- *substances and mixtures*
- *waste alkaline batteries*

ESPP comments on NMI 2nd report v1 (circulated 27/1/26) on new materials/processes for the FPR

General comments:

How to move forward

This evaluation process has now been running for 3 ½ years (since the 2022 COM survey). This is, to be very polite: embarrassing.

A number of the materials/processed by NMI have today a clear positive evaluation and (for some) proposed criteria. ESPP requests, for these, to move rapidly to finalisation of criteria wording, followed by the Delegated Amendment procedure:

- 4.1 Feed industry vinasse,
- 4.2 Pulp and paper lime, and combined amendment of CMC15 (to cover 4.2, 4.5, 7.1)
- 4.5 battery recycling (micro)nutrients,
- 5.2 Food & feed industry residues input to digestate and compost,
- 5.4 Source-separated urine input to precipitated phosphates,
- 5.5 & 5.6 KCl from combustion ashes,
- 6.1 Buffered coir,
- 6.2 Solvent extracted plant materials,
- 6.3 Salts from food industry residues,
- 7.1 Wood fiberisation,
- 7.2 Bark hummus,
- 7.3 Tunnel composting,
- 7.6 Multi stage combustion

For a number of other materials, clear stakeholder demand and recycling potential exists and stakeholders have provided data which is not yet considered by NMI, or NMI have not yet considered the material or certain conclusions do not seem to be justified. For these, we request that NMI complete their study through to proposing criteria, which might in some cases be accompanied by indications that they consider the criteria inadequate to ensure health and environmental safety:

- 4.3 Vivianite,
- 4.4 Fire extinguishers,
- 4.10 Processed source-separated urine,
- 5.XX Biorefinery residues input to digestates (submitted in 2022 but NMI have not yet considered)
- 5.1 Composted source-separated human faeces
- 5.7 Sewage sludge biochars,
- 6.XX Pre-treatment of input materials (submitted in 2022 but NMI have not yet considered)
- 6.5 Alkali/acid fibre extraction of seaweed

Why so narrow-minded ?

NMI's approach is in many cases contrary to adaptation to technological progress and to technology neutrality. Wherever possible, approached changes of criteria should not unnecessarily limit to one process or material but should be open to similar inputs where risks and agronomic efficiency are comparable.

For example, why does 7.6 propose to extend CMC13 from "one stage" combustion to "two stage" only for sewage sludge. Surely the logic applies to other input materials (mostly less contaminated than sewage sludge) ? And why only two stages. If a process has six stages, of which one ensures the required combustion conditions, then why exclude it ?

There are other examples of similar unnecessary rigid limitations:

- 4.2 calcium carbonate or calcium oxide only, why not the other salts listed in CMC15?
- 4.2 why only from pulp and paper, not other biorefineries ?
- 4.5 why recovery of Zn and Mn only? Why not other micronutrients? Why not phosphates ?
- 5.2 why only "sludges" from food and feed processing? Why not dry residues? (sludge … if dried!)
- 5.5-5.6 why KCl from municipal sold waste incineration ash by one process only ?
- 6.2 why extraction by one solvent only (hexane)? Why not other non-toxic solvents ?

What data is needed? What criteria ? Nobody knows …

A comment received from one stakeholder I suggest sums things up: “My greatest concern is that one cannot find a red line in how the materials were evaluated. … sometimes well-known materials are rejected, other times the conducted studies were deemed useless”

The example of fire extinguisher powder illustrates the problem. The material is essentially ammonium phosphate and ammonium sulphate, well known and recognised fertilisers, and a couple of scientific trials exist, yet NMI say that that scientific data to evaluate agronomic efficiency is not available.

Contaminants are principally silicones, for which REACH data must be available. EU and national funded pilot trials have been successfully run (and funded with public money), yet NMI say data on environmental safety, contaminants and process are inadequate to evaluate.
We do not see what more can reasonably be expected from an innovative recycling process? Does the process have to be operated full scale and thousands of tonnes sold on national markets (under national fertilisers regulations) before it can be considered for the FPR ? How many field trials and product analysis must be carried out (budget, time needed, confidentiality …) ?

No criteria defining what data might be sufficient for agronomic efficiency or safety

Today there are no criteria to indicate what data is required on agronomic efficiency or on safety. How many studies, at what scale, in how many different soils/countries, must it be peer reviewed, … Are field trials needed or pot trials ? Are ecotoxicity tests required on the recovered material or could a risk assessment be based on REACH data for the initial extinguisher components, chemicals used in processing, contaminants identified in material analysis ? How many material samples need to provide data, from how many companies ? What information is needed concerning the recycling process (this will be largely confidential industry know-how) ? The only thing that is clear is that the data generated by EU-funded projects is “not adequate”. In this situation, industry is not motivated to come together and prepare further data, in that nobody knows what is required.

If industry were to prepare a new concerted dossier, by which time the current NMI report will be closed, when would this be considered? Will it take another 3-5 years?

This illustrates the need for a criteria-based approach – see joint industry position at www.phosphorusplatform.eu/regulatory

No criteria defining what is “significant potential for trade

There are also no criteria to know what evidence is needed for potential trade. There are no clear criteria for interpreting the art. 42.1(a) requirement: “fertilising products … which have the potential to be the subject of significant trade on the internal market”. For the example of products derived by processing source separated human urine or dry toilet materials. Niche products are today produced, in some cases authorised in several European countries. Trade between countries is highly significant for the SME’s marketing these products. The tonnages and total economic value are very small compared to total EU fertilising products sales – but this is true of many recycled nutrients or fertilising products for specific applications.

Art.42 not fit for purpose ?

Even for fertilising products which likely to be used locally (for reasons of logistics), the EU FPR recognition is key to roll-out of the technology because it is unrealistic for an SME to prepare 27 different authorisation dossiers, and the technology is unsellable in a country where the output product is not authorised. This is particularly true for recycling and bioeconomy processes where dossiers tend to be complex and production decentralised. Unfortunately, this important innovation enabling aspect of the FPR is not recognised in art. 42.

Attachements

We include the following attachments with detailed supporting evidence from stakeholders:

- 4.3 Vivianite
  - joint input from Aquaminerals, Kemira, Wetsus, Fertiberia, INCO, including list of studies not considered in NMI report and detailed reference list
  - input from Fertiberia
- 5.1 Composted source-separated human faeces:
  - inputs from P2GreeN
  - input from Valoo
- 5.7 Sewage sludge biochars:
  - BCE (Biochar Europe) paper on PFAS 6/2/26
  - Jaroslav Moško, UCT Prague (University of Chemistry & Technology Prague) – 10/2/26

	Material (2022 survey refs)	**1st report**	**Page**	**2nd report v1 proposals**	**ESPP comments on criteria wording**	**ESPP comments on approach**
Proposals for new CMCs						
4.1	Vinasse from feed industry	-	21	YES – proposal = add to CMC11 (By-Products")	Criteria proposal CMC11 2.1(h)	Proposed approach is problematic because it depends whether local regulator classes as "By-Product" or "Waste". In that this is essentially the same material as "food" industry vinasse, it would be preferable to modify CMC6 to specify "*food OR FEED industry by-products*"
4.2	Lime mud, lime dust, and burnt lime from pulp and paper industry	YES	23	YES – proposal = add to CMC11 or to CMC15-1(2)	Two criteria proposals page 27 CMC11 and CMC15: CMC 15(2) says "recovered from waste" – but proposed wording says "derived as waste" = contradictory The proposed wording says the material must be a solid salt as a lime mud, burnt lime or lime dust - contradictory	The limitation to only calcium carbonate or calcium oxide is not justified, and causes duplication and confusion with the obligations of CMC15(1). Why allow such materials from "pulp and paper" industry (using plants and chemicals) but not from other biorefineries (using plants and chemicals) if these are producing fuels, chemicals, fibres for textiles … ? See proposed coherent rewording amendment of CMC15 below.
4.3	Vivianite from waste water treatment plants	YES	28	NO – agronomic efficiency as iron fertiliser considered NOT proven because studies used application rates 100 – 1000 x higher than real field rates. **Inadequate data**		Additional input provided by Aquaminerals, Kemira, Wetsus, Fertiberia, INCO attached: joint input 15/2/26: - Provides detailed arguments and list of references on iron fertiliser value of vivianite - Requests evaluation of vivianite as a phosphate fertiliser (not done in the NMI report), based on extensive evidence already submitted, including new evidence since the JRC STRUBIAS report. Input from Fertiberia 6/2/26 confirms fertiliser industry interest in vivianite as an iron fertiliser.
4.4	Recovered ammonium salts from ABC extinguishers	NO	33	NO – data on agronomic efficiency and environmental safety "not available". More data on recovery process, material composition, contaminants needed. **Inadequate data**		**This is a clear example of the problems with the current evaluation process.** ● There have been several EU or national funded pilot projects (EU LIFE PHOSave, EnTRESS Regional Development, Phos Cycle UK RI, Firecompost EU FESR-FSE). Why is the EU wasting tax payers' money on R&D projects which deliver no data ?

	Material (2022 survey refs)	**1st report**	**Page**	**2nd report v1 proposals**	**ESPP comments on criteria wording**	**ESPP comments on approach**
						• There are also companies recycling extinguisher material full scale: CWS, PHOSCycle • The basic materials in ABC extinguishers are ammonium phosphate and ammonium sulphate … so the agronomic efficiency is not worth discussing (and has been demonstrated:Tsigra et al. 2024) • Ecotoxicity has been tested PhosSave deliverable D6.2 See further discussion below
4.5	Recovered Mn, and Zn from battery recycling	NO	37	P41: says inadequate data. But p42 proposes criteria to add to CMC15-2	Criteria proposal p42 – CMC15. Current proposal would read "the … material shall be recovered from waste generated from a recycling process destined to recycle nutrients from waste". This is incoherent (recovery from waste from recovery from waste …). We do not see why the process must be "*designed to recover nutrients*": the nutrients could be a by-product of a process designed to recover rare earths, on condition that they meet the CMC15 safety criteria. We request to remove the limitation that the nutrient recovery process be "*hydrometallurgical processing*": this is vague so does not add clarify or added value, such "technology limiting" criteria are obstacles to competition, innovation and technical progress.	ESPP supports taking this forward, because safety criteria (as NMI indicates) are ensured by CMC15-1 and -3. Wording should be corrected – see proposal below the table. ESPP regrets that only Zn and Mn sulphates are considered, not phosphates or other (micro)nutrients from batteries. In particular, phosphates are an EU Critical Raw Material (Phosphate Rock) and are included in the list of elements which must be taken into account in battery recycling (Regulation 2025/606). Because LFP (Lithium Iron Phosphate) batteries are today the most used technology for vehicle and energy storage batteries, the recycling potential will be considerable. This "one-by-one" approach (only Zn and Mn) seems be the basis of the NMI studies. It prevents 'obvious' widening of proposed criteria, to be more open to different technologies, in particular to innovations which are known to already be underway. It means that the FPR is failing to adapt to technological progress. See joint industry statement on need for a criteria-based approach.
4.6	N and K recovered from digestate sludge liquor	-	43	EasyMining process: Considered covered as CMC12 "derivate".		This is OK in so far as the intermediate precipitated struvite can be sampled for Certification, has <3% organics…

	Material (2022 survey refs)	**1st report**	**Page**	**2nd report v1 proposals**	**ESPP comments on criteria wording**	**ESPP comments on approach**
	- Aqua2N EasyMining					
	- Fraunhofer Newtrient	NO		Fraunhofer process: NO - no data **Inadequate data**		Agree
4.7	Sludge from paper, pulp, and cardboard industries	NO	47	NO – Rejected by JRC during STRUBIAS. No new data since then **Inadequate data**.		Agree
4.8	Recovered mineral oils used as anti-dust and anti-caking additives	NO	52	NO – No relevant data provided by industry **Inadequate data**		Agree
4.9	Plant biomass recovered from waste water treatment	NO	57	NO – inadequate data, processes still under development. **Inadequate data**		Despite a number of EU-funded Horizon, Interreg, LIFE projects However, difficult to proceed given the wide range of processes (e.g. different stage of wastewater treatment, leading to different contaminant and pathogen risk).
4.10	Source separated human urine	YES	61	YES, but …– but for two specific company processes only – see notes below	**Why no draft criteria ?**	**Why no draft critera ?**
4.11	Unprocessed composted or digested sewage sludge	NO		Considered inappropriate as regulated by Sewage Sludge Directive		
Assessment of new input materials for existing CMCs						
-	CMC 3: Sewage sludge (input to compost)		-	Not considered		
-	CMC5 : biorefinery streams as inputs to digestates		**-**			**This was input to the 2022 survey (n°44, listed page 135 in the NMI 1st report) and ESPP specifically requested it be studied in our input of September 2025. but is still not studied – why ?**
5.1	CMC 3: Human excreta and residues of dry toilets/ECO-toilets or diapers	NO	73	NO – no market / trade No data supplied on agronomic effectiveness or safety		Stakeholders have provided further input which NMI should take into consideration. Documents attached from P2GreeN and from Valoo.

	Material (2022 survey refs)	**1st report**	**Page**	**2nd report v1 proposals**	**ESPP comments on criteria wording**	**ESPP comments on approach**
				Inadequate data		What is the interpretation of "potential significant trade" in art. 42? Significant part of total EU fertilising products market ? Or significant for the SME producing companies ? See additional note below.
5.2	CMC 3 and CMC5: Sludges from food and feed processing industry (156, 161, and 181)	YES	76	YES (as inputs for compost CMC3 and digestate CMC5)	Proposed criteria p84 The NMI proposed text is confused: - refers to "feed" in $1, but then not in $2 ESPP proposes to combine $1 and $2 into one paragraph citing: "*production and processing of food and beverages and animal feeds, including dairy products*"	Why only "sludges" – the term 'sludge' has no clear legal meaning. If a sludge is dried it becomes a solid … and is then excluded, or if diluted it becomes a liquid and is excluded. Replace "sludge" by "residue".
5.3	CMC 12: Food additive wastewater for P precipitation (136)	-	87	Considered already covered by CMC12-1(b) because "food additive production" is covered under "food processing"	Add to FAQ	It would be a strange interpretation to consider that a factory purifying phosphoric acid and making calcium phosphate animal feed additives … is "processing food". However, precipitated phosphates from wastewater from such a site would fit under CMC12(2)(a) If the site was producing the feed additives from edible plants, then it could be considered to fit under CMC12. This should be clarified in the FAQ.
5.4	CMC 12: Source-separated urine for production of calcium phosphate	-	87	Considered already covered by CMC12-1(a) "*wastewaters and sewage sludge from municipal wastewater treatment plants*"	NMI's analysis is in our view wrong. ESPP proposes to add to CMC12-1(b) "from … treatment plants and from source-separated human urine"	Source separate urine is, by definition, NOT from a municipal waste water treatment plant (the separative toilet is not owned by a municipality and is not a "plant". This will NOT be resolved by the current "Clarifications" amendment of (replace "municipal" by "urban") does not address the current exclusion.
5.5	CMC 13 KCl recovered from fly ash from municipal household waste incineration (EasyMining)	YES	89	Conclusion is positive	**Why no draft criteria ?** These criteria should be technology neutral (note exclude one company's process = NOAH but allow another company's process = EasyMining). ESPP suggests the following criteria: Add to CMC13 $1 (combustion input materials list):	**Why no draft critera ?**
5.6	CMC 15 KCl recovered from gypsum slurry derived from fly ash from	NO	93	NO **Inadequate data**		NMI say insufficient data to evaluate agronomic efficiency. This is incomprehensible. KCl is a widely used fertiliser (as NMI themselves point out p95).

	Material (2022 survey refs)	**1st report**	**Page**	**2nd report v1 proposals**	**ESPP comments on criteria wording**	**ESPP comments on approach**
	municipal solid waste incineration (NOAH)				*"1(e-bis): municipal solid wastes, excluding industrial hazardous wastes, subject to the conditions of point $6"* *Add to $6 (derivates):* *"An EU fertilising product may contain derivates, as above, of materials under 1(e-bis) only if the derivate is a high purity material respecting the criteria of CMC12 (1) and (3) (4) (5) and (6)"*	NMI say insufficient data to evaluate environmental safety. This unjustified: • The material is produced from ash, so no risks of organic contaminants from the input waste • Heavy metals are in any case limited by PFC criteria • Incineration contaminants (dioxins, …) can be limited as per CMC13 Environmental safety could thus be ensured by application of the criteria of CMC13 and CM15. Why is this Noah KCl from mixed household waste ash excluded … when the EasyMining KCl from household waste ash is concluded positive. The FPR is supposed to be technology neutral.
5.7	CMC 14 Sewage sludge biochar	**YES**	**101**	NO **Inadequate data on PFAS** Conclusion: • $5.7.5 p99: YES for agronomic value. Notes that biochar >600°C has little nutrient fertilising value (soil improver only) • Removal of pharmaceuticals, PCBs, PAH, dioxins, microplastic = good • Inadequate data on PFAS removal and PFAS levels in sewage sludge biochars	**Consensus criteria have been proposed by industry (EBI). Why are these not considered ?**	NMI conclude that other questions are positive and the proposed rejection is ONLY because of PFAS risk. This is despite most studies suggesting at least 90% PFAS removal in pyrolysis. … and that on the other hand there is PFAS in most if not all other secondary materials currently authorised in EU FPR: biowaste compost and digestate, ash materials (CMC13), and in some commercial chemical fertilisers (see Dunsin Saliu 2024). It is not coherent to exclude sewage sludge biochars because of possible PFAS (when most PFAS is removed in the pyrolysis process) when there is no consideration of PFAS in other CMCs. Additional data on PFAS elimination has been submitted by stakeholders (BCE Biochar Europe, 6/2/26, attached) and recent exchanges have taken place with NMI. ESPP requests that this material be further evaluated by NMI taking into account recently submitted information and considering that the same levels of

	Material (2022 survey refs)	**1st report**	**Page**	**2nd report v1 proposals**	**ESPP comments on criteria wording**	**ESPP comments on approach**
						PFAS safety should be achieved with sewage sludge biochar as with other CMCs.
Proposals for new materials for existing CMCs						
	CMC12: P leached from sewage sludge, biochars …			Not considered.		**This was input to the 2022 survey (n°44, listed page 135 in the NMI 1st report) and ESPP specifically requested it be studied in our input of September 2025. but is still not studied – why ?**
	CMCs 13, 14: pre-processing of input materials			Not considered.		**This was input to the 2022 survey (n°44, listed page 135 in the NMI 1st report) and ESPP specifically requested it be studied in our input of September 2025. but is still not studied – why ?**
6.1	CMC 2: Buffered coir (23, 56, and 109)	YES	107	YES Proposed to add to CMC2	We do not understand the reference to "*calcium and magnesium salts … CMC1 or CMC11*" ? It is confusing that the material must belong to two CMCs	Agree with NMI that most appropriate route is modification of CMC2. "*buffering with … a salt solution*" is too vague. Some salts are highly toxic. Suggest to limit to "solution of salts of ….. (certain ions)".
6.2	CMC 2-6-11: Oil meals and cakes when a solvent was used in extraction (47(1) and 122)	YES	111	YES via CMC11	Add to CMC2 not CMC11. Suggest to modify proposal to not limit to hexane but to specify • *Hexane if >99.9% recovery* • *Any solvent subject risk assessment showing no significant risk, for fertilising product use, to crop health, human health or the environment at levels remaining in the product* • *Solvent recovery is < 0.1% then the solvent itself is considered a CMC* See also proposals under 6.5, 7.1.	CMC 11 is not appropriate –concerns industrial by-products not biorefinery by-products. Also, these materials may be classified by local regulators NOT as by-products but as wastes or products, so excluded from CMC11. We suggest instead to add to CMC2 Why only hexane solvent ? This is NOT technology neutral. Criteria should apply to any solvent for which the residues are low and safe. The wording should not suggest limitation to certain specified list of seeds, but should concern any solvent extraction from any grains or seeds, or from any plant materials.
6.3	CMC 6: Binary salt by-products from food industry	YES	115	YES – CMC6		OK. CMC6 is not same wording as CMC12. CMC6 is "*food processing*" which would exclude MSG production. CMC6 is "*Food industry by-products*" which can, at a pinch, be considered to include this.
6.4	CMC 11: Iron(hydr)oxide Fe2O3.6H2O from the	NO ?	121	YES – as a digester additive -> already OK under CMCs 4 and 5.		Agree

	Material (2022 survey refs)	**1st report**	**Page**	**2nd report v1 proposals**	**ESPP comments on criteria wording**	**ESPP comments on approach**
	production of drinking water (de-ironing process).			NO – for use as fertiliser (iron hydroxide not considered plant available.		
6.5	CMC 11: Fibrous insoluble residue obtained after alkaline and/or acid extraction of seaweed (114)	NO	123	NO **Inadequate data**	Coherent with 6.2 above, suggest to add to accepted processing methods in CMC2: • *Acid or alkali extraction* • *Subject to risk assessment showing no significant risk, for fertilising product use, to crop health, human health or the environment at acid or alkali levels remaining in the product* • *If acid/alkali recovery is < 0.1% then the acid/alkali itself is considered a CMC* See also proposals under 6.2, 7.1.	Common sense says there should be no question. The seaweed is OK under CMC2. Subject to the acid or alkali being OK under CMC1, CMC11, CMC15
6.6	CMC 13: P recovered from ash of incineration of food and feed by-products, fish sludge, digestate, and ABPs (35, 52, 91)	-	124	Outside scope because ABPs		
Assessment of new processes and treatments						
7.1	CMC 2 Wood fiberisation without temperature limit (135, 183, 184, 188, 192, 193, and 194)	YES	130	YES – under CMC2, up to 160°C, with N, without dyes See also no.8	Coherent with proposal above, suggest to specify that processing additives can be used in wood fiberisation to improve the C:N ratio: • *Subject to risk assessment showing no significant risk, for fertilising product use, to crop health, human health or the environment at acid or alkali levels remaining in the product* • *If the additive remains in the fiberised wood at > 0.1% then the it is itself considered a CMC*	Proposed criteria suggest to allow "*additives … compound which meets the criteria of CMC1, CMC11 or CMC15".* We believe that this is legally doubtful (it is not how additives are specified in CMCs 3-5) and will cause confusion (CMCs are supposed to be included into the final fertilising product, not used as reactants).

	Material (2022 survey refs)	**1st report**	**Page**	**2nd report v1 proposals**	**ESPP comments on criteria wording**	**ESPP comments on approach**
					See also proposals under 6.2, 6.5.	
7.2	CMC 3: Aged bark / bark hummus (7, 24, 57, 58, 59 110, and 111)	YES	134	YES – under CMC2, with wide criteria. See also no.8	For coherence with CMCs 3-4-5, modify to read "*5% of the total input material weight*"	Agree
7.3	CMC 3: Tunnel composting with alternative process requirements (140)	YES	138	YES – but unclear if excludes ABPs (so de facto biowaste, catering waste) … or not. Specifies particle size < 200 mm		Should include ABPs (the EFSA Opinion positively concluded considering ABPs for these methods).
7.4	CMC 5: Thermal hydrolyses as an alternative process to standard pasteurisation	-	142	NO - Considered not relevant (concerns sewage sludge, which is not currently authorised)		Agree
7.5	CMC 5: Plasma treatment of digestate (141)	NO	144	NO - Considered will not be traded on EU market, production and use at farm level only.		Agree
7.6	CMC 13: Two stage combustion, including post oxidation of ashes	YES	148	YES Proposed amendments to modify articles 1 and 4 of CMC13.	For CMC13 point 1: Proposed amendment: modify existing CMC-1(d): *"(d) materials resulting from a controlled microbial ~~or~~ ~~thermochemical~~ conversion process using only input materials referred to in sub-points (a), (b) and (c);* *(dd) materials resulting from a controlled ~~microbial or~~ thermochemical conversion process using only input materials referred to in sub-points (a), (b), (c), € and (f);"* For CMC point 4: Proposed amendment: modify: *"The thermal oxidation shall take place in an incineration or combustion ~~chamber~~ installation. The*	For CMC13 point 1: Why limit to sewage sludge ((CMC13-1(e)) and exclude à priori less polluted wastewaters from food etc industries? This will lead to complexity and confusion : some thermal processes can accept some materials, others not ; prevent operators taking several waste flows (improve operation and economics). For CMC13 point 4: Why limit to two stage processes where stage 1 is gasification ? CMC13 should cover thermal oxidation processes, irrespective of how many chambers … No other criteria specify the number of chambers. A precipitation "reactor" for CMC12 could have any number of chambers … Limiting to one or two chambers, one of which is gasification, in a specific order is NOT technology open, excludes innovation and progress.

	Material (2022 survey refs)	**1st report**	**Page**	**2nd report v1 proposals**	**ESPP comments on criteria wording**	**ESPP comments on approach**
					~~chamber~~ installation may only process input materials …”	
7.7	CMC 15: Ammonia recovered from digestate supernatant by zeolite ion exchange plus membranes	NO	151	NO. Refused because “not at sufficient technological level for implementation”, no data on agronomic efficiency, no data on environmental safety. **Inadequate data**		There exists data on ammonia salts recovery from offgas, which is widely operational full scale. But agree regarding recovery by ion-exchange or membranes.
7.8	Lime treated biodegradable materials (including sewage sludge but excluding ABP)	NO	155	NO. Concerns sewage sludge which is excluded. No clear need for liming of other biowastes.		Agree.
New proposal						
8	Proposed new CMC from growing media materials	YES	130	YES Alternative to 7.2, 7.3		This limits use of the added materials (aged bark, fiberised wood) to CMCs 3 and 4 only (soil improvers, growing media). Why exclude these from Fertilisers, Biostimulants and from Blends (CMCs 1, 6 and 7). If safe in Growing Media, then even safer in these uses (diluted).

Notes on specific materials

Proposal for rewording of CMC15 (NM%I chapters 4.2, 4.5, 7.1)

The NMI proposals for including several materials into CMC15 are not coherent because of the current wording of CMC15(2) – leading to recovered from waste generated from recovery from waste …

ESPP proposes to reformulate CMC15(2), without modifying its meaning for materials currently covered, as follows:

(2) The high purity material shall be recovered ~~from waste generated from~~
(a) from waste generated from a production process …
(b) from waste generated from a gas purification or emission control process …
(c) [NMI 4.2.7] ~~calcium carbonate or calcium oxide or a mixture thereof, derived as solid waste~~ as lime mud, burnt lime or lime dust ~~residues~~ from the Kraft (sulphate) pulping process
(d) as Mn and Zn sulphate salts ~~by hdrometallurgical processing~~ from a process ~~designed to recover nutrients from waste~~ that uses as input materials:
- substances and mixtures
- waste alkaline batteries

Source separated urine (4.10)

NMI conclude that two specific products, derived by processing source-separated urine (Aurin/Vuna, Granurine/Sanitation360), show adequate data on agronomic efficiency, have significant potential trade, are already in one case authorised in several European countries, are "likely" to be safe … but that NMI "are unable to propose safety criteria for pathogens and pharmaceuticals" sufficient for protection and trust.

This is understandable in the FPR nowhere provides guidance on this. However, ESPP notes that art. 42.1(b) requires safety for human, animal, plant health and the environment, but does not require "trust" (which is subjective and unpredictable). Pathogen limits are specified in the FPR for a number of CMCs: we suggest that these should be applicable and sufficient (after possibly appropriate adaptation for dose rate and use). Pharmaceutical limits are specified for no FPR CMC or PFC at present. However, we would suggest that pharmaceutical (human and veterinary) residue limits do exist for other sectors (food, animal feed, sewage sludge in some countries …) so NMI could reasonably propose a limit based on these. This might be overly precautionary but could be starting point for discussion with concerned companies and stakeholders.

More widely, NMI state that "it would be great to have CMC criteria which cover a broad range of technologies". This is absolutely correct. Criteria should be open to innovation and technology neutral. After 2 years of study and exchanges with stakeholders, and the conclusion that the two products today on the market respect the art. 42 criteria (subject to pharmaceutical and pathogen limits) why cannot such criteria be proposed?

ESPP requests that criteria be now proposed for "Sanitised separately processed urine and derivates", including:

- Criteria of purity of urine "separation" (separation process designed to ensure X% separation, suspended solids limit)
- Processing intended to ensure concentration and sterilisation, defined as per "derivates" in other CMCs
- Stability (maximum ammonia loss in final product)
- Pathogen limits
- Pharmaceutical limits

Source separated faeces / dry toilets (5.1)

NMI conclude that there is no "significant trade potential" (art. 42). However, this is questionable, as the trade is significant for the innovative SME producers, and for companies developing or using dry toilet systems.

The company emphasised by stakeholders is composting the material to CMC3 requirements (in fact twice). However, the proposal is to not mix this into CMC3 compost (with other materials) but to process separately, to ensure safety and to produce a specific, identified, quality and value product.

Additional studies and information, not considered to date by NMI, have been submitted, see attached from P2Green and Valoo. Data has been generated by EU-funded projects as P2Green and ZirkulierBar.

ESPP suggests that this should be reevaluated by NMI taking into account information not considered to date, considering significance for innovative SMEs and targeted niche markets, and basing the safety assessment on the consideration that human excreta pose essentially the same risks (pathogens, pharmaceuticals) as manures (pathogens, veterinary pharmaceuticals) which are authorised under defined conditions to CMC3.

Recovered KCl

Please consider the following additional data on agronomic efficiency:
Nutrient Recovery Strategies and Agronomic Performance in Circular Farming: A Comprehensive Review
Edgardh-H-20260108.pdf

Joint input : Aquaminerals, Kemira, Wetsus, Fertiberia INCO

From: AquaMinerals BV (coordinator)

To: ESPP and other parties (CC)

Date: February 15th 2026

Subject: view on draft 2nd interim report “New material processes FPR draft for comments”, regarding Vivianite

Attached:

- Statement in response to the NMI assessment of vivianite as an iron and phosphate fertiliser
- Annex I- Summary of (additional) scientific references relevant to vivianite not considered in the NMI assessment
- Annex II- List of references

Dear Chris,

On your request of 6/2/2026, hereby we sent you our views on the draft 2nd interim report “New material processes FPR draft for comments”, regarding Vivianite, in the two attachments,

We kindly ask whether ESPP, as a member of the Commission Expert Group on Fertilising Products, would be willing to convey to the Commission that NMI will:

- reconsider the argument of NMI that for Iron micronutrient, the agronomic efficiency of vivianite cannot currently be ascertained;
- evaluate vivianite not only as an Iron micronutrient but also as a Phosphate fertilizer in the FPR, as the consortium supported extensive evidence.

The reason for our request is clarified in our attached statement. Amongst others the reason is that NMI has not taken all relevant references into account.

At your request we provided a list of sources and to what extend they have been sent to, and cited by NMI (and Huygens 2019), to our best effort.

With kindest regards

Jouke Boorsma

AquaMinerals BV (coordinator)

Wetsus

Kemira

1. Statement in response to the NMI assessment of vivianite as an iron and phosphate fertiliser

February 15th 2026

Authors: AquaMinerals, Wetsus, Kemira

1. Introduction and scope

The NMI has produced a draft Second Interim Report on the assessment of new materials under the FPR. For vivianite the report concludes that "the available scientific literature does not support the agronomic efficiency of vivianite at common rates of iron application". In our opinion this conclusion is based on (i) an incomplete consideration of the available scientific evidence and (ii) an agronomically inappropriate benchmark for "usual" iron application rates.

Further, it does not touch the topic of vivianite also being eligible in the FPR revision as phosphate fertilizer and simply refers to (Huygens 2019) that concluded that the phosphate fertilising value of iron containing phosphate fertilisers was uncertain. We have provided novel references post-dating this report that provide, in our opinion, reasons to reconsider the conclusion of Huygens 2019. This novel information has not been discussed nor considered in the NMI report.

In addition, several peer-reviewed and practice-oriented studies directly relevant to vivianite were not cited or assessed in the NMI report. Their omission materially affects the robustness of the conclusions and justifies a formal reconsideration.

In paragraphs 2 to 7 below we give a reaction to the NMI assessment on the effectiveness of using vivianite as an iron fertiliser. Paragraph 8 discusses the possible use of vivianite as a fertiliser. Phosphate. In annex I lists peer-reviewed and practice-oriented scientific studies are listed that are directly relevant to the agronomic efficiency of vivianite as an iron fertiliser and that were not cited or assessed in the NMI Draft Second Interim Report.

2. Misinterpretation of "usual" iron application rates

The NMI report benchmarks vivianite application rates against "usual Fe-fertiliser rates of 1–15 kg Fe ha^{-1}". This benchmark reflects only synthetic chelated iron fertilisers (e.g. Fe-EDDHA) and does not represent fertilisation practice with non-chelated iron sources, such as ferrous sulphate, which is authorised under Regulation (EU) 2019/1009.

Peer-reviewed agronomic literature shows that when ferrous sulphate ($FeSO_4$) is used to correct iron chlorosis—particularly on calcareous soils—application rates are substantially higher than chelated Fe rates, for example:

- In Mediterranean viticulture, Díaz et al. (2009) report the use of 500 g $FeSO_4·7H_2O$ per vine per year as the traditional grower practice against which vivianite and Fe-EDDHA were compared. This treatment represents iron sulphate inputs far exceeding the 1–15 kg Fe ha^{-1} range cited in the NMI report.
- In peer-reviewed field research on row crops, Godsey et al. (2003) identify ~80 kg $FeSO_4$ ha^{-1} as an effective soil/row application rate for correcting iron deficiency.

Accordingly, comparing vivianite application rates to chelated-iron benchmarks leads to a systematic underestimation of its agronomic relevance. When compared instead to authorised non-chelated iron fertilisers, the rates used in vivianite studies fall within a realistic and well-documented agronomic range.

The use of ironsulphate as a benchmark, rather than Fe-chelates, was already highlighted in the documents we provided on 30/4/2024 to NMI. Then we highlighted the potential replacement of ironsulphate by vivianite:

"*We expect that the estimated EU market for the use as micronutrient in calcareous soils such as Spain and Italy is at least to replace 15.000t FeSO4 (20-30% Fe). Vivianite 27% Fe. This is a rough estimate from a third-party expert judgement. The market for iron chelates such as FeEDDHA is not yet estimated in volumes*."

3. Persistence and reduced application frequency

An important agronomic characteristic of vivianite, insufficiently considered in the NMI report, is its high persistence in soil. Several studies (for instance but not limited to: Díaz et al., 2009, 2010; Iglesias et al., 1998) demonstrate that a single application can alleviate iron chlorosis for 3–5 years, meaning that annualised application rate comparisons are inappropriate. This persistence is agronomically advantageous and reduces both iron and phosphorus inputs over time. Iron-chelates are relatively soluble and therefore dosages have to be small but repeated regularly because of significant losses of the iron-chelate due to washing out effects, especially under field conditions. Therefore, a direct comparison between vivianite and iron chelate dosages should take multi-year persistence into account.

4. Relevance and limitations of pot experiments

The NMI report places disproportionate emphasis on pot experiments expressed as g vivianite kg^{-1} soil and extrapolates these directly to field-scale application rates. Such experiments are intended to study mechanisms and potential effectiveness, not to define agronomic recommendations. Direct extrapolation to annual field rates does not reflect agronomic practice and overlooks available field evidence that was also provided.

5. Relevant studies NOT cited in the NMI report (iron fertilizer)

The following peer-reviewed and practice-oriented studies were not cited or assessed in the NMI report, despite being directly relevant to the agronomic iron fertilising efficiency of vivianite and showing commercial relevant dosages in field experiments. The first two references are new references, the second two have been sent to NMI but were not discussed and cited.

- Díaz et al. (2009) – Grapevine: Multi-site, three-year field experiments across six Spanish wine regions showed that a single application of 250–375 g vivianite per vine significantly alleviated iron chlorosis for at least three years. Vivianite was as effective as $FeSO_4$ (traditional grower practice) or Fe-EDDHA, depending on site.
- Iglesias et al. (1998) – Pear: Orchard-scale, multi-year evidence showed that vivianite effectively prevented iron chlorosis with persistence up to 4–5 years, with agronomic performance comparable to Fe chelates under commercial conditions.

- Rombolà et al. (2003) – Kiwifruit: Greenhouse and field experiments demonstrated that a single autumn application of vivianite effectively prevented iron chlorosis. In the field trial, vivianite was effective whereas Fe-EDDHA was not, despite repeated applications.
- Ammari et al. (2009) – Citrus: Controlled pot experiments showed that vivianite applied at realistic per-plant doses prevented iron chlorosis and improved chlorophyll and growth, performing as effectively as Fe-EDDHA at equivalent Fe supply.

6. Phosphorus considerations (related to using vivianite as an iron fertilizer)

At agronomically relevant iron application rates (generally <600 kg vivianite ha^{-1} for most systems), the associated phosphorus input (<70 kg P ha^{-1}) is within normal fertilisation practice for perennial crops. There is no evidence in the reviewed literature that phosphorus input at these rates poses agronomic or environmental concerns beyond standard fertilisation management.

7. Market and commercial evidence

In addition to the scientific literature, long-term commercial use provides strong practical confirmation of vivianite's agronomic efficiency. The Spanish fertiliser manufacturer Fertiberia has used vivianite (commercially known as carbolita) for over 15 years as an iron source in compound NPK fertilisers for Mediterranean agriculture. The NMI report now states the vivianite has been used "for several years".

A representative product (NPK 17-8-10 with micronutrients) supplies 0.5 % Fe from vivianite, corresponding to only a few kilograms of Fe per hectare in normal use. This iron source has proven stable, effective, and persistent, has improved crop nutritional status, and has been well accepted by the market. This real-world experience further contradicts the conclusion that vivianite lacks demonstrated agronomic efficiency at realistic application rates.

8. Lacking review of vivianite as phosphate fertilizer

In the draft 2nd interim report "New material processes FPR draft for comments", NMI limits the scope of its agronomical review of vivianite of that of an Iron micronutrient. It does not touch the topic of vivianite also being eligible in the FPR revision as Phosphate fertilizer and simply refers to (Huygens 2019) that concluded that the phosphate fertilising value of iron containing phosphate fertilisers was uncertain. The consortium proposed vivianite specifically both as an iron micronutrient and as a phosphate fertilizer and has maintained this in communication with NMI throughout the process. Citing our proposal:

> *"Vivianite is a sustainable, slow-release phosphorus source that is particularly suitable for wet or reducing soils and long-term phosphorus management, while TSP remains better for rapid phosphate availability in conventional systems. Because vivianite can also supply iron, it can address both iron and phosphate needs. The cited publications indicate that, under conditions relevant to European soils, vivianite can function as a slow-release phosphate fertilizer and may help reduce phosphate leaching to groundwater, supporting Water Framework Directive objectives.*
>
> *Therefore, it is proposed that vivianite be eligible under the CE Fertilising Products Regulation both as an iron micronutrient and as a phosphate fertilizer, with clear boundaries for applications and soil conditions, leaving product formulation and validation to CE-marked market products."*

The consortium provided in various documents sent to NMI in April '24, March'25 and October '25, extensive documentation regarding the use as a phosphate fertilizer that provide novel insights compared to (Huygens 2019). This included 9 studies/reports on vivianite showing positive effects as a phosphate fertilizer in certain soil conditions (included in Annex II, section b).

9. Overall assessment and request for reconsideration

When the full body of available evidence is considered—peer-reviewed field studies, controlled experiments, long-term persistence data, peer-reviewed benchmarks for non-chelated iron fertilisers, and extensive commercial use—the conclusion that "the agronomic efficiency of vivianite cannot currently be ascertained" is not supported.

The NMI conclusion is primarily driven by:

- An inappropriate comparison with chelated-iron dosage benchmarks: a comparison with much higher typical dosages for iron sulphate is lacking and the multi-year persistence of the fertilising effect of vivianite compared to iron-chelates is neglected.
- the omission of several relevant and directly applicable studies that have been provided but are not taken into account.

Given these factors, there is a clear and justified basis for requesting that the NMI assessment and conclusions regarding vivianite be formally reconsidered, with:

- a clear distinction between chelated and non-chelated iron fertilisers,
- appropriate weighting of field-scale and multi-year evidence, and
- recognition of demonstrated agronomic performance under Mediterranean conditions.

Conclusion

We kindly ask whether ESPP, as a member of the Commission Expert Group on Fertilising Products, would be willing to convey to the Commission that NMI will:

- **reconsider of the argument of NMI that for Iron micronutrient, the agronomic efficiency of vivianite cannot currently be ascertained**

- **evaluate vivianite not only as an Iron micronutrient but also as a Phosphate fertilizer in the FPR, as the consortium supported extensive evidence.**

Annex I

(Additional) scientific references relevant to vivianite as iron fertilizer, not considered in the NMI assessment

Annex to the statement in response to the NMI assessment of vivianite as an iron fertiliser, February 15th 2026.

Purpose of this annex

This annex lists peer-reviewed and practice-oriented scientific studies that are directly relevant to the agronomic efficiency of vivianite as an iron fertiliser and that were not cited or assessed in the NMI Draft Second Interim Report. These references provide field-scale, multi-year, and crop-relevant evidence and therefore warrant reconsideration of the conclusions drawn in the report. In Annex II, section A, all sources are summarised in a table.

A. Peer-reviewed studies NOT cited in the NMI report (related to iron fertilizer)

1. Grapevine (field, multi-site, multi-year)

Díaz, I., Barrón, V., del Campillo, M. C., & Torrent, J. (2009). Vivianite (ferrous phosphate) alleviates iron chlorosis in grapevine. Vitis, 48(3), 107–113.

- Three-year field experiments conducted in six Spanish wine-growing regions.
- Vivianite applied once (250–375 g per vine) showed effectiveness for at least three years.
- Compared directly with $FeSO_4$ (traditional grower practice) and Fe-EDDHA.

2. Kiwifruit (field and greenhouse)

Rombolà, A. D., Toselli, M., Carpintero, J., Ammari, T., Quartieri, M., Torrent, J., & Marangoni, B. (2003), Prevention of iron-deficiency-induced chlorosis in kiwifruit (Actinidia deliciosa) through soil application of synthetic vivianite in a calcareous soil, Journal of Plant Nutrition, 26(10–11), 2031–2041, https://doi.org/10.1081/PLN-120024262

- Combined greenhouse and mature orchard field experiment.
- Single autumn application of vivianite prevented iron chlorosis; in the field, vivianite was effective whereas Fe-EDDHA was not.

3. Citrus (controlled agronomic experiment)

Ammari, T., Alaeddin, T., & Abu-Zahra, T. (2009), Management of iron deficiency stress in citrus through soil application of vivianite to a calcareous soil, International Journal of Botany, 5(2), 186–189.

- Controlled pot experiment on calcareous soil.
- Vivianite applied at realistic per-plant doses was as effective as Fe-EDDHA in correcting iron deficiency.

4. Pear (orchard-scale, multi-year, practice-oriented)

Iglesias, I., Dalmau, R., Marcé, X., del Campillo, M. C., Barrón, V., & Torrent, J. (1998), Diversos fosfatos de hierro presentan eficacia prolongada en la prevención de la clorosis férrica en peral (cv. 'Blanquilla'). Nutri-Fitos, 76, 76–87. (in Spanish)

- Orchard-scale experiments conducted under commercial conditions.
- Vivianite showed prolonged effectiveness (up to 4–5 years) comparable to Fe chelates at comparable dosing rates.

B. Reference on non-chelated iron fertiliser dosage (benchmarking)

Godsey, C. B., Schmidt, J. P., Schlegel, A. J., Taylor, R. K., Thompson, C. R., & Gehl, R. J. (2003). Correcting iron deficiency in corn with seed row–applied iron sulfate. Agronomy Journal, 95, 1600–1608.

- Field research identifying effective soil/row application rates of approximately 80 kg $FeSO_4$ ha^{-1}, demonstrating that non-chelated iron fertilisation operates at substantially higher dosage ranges than chelated Fe.

C. Reference already cited in the NMI report (not new)

Rosado, R., del Campillo, M. C., Martínez, M. A., Barrón, V., & Torrent, J. (2002). Long-term effectiveness of vivianite in reducing iron chlorosis in olive trees. Plant and Soil, 241, 139–144.

- Multi-year field evidence (3–5 years persistence).
- Already included in the NMI assessment; listed here for completeness.

Annex II
Reference list

Annex to the statement in response to the NMI assessment of vivianite as an iron fertiliser, February 15th 2026. The list provides all to be considered sources for the use as iron micronutrient (II a) and/or phosphate fertilizer (II b)

A. References on the use of Vivianite as iron micronutrient/fertilizer

Literature/articles and hyperlink	P /Fe	Year	Send to NMI	Cited by NMI in 2nd draft	Considered or not considered by JRC (2019)	Abstract
Technical proposals for selected new fertilising materials under the Fertilising Products Regulation (Regulation (EU) 2019/1009), Huygens et al,	P/Fe	2019	-	yes	Yes	5.3.4 Agronomic value of precipitated salts The objective for materials from the CMC precipitated phosphate salts & derivates is to supply plants with soluble phosphates as a macronutrient. Recovered Ca and Mg phosphate salts show generally good plant P-availability, with plant responses to fertilisation being similar to mined and synthetic P-fertilisers currently on the market (see Section 6.2.2). Some members of the STRUBIAS subgroup also formulated requests to include recovered Fe phosphates in this category, thus as CMC materials that can be incorporated into the EU fertilising product (e.g. KREPRO process). Aluminium and iron phosphates are, however, not registered as fertilisers pursuant to Regulation EC No 1907/2006 (REACH). The material properties of the ferric phosphates (24-29% Fe) obtained through the KREPRO process that were proposed as end materials to be included in this CMC showed high organic C contents (6-29%), low to moderate P contents (6.6-30.6%, expressed as P_2O_5), and molar Fe/P ratios in the range of 1.3-5.1. As only limited testing has been performed on these materials, their agronomic value remains uncertain due to concerns over the plant availability of Fe-complexed phosphates (Lindsay and De Ment, 1961; Ghosh et al., 1996; Wilfert et al., 2015). Kahiluoto et al. (2015) indicated good plant availability for sludges with moderate molar Fe/P ratios of 1.6, but not for materials with higher molar Fe/P ratios of 9.8. Moreover, if the P in Fe and Al phosphates were plant-available, there would be a substantial risk of the soluble aluminium or iron forms inducing plant toxicity as the liberation of P from such complexes involves a breakup of the chemical bonds, and thus the liberation of free Al and/or Fe in the soil solution. Both Fe and Al can be toxic if supplied in excessive concentrations to plants (Connolly and Guerinot, 2002). Hence, the direct use of Al and Fe phosphates as CMC materials is not desirable as (i) the agronomic value of such materials of a P source remains unknown, thus leading to a tangible risk for the accretion of P in the soil, and (ii) liberated phosphate counter-ions in the form of Al or Fe could cause potentially toxic plant effects. Therefore, the following criterion is proposed: Precipitated phosphate salts & derivates contained in the EU fertilising product shall have a maximum of 10% of the sum of elemental Al and elemental Fe of the dry matter content
Rombola et al, 2003, Prevention of Iron-Deficiency Induced Chlorosis in Kiwifruit (Actinidia deliciosa) Through Soil Application of Synthetic Vivianite in a Calcareous Soil, DOI: 10.1081/PLN-120024262	Fe	2003	30/4/25	No	No	In this study we have tested the hypothesis that lime-induced Fe deficiency chlorosis of kiwifruit may be prevented by the application of a synthetic iron(II)-phosphate analogous to the mineral vivianite [$(Fe_3(PO_4)_2 \cdot 8H_2O)$]. Two experiments, under greenhouse and field conditions, were performed. In the greenhouse, 1-year old micro propagated plants (Actinidia deliciosa, cv. Hayward), grown in 3-L pots on a calcareous soil, were treated in early autumn with soil-applied: (1) synthetic vivianite (1.35 g plant−1) and (2) Fe-EDDHA (24 mg Fe plant−1). The synthetic vivianite suspension, prepared by dissolving ferrous sulfate and mono-ammonium phosphate, was injected into the soil as a sole application whereas the Fe-EDDHA solution was applied four times at weekly intervals. The field experiment was conducted in a mature drip-irrigated kiwifruit orchard located on a calcareous soil in the Eastern Po Valley (Italy). Treatments were performed in early autumn by injecting synthetic vivianite (1.8 kg tree−1) and Fe-EDDHA (600 mg Fe tree−1) into four holes in the soil around each tree, at a depth of 25–30 cm. The Fe-chelate application was repeated at the same rate in the following spring. Untreated (control) plants were used in both experiments. Autumn-applied Fe fertilizers significantly prevented development of Fe chlorosis under greenhouse conditions whereas in the field only vivianite was effective. In conclusion, these 1-year results show that vivianite represents an effective alternative to soil-applied Fe chelates for preventing Fe chlorosis in kiwifruit orchards. • Combined greenhouse and mature orchard field experiment. • Single autumn application of vivianite prevented iron chlorosis; in the field, vivianite was effective whereas Fe-EDDHA was not.

Ammari, T., Alaeddin, T., & Abu-Zahra, T. (2009), Management of iron deficiency stress in citrus through soil application of vivianite to a calcareous soil, International Journal of Botany, 5(2), 186–189. DOI: 10.3923/ijb.2009.186.189	Fe	2009	14/2/26	No	No	Iron deficiency is a common abiotic stress in citrus trees grown on calcareous soils, where considerable reduction in yield is expected if not treated. In this study the effectiveness of synthetic vivianite [(Fe3(PO4)2.8H2O)] to prevent Fe chlorosis in citrumelo Swingle (Citrus paradisi Macf. x Poncirus trifoliata) a susceptible rootstock to Fe deficiency stress, was investigated. One-year old citrumelo plants were grown on calcareous soil-sand mixture under greenhouse conditions and treated with: (1) no Fe (as control); (2) 1.6 g FeEDDHA plant-1 (3) 5.4 g vivianite plant-1. Chlorophyll measurements were performed on the youngest fully expanded leaves in terms of SPAD index and at the end of the experiment leaf chlorophyll and Fe concentrations and growth vigor (young shoot dry weight) were determined. Vivianite was as effective as the FeEDDHA. Vivianite significantly prevented the development of Fe chlorosis. Chlorophyll concentration of plants treated with vivianite was significantly higher than those of control plants although vivianite-treated plants had almost equal leaf Fe concentration as control plants, vivianite significantly improved the vigor of citrus plants similar to the FeEDDHA compared to the control treatment. These results suggest that vivianite is an effective alternative to the environmental-unfriendly and expensive Fe-chelates for preventing Fe deficiency in citrus orchards. • Controlled pot experiment on calcareous soil. • Vivianite applied at realistic per-plant doses was as effective as Fe-EDDHA in correcting iron deficiency.
Díaz, I., Barrón, V., Del Campillo, M. C., & Torrent, J. (2009). Vivianite (ferrous phosphate) alleviates iron chlorosis in grapevine. Vitis, 48(3), 107-113.	Fe	2009	**NEW**	No	No	Synthetic vivianite [Fe 3 (PO 4) 2 ·8H 2 O] has been reported to alleviate iron (Fe) chlorosis in crops growing on calcareous soils. To test the effectiveness of vivianite in grapevine we carried out three-year (2003 to 2005) experiments in vineyards located in six different areas of Spain with Denomination of Origin (Rioja, Ribera del Duero, La Mancha, Montilla-Moriles, Condado de Huelva, and Jerez), which differed in grapevine root-stock/variety, climate, and soil properties. In all cases there was at least one treatment in which a suspension of vivianite was injected into the soil at the beginning of the experiment in spring, one control ("-Fe", no Fe fertilizer added) treatment, and one or more treatments with Fe chelate (FeEDDHA) or an Fe(II) salt applied yearly. The concentration of chlorophyll per unit leaf area was estimated with a portable chlorophyll meter (readings in SPAD units). The SPAD value and the trunk perimeter increment of the vines fertilized with vivianite were significantly higher than those of the control (-Fe) vines through the three years in all fields except the Jerez one. Vivianite was not significantly more effective than Fe-sulfate (in Rioja field) or Fe chelate (in La Mancha field). Our results suggest in summary that vivianite is effective in improving the Fe nutrition of vine and has a significant long-lasting effect of at least three years. This is ascribed to vivianite being incon-gruently dissolved to produce a poorly crystalline Fe oxide phase (lepidocrocite), which is considered to be a good source of Fe to plant. Vivianite is effective, readily prepared in the field, not easily leached from the soil, cheap, and environmentally safe, constituting thus an adequate Fe fertilizer for grapevine.
Iglesias, I., Dalmau, R., Marcé, X., del Campillo, M. C., Barrón, V., & Torrent, J. (1998), Diversos fosfatos de hierro presentan eficacia prolongada en la prevención de la clorosis férrica en peral (cv. 'Blanquilla'). Nutri-Fitos, 76, 76–87. (in Spanish)	Fe	1998	**NEW**	No	No	Various ferrous phosphates present a prolonged effectiveness in preventing iron chlorosis in pear tree (cv. Blanquilla). To study the effectiveness of ferrous phosphates in preventing iron chlorosis, suspensions of $Fe_3(PO_4)_2 \cdot 8H_2O$ (vivianite) and $FeNH_4PO_4 \cdot 6H_2O$ (ammonium ferrous phosphate) were injected in an iron chlorosis inducing soil, planted with pear trees (cv. Blanquilla). In the first three growing seasons, the leaf chlorophyll content of the treated trees was significantly higher than that of the untreated (control) trees and not significantly different from that of iron chelate-treated trees. The behaviour of the leaf color (CIE Lab* color space) was parallel to that of the chlorophyll content. In the fourth year (first production year), leaf chlorophyll content, blooming and fruit set in the treated trees were significantly higher than in the control but lower than in the iron chelate-treated trees. The average cumulative yield during fourth and fifth growing seasons for the treatments with ferrous phosphates ranged from 73 to 82 kg/tree, did not differ significantly from that of the trees treated with chelates (73 kg/tree) and was much higher than that of the control trees (34 kg/tree).
Fertiberia, 2025, agronomic value and market for vivianite as an Fe+P fertiliser in iron- deficient soils	Fe	2025	21/3/25	No	No	In a 35-day pot trial with cucumber (Cucumis sativus L.) in calcareous soil, vivianite was benchmarked against Fe-EDDHA and $FeCl_3$ plus a "0 Fe" control. Leaf greenness (SPAD) increased strongly with vivianite; at 1.0–1.5 g vivianite/kg soil, SPAD values were comparable to Fe-EDDHA. Biomass (total dry matter and root dry matter) improved with vivianite; 1.0 g/kg gave the highest total DM in the shown dataset, broadly matching or approaching Fe-EDDHA performance. Plant Fe uptake rose with increasing vivianite dose, reaching levels similar to Fe-EDDHA at the higher vivianite dosages (notably 1.0–1.5 g/kg). Overall conclusion on the slide: "Vivianite performed equal to Fe-EDDHA at 1 and 1.5 g/kg soil," while $FeCl_3$ performed clearly weaker than Fe-EDDHA on SPAD/Fe uptake.
Godsey, C. B., Schmidt, J. P., Schlegel, A. J., Taylor, R. K., Thompson, C. R., & Gehl, R. J. (2003). Correcting iron deficiency in corn with seed row–applied iron sulfate. Agronomy Journal, 95, 1600–1608. doi.org/10.2134/agronj2003.1600	Fe	2003	**NEW**	No	No	Corn (Zea mays L.) grown on calcareous, high-pH soils is susceptible to Fe deficiency, which can reduce grain yield by as much as 20%. The objective of this study was to evaluate several treatments of FeSO4 that could be used with precision-farming technologies to alleviate Fe deficiency in irrigated corn. Three sites in 1999 and four in 2000 were selected (based on a history of Fe deficiency) for small-plot (3 by 12.2 m) studies in western Kansas. In 1999, five treatments, including four rates of FeSO4·H2O (0–81 kg ha−1 product) applied in the seed row and one foliar treatment (chelated Fe), were evaluated. In 2000, two additional treatments, CaSO4·2H2O (85 kg ha−1 product) and liquid FeSO4·7H2O (91 kg ha−1 product) applied in the seed row, were included. Grain yield increased linearly with increasing rates of FeSO4·H2O at four of seven site-years, increasing 0.02 Mg ha−1 for each kilogram per hectare of FeSO4·H2O applied. Based on yield responses observed in this study, 81 kg ha−1 FeSO4·H2O was the most consistent treatment for correcting Fe deficiency in corn. If the average yield response

						obtained in this study can be achieved on 15% of an individual cornfield, the expected return would be $3.00 ha−1 for the entire field. Current precision-farming technologies allow application of FeSO4·H2O only to areas susceptible to Fe deficiency. Employing these technologies provides a practical solution to the spatial heterogeneity of Fe deficiency in irrigated corn and increases the probability of crop response to the fertilizer application.
Santiago et al, 2013, Effectiveness of mixtures of vivianite and organic materials in preventing iron chlorosis in strawberry	Fe	2013	30/4/25	Yes	No	Application of Fe salts with different organic matter sources has been demonstrated to be effective in preventing Fe deficiency chlorosis. The main objective of this work was to study the effectiveness of different Fe sources based on mixtures of humic substances or compost with vivianite in preventing this nutritional disorder in strawberry (Fragaria × ananassa cv Camarosa). To this end, a randomised block experiment involving four replications (3 plants per replication) and one factor (Fe source) was performed in a greenhouse using a calcareous growing medium. Iron sources studied were: (i) control without Fe, (ii) control with an effective Fe source in calcareous media (EDDHA-Fe, 0.1 g kg-1), (iii) vivianite (1 g kg-1 medium, which is the recommended rate), (iv) vivianite (1 g kg-1) + humic substances (HS 0.06 g kg-1), (v) vivianite (0.5 g kg-1) + HS (0.06 g kg-1) and (vi) a mixture of composted cork residue and vivianite at a 6:1 mass ratio (CORVIV) applied at a dose of 6 g kg-1 medium. All Fe sources were effective in increasing SPAD readings when compared with control without Fe. Treatments based on vivianite provided non-significantly different SPAD readings from that obtained with EDDHA-Fe. However, only CORVIV showed non-significantly different dry matter (DM) production, leaf area index, and total Fe content in the aerial part than EDDHA-Fe. Humic substances and vivianite at 1 g kg–1 increased DM yield in plants when compared with vivianite without HS, results with this last treatment being similar to those obtained with vivianite at 0.5 g kg–1 with HS. It can be concluded that studied sources of organic matter increased the efficiency of vivianite in preventing Fe chlorosis in strawberry, especially vivianite enriched cork compost which was as effective as EDDHA-Fe.
Rosado et al, 2002, Long-term effectiveness of vivianite in reducing iron chlorosis in olive trees	Fe	2002	30/4/25	Yes	No	Iron (Fe) chlorosis is common in olive (Olea europaea L.) trees growing on highly calcareous soils in Southern Spain, where generally causes reduction in yield, size and commercial value of the olives. The objective of this research was to study the effectiveness of synthetic vivianite (Fe3(PO4)2ċH2O) to reduce Fe chlorosis in olive. Experiments were established in three orchards with cultivars `Hojiblanco', `Manzanillo', and `Picual'. The design was a randomised block design with two or three treatments (control with no Fe fertiliser and vivianite at one or two rates). A vivianite suspension (0.05 kg dm−3 water) was injected into the soil at 10–20 points around the tree at the depth of maximum root density (25–35 cm). The rates (and times of application) were 0.5 and 1 kg tree−1 for `Hojiblanco' (March 1997), 1 kg tree−1 for `Manzanillo' (March 1998), and 2 kg tree−1 for `Picual' (March 1998). The leaf chlorophyll content index (CCI) was estimated on the youngest expanded leaves by means of a Minolta apparatus (SPAD units). The colour index of the olives was estimated by visual comparison with a scale ranging from 1 (pale yellow) to 8 (normal green). For the period studied (July 1997–November 1999), the CCI of fertilised trees was, in general, significantly higher than that of control trees, and so was the case with the olive colour index. Olive yield, measured in the experimental fields with `Hojiblanco' (in 1999) and `Manzanillo' (in 1998 and 1999), was higher for the fertilised than for the control trees but differences were only significant in 1999. These results suggest that vivianite is effective to reduce Fe chlorosis for more than two seasons. Such effectiveness is probably due to the poorly crystalline Fe(III) oxides (which are good sources of Fe to plants) that result from the slow oxidation and incongruent dissolution of vivianite.
Santiago et al, 2010, Interaction between beet vinasse and iron fertilisers in the prevention of iron deficiency in lupins	Fe	2010	30/4/25	Yes	No	Recycling of organic byproducts for use as soil amendments or fertilisers may enhance the productivity of soils. The aim of this study was to investigate the potential of sugar beet vinasse to correct iron chlorosis in crops when applied in conjunction with Fe fertilisers such as vivianite and ferrous sulfate (FS). An experiment involving two factors (Fe source and dialysed sugar beet vinasse (DBV) rate) was performed using white lupin (Lupinus albus L.) and calcareous sand as growing medium.Although vivianite provided lower chlorophyll contents than Fe-chelate, dry matter production was not significantly different between the two Fe sources. Vivianite was more effective than FS in preventing iron chlorosis in white lupin, but not when DBV was applied. DBV significantly increased chlorophyll content in plants treated with FS after 3 weeks of growth. Conclusion: DBV increased the effect of FS in preventing iron deficiency chlorosis in white lupin. This was due, at least in part, to the inhibition of the precipitation of Fe oxides by organic compounds and to the increase in the content of Fe complexed by organic compounds in the growing medium, as revealed by sequential Fe fractionation.
Caballero et al, 2009, Evaluation and correction of nutrient availability to Gerbera jamesonii H. Bolus in various compost-based growing media,	Fe	2009	30/4/25	Yes	No	Nutrient deficiencies usually constrain the use of some composted materials as peat-substitute growing media even if some fertilizer is applied to the media. In this work, we assessed the suitability of various composted materials as such or mixed with peat for potted plant production, with special emphasis on their effects on nutrient availability to plants. Further, we examined the effect of vivianite [Fe3(PO4)2·8H2O] as a fertilizer and its mixture with humic substances (HS) on these growing media (particularly their effectiveness in preventing Fe deficiency chlorosis in alkaline substrates). A completely randomized experiment design was developed involving the growth of gerber (Gerbera jamesonii H. Bolus) and two factors, namely (i) the growing medium, specifically composted cork residue (C), compost obtained from a mixture of olive husk and cotton gin trash mixed with rice hulls and peat in a 1:1:1 volume proportion (OH), composted grape marc (GM), Sphagnum peat mixed with spent mushroom compost (M), coconut fibre (CF), and Sphagnum peat; and (ii) the Fe source (control without Fe, Fe-EDDHA, vivianite and vivianite + HS in a weight ratio of 10:1). The highest chlorophyll meter readings were provided

						by the two media with the lowest pH (peat and CF), and the lowest readings were provided by the medium exhibiting the highest pH (C). Composted grape marc (GM) and M provided the largest amounts of dry matter (DM), whereas peat and M gave the highest flower yields. Flower and DM yield were lower in CF and C than those in other substrates; the low production in the former can be ascribed to Ca deficiency; in fact, the medium was poor in this nutrient; therefore, plants grown on it exhibited low Ca concentration in leaves. On the other hand, the low chlorophyll meter readings and DM yield in C can be largely ascribed to Fe deficiency chlorosis since the application of Fe improved both the parameters, the best results being obtained with the vivianite + HS mixture. Vivianite-based treatments increased P concentrations in leaves, but only in more acidic medium (CF and peat), where the pH of the media facilitated the dissolution of the product. The adverse effects of Fe sources on the Mn and Zn concentrations in leaves were as a result of the antagonistic effect of the Fe supply, which varied with the particular growing medium: Fe-chelate depressed Mn in plants grown on C, whereas vivianite + HS decreased the Mn concentration in plants grown on GM. The results obtained with the different compost-based materials studied and the ability to overcome Fe deficiency in C by using a vivianite + HS mixture are interesting with a view to reduce the use of peat in the potted plant industry.
Diaz et al, 2010, Testing the ability of vivianite to prevent iron deficiency in pot-grown grapevine ('Vivianite (ferrous phosphate) alleviates iron chlorosis in grapevine') doi.org/10.1016/j.scienta.2009.11.006	Fe	2010	30/4/25	Yes	No	Synthetic vivianite (ferrous phosphate octahydrate) has been reported to reduce the iron (Fe) deficiency symptoms in different crops growing on calcareous soils. We investigated the effectiveness of vivianite in grapevine by means of a 3-year (2002–2004) pot experiment with a Fe chlorosis-susceptible rootstock ('110 Richter') grown on a calcareous soil poor in available Fe. There was one treatment in which a suspension of vivianite was injected into the soil at the beginning of the experiment, one treatment with Fe chelate (FeEDDHA) applied yearly, one treatment with one initial application of both vivianite and FeEDDHA, and one control (no Fe fertilizer added) treatment. The concentration of chlorophyll per unit leaf area was estimated with a portable chlorophyll meter (readings in SPAD units). The vines fertilized with vivianite had longer shoots and higher number of leaves, and exhibited higher SPAD values than the control vines. The differences in SPAD value and pruning wood weight between the vines fertilized with Fe and the control were significant through the 3 years. There were no significant differences in SPAD value and pruning wood weight between the vines fertilized with Fe chelate and vivianite. Our results suggest in summary that vivianite is an interesting alternative to other Fe fertilizers used to prevent Fe chlorosis in grapevine judging by its effectiveness and long-term fertilizing effect. Moreover, it is not easily leached from the soil, easy to prepare, and environmentally safe.. • Three-year field experiments conducted in six Spanish wine-growing regions. • Vivianite applied once (250–375 g per vine) showed effectiveness for at least three years. • Compared directly with $FeSO_4$ (traditional grower practice) and Fe-EDDHA.
Ammari TG & Hattar B (2011). Effectiveness of Vivianite to Prevent Lime-Induced Iron Deficiency in Lemon Trees Grown on Highly Calcareous Soil. Communications in Soil Science and Plant Analysis 42 (21): 2586–93.	Fe	2011	-	Yes	No	The short-term effectiveness of three application rates of vivianite [(Fe3(PO4)2·8H2O)] in preventing lime-induced iron (Fe) chlorosis in Eureka lemon (Citrus lemon L.) cuttings grafted on sour orange (Citrus aurantium L.) was investigated and compared with the commonly applied iron ethylenediaminedi(o-hydroxyphenylacetic) acid (FeEDDHA). Treatments were suspension of vivianite injected into the soil at three rates (0.5, 1.0, and 2.0 g kg−1 soil), 417 mg FeEDDHA per plant, and untreated plants. Chlorophyll concentration index (CCI) of the youngest fully expanded leaves was estimated. Growth vigor and leaf Fe concentration were also measured. Vivianite, particularly at the greatest two rates, resulted in significantly greater growth vigor and leaf Fe concentration and exhibited greater CCI values compared to untreated plants similar to FeEDDHA. However, if excessive growth vigor is not favorable, the 0.5 g vivianite kg−1 soil is recommended for farmers. Vivianite is a potential environmentally safe alternative to the expensive FeEDDHA to prevent Fe chlorosis in lemon. - Synthetic vivianite at doses of 1 and 2 g kg-1 soil was more effective than Fe-EDDHA in preventing chlorosis and increasing growth. Their pot trial used calcareous soil collected from citrus orchards planted with Citrus lemon L grafted on Citrus aurantium L rootstocks.
Eynard et al, 1992, Use of vivianite (Fe3(PO4)2.8H2O) to prevent iron chlorosis in calcareous soils,	Fe	1992	30/4/25	Yes	No	For various reasons, iron phosphate might be effective in correcting Fe chlorosis in calcareous soils. To test this hypothesis, several pot experiments were conducted using an Fe chlorosis-sensitive chickpea (Cicer arietinum L.) cultivar cropped in soils to which partially oxidized vivianites (Fe3(PO4)2.8H2O) and Fe(III) phosphates with different characteristics had been added. Vivianites mixed with the soil at a rate of 1 g kg−1 were as effective in preventing chlorosis as Fe chelate (FeEDDHA). However, the effectiveness of Fe(III) phosphates was less, suggesting that the presence of Fe(II) in the phosphates used was a key factor in their Fe-supplying value to plants. The effectiveness of vivianites, however, seemed to be largely independent of their Fe(II) content. The future of vivianite as a Fe amendment will depend not only on economic considerations (production and application costs) but also on its long-term capacity to release plant-available Fe in soil environments.

B. References on the use of Vivianite as phosphate fertilizer

Literature/articles and hyperlink	P /Fe	Year	Send to NMI	Cited by NMI in 2nd draft	Considered or not considered by JRC (2019)	Abstract
Technical proposals for selected new fertilising materials under the Fertilising Products Regulation (Regulation (EU) 2019/1009), Huygens et al,	P	2019	-	yes	Yes	5.3.4 Agronomic value of precipitated salts The objective for materials from the CMC precipitated phosphate salts & derivates is to supply plants with soluble phosphates as a macronutrient. Recovered Ca and Mg phosphate salts show generally good plant P-availability, with plant responses to fertilisation being similar to mined and synthetic P-fertilisers currently on the market (see Section 6.2.2). Some members of the STRUBIAS subgroup also formulated requests to include recovered Fe phosphates in this category, thus as CMC materials that can be incorporated into the EU fertilising product (e.g. KREPRO process). Aluminium and iron phosphates are, however, not registered as fertilisers pursuant to Regulation EC No 1907/2006 (REACH). The material properties of the ferric phosphates (24-29% Fe) obtained through the KREPRO process that were proposed as end materials to be included in this CMC showed high organic C contents (6-29%), low to moderate P contents (6.6-30.6%, expressed as P2O5), and molar Fe/P ratios in the range of 1.3-5.1. As only limited testing has been performed on these materials, their agronomic value remains uncertain due to concerns over the plant availability of Fe-complexed phosphates (Lindsay and De Ment, 1961; Ghosh et al., 1996; Wilfert et al., 2015). Kahiluoto et al. (2015) indicated good plant availability for sludges with moderate molar Fe/P ratios of 1.6, but not for materials with higher molar Fe/P ratios of 9.8. Moreover, if the P in Fe and Al phosphates were plant-available, there would be a substantial risk of the soluble aluminium or iron forms inducing plant toxicity as the liberation of P from such complexes involves a breakup of the chemical bonds, and thus the liberation of free Al and/or Fe in the soil solution. Both Fe and Al can be toxic if supplied in excessive concentrations to plants (Connolly and Guerinot, 2002). Hence, the direct use of Al and Fe phosphates as CMC materials is not desirable as (i) the agronomic value of such materials of a P source remains unknown, thus leading to a tangible risk for the accretion of P in the soil, and (ii) liberated phosphate counter-ions in the form of Al or Fe could cause potentially toxic plant effects. Therefore, the following criterion is proposed: Precipitated phosphate salts & derivates contained in the EU fertilising product shall have a maximum of 10% of the sum of elemental Al and elemental Fe of the dry matter content
Phosphorus in Manure and Sewage Sludge More Recyclable than in Soluble Inorganic Fertilizer, H. Kahiluoto,*,† M. Kuisma,§ E. Ketoja,‡ T. Salo,‡ and J. Heikkinen‡	P	2015	-	No	Yes	Phosphorus (P) flow from deposits through agriculture to waterways leads to eutrophication and depletion of P reserves. Therefore, P must be recycled. Low and unpredictable plant availability of P in residues is considered to be a limiting factor for recycling. We identified the determinants for the plant-availability of P in agrifood residues. We quantified P in Italian ryegrass (Lolium multiflorum) and in field soil fractions with different plant availabilities of P as a response to manure and sewage sludge with a range of P capture and hygienization treatments. P was more available in manure and in sludge, when it was captured biologically or with a moderate iron (Fe)/P (1.6), than in NPK. Increasing rate of sludge impaired P recovery and high Fe/P (9.8) prevented it. Anaerobic digestion (AD) reduced plant-availability at relevant rates. The recovery of P was increased in AD manure via composting and in AD sludge via combined acid and oxidizer. P was not available to plants in the sludge hygienized with a high calcium/P. Contrary to assumed knowledge, the recyclability of P in appropriately treated residues can be better than in NPK. The prevention of P sorption in soil by organic substances in fertilizers critically enhances the recyclability of P.
Significantly enhanced P release from vivianite as a fertilizer in rhizospheric soil: Effects of citrate , Songying Yang , Xiaofan Yang , Changyong Zhang , Shaoyu Deng , Xinran Zhang, Yue Zhang , Xiang Cheng, 2022	P	2022	24/4/24	No	No	The use of vivianite (Fe3(PO4)2•8H2O) as a slow-release P fertilizer in agriculture could be a promising way for the utilization of the recovered vivianite products from sewage treatment systems but the efficiency of vivianite-P release in the rhizospheric soil was yet unclear. In this work the dissolution of vivianite was investigated under anoxic and aerobic conditions with the focus on the effects of citrate as a common organic matter in the rhizosphere by tracking the kinetics of P release and the variations of aqueous and solid phases. The results show that citrate effectively induced the dissolution of vivianite particles at pH 6 with simultaneous release of Fe and PO4–P. The enhancement of vivianite dissolution was positively correlated to the concentrations of citrate with complete dissolution observed when citrate was above 6 mM. Compared with anoxic conditions, aerobic conditions further enhanced the dissolution of vivianite to some extent, which could be partially attributed to the oxidation and removal of aqueous FeII in the solution that drove the equilibrium towards dissolution. In the presence of 2 mM citrate, the decrease in pH from 6.0 to 4.0 enhanced the vivianite-P release by 56.1%, indicating the pH dependence of the citrate-induced

						vivianite dissolution. This study has shown that the efficiency of P release from vivianite products as a fertilizer varies largely under different physico-chemical conditions in the rhizospheric microenvironment, which is critical for determining the dosage of vivianite for a specific soil.
Rates and Mechanism of Vivianite Dissolution under Anoxic Conditions, Rouven Metz, Naresh Kumar,* Walter D. C. Schenkeveld,* and Stephan M. Kraemer , 2023.	P	2023	24/4/24	No	No	The iron phosphate mineral vivianite Fe(II)3(PO4)2·8H2O has emerged as a potential renewable P source. Although the importance of vivianite as a potential P sink in the global P cycle had previously been recognized, a mechanistic understanding of vivianite dissolution at the molecular level, critical to its potential application, is still elusive. The potential of vivianite as a P sink or source in natural or engineered systems is directly dependent on its dissolution kinetics under environmentally relevant conditions. To understand the thermodynamic and kinetic controls on bioavailability, the oxidation and dissolution processes of vivianite must be disentangled. In this study, we conducted controlled batch and flow-through experiments to quantitatively determine the dissolution rates and mechanisms of vivianite under anoxic conditions as a function of pH and temperature. Our results demonstrate that vivianite solubility and dissolution rates strongly decreased with increasing solution pH. Dissolution was nonstoichiometric at alkaline pH (>7). The rapid initial dissolution rate of vivianite is related to the solution saturation state, indicating a thermodynamic rather than a kinetic control. A defect-driven dissolution mechanism is proposed. Dissolution kinetics over pH 5−9 could be described with a rate law with a single rate constant and a reaction order of 0.61 with respect to {H+}: 1.41·pH (0.2· G/RT) 4.7 −1·[1 e] The activation energy of vivianite dissolution proved low (Ea = 20.3 kJ mol), suggesting Rexp = 36.0·e hydrogen bridge dissociation as the rate-determining step.
Increasing phosphorus fertilizer value of recycled iron phosphates in strong P-fixing soils by prolonged flooding and organic matter addition, Rochelle Joie Saracanlao, 2022.	P	2022	24/4/24	No	No	Iron (Fe) minerals are commonly used to remove phosphorus (P) from waste streams, producing Ploaded Fe(III) oxides or Fe(II)P minerals (e.g. vivianite). These minerals may be used as fertilizers to enhance P circularity if solubilized in soil. Here, we tested the P fertilizer value of recycled iron phosphates (FePs) in a pot trial and in an incubation experiment, hypothesizing that P release from FePs is possible under Fe(III) reducing conditions. First, a pot trial was set up with rice (Oryza sativa) in all combinations of soil flooding or not, three P-deficient soils (acid,neutral, calcareous) and six FePs (three Fe(III) and three Fe(II)phosphates) referenced to triple superphosphate (TSP) or zero amendments. Shoot P uptake responded to TSP applications in all treatments but only marginally to FePs. The redox potential did not decrease below 200 mV by flooding for a brief period during the pot trial. A longer incubation experiment (60 days) was performed which included a treatment of glutamate addition to stimulate reductive conditions and P availability was assessed with CaCl2 extraction of soils. Glutamate addition and/or longer incubation lowered soil redox potential to <-100 mV. On the longer term, Fe(III) minerals released P and adequate P was reached in the calcareous soil and in the neutral soil amended with Fe(III)P-sludge. It can be concluded that prolonged soil flooding and organic matter (OM) addition can enhance the P fertilizer efficiency of FePs. Additional treatments showed that application of FeP in powder form may enhance P availability
Effect of applying vivianite and P-containing Fe(III)oxides on P bioavailability and dynamics in different agricultural soil types. Catholic university of Leuven, 2024, [published Q1 '24)	P	2024	24/4/24	No	No	*[opm. AquaMinerals: this study is expected to be published after April 29th 24, so we will sent the final publication in may/June '24)* Phosphorus (P) fertilizers play a vital role in sustaining crop production, yet their production and usage present significant global challenges, e.g. depletion of good quality phosphate rock and decline in surface water quality. One solution to both problems lies in capturing excess P using iron (Fe) minerals from liquid waste streams and recycling the trapped P, e.g. Fe(III) oxides with adsorbed/co-precipitated P or Fe(II)P minerals (e.g., vivianite), as P fertilizers. However, the efficacy of FeP fertilizers is hindered by low solubility and poor agronomic efficiency, particularly in aerobic conditions. In this work, it was hypothesized that the agronomic effectiveness of FePs can be improved if applied in flooded soil systems (paddy rice), where the reductive dissolution of Fe could allow P to be released from FePs. Yet, an initial pot trial did not confirm this hypothesis. The poor performance of FePs compared to triple superphosphate (TSP) as a P source was attributed to (i) their application of FePs as granules, which drastically reduced their already low P solubility, and (ii) a flooding period (13 d) that was not long enough to achieve reduced conditions. Hence, subsequently, the effect of the fertilizer's physical form (powdered, granulated) and water regimes (flooded, non-flooded) on the P fertilizer value of FePs in three soils was explored, hypothesizing that powdered forms of FePs will be more efficient than granular forms due to increased contact between soil and fertilizers. Fertilizer incubation experiments with flooded soils (120 d) confirmed that there is no P diffusion from granular FePs fertilizers into flooded soil, while, on the contrary, powdered FePs demonstrated an excellent increase in extractable P. It was also inferred from the incubation experiment that redox potential values needed for the onset of reduced conditions and, therefore, P release from FePs were achieved after about two weeks. As such, a rice pot trial was designed to identify the agronomic efficiency of FePs as compared to TSP in paddy rice, as affected by granular or powdered forms of fertilizers in acid and calcareous soil that were both flooded for a longer period than in the initial pot trial. The fertilizer value of FePs was remarkable when dosed as a powder, as it was even up to

						threefold higher than TSP in the acid soil and similar to TSP in the calcareous soil. These positive effects were attributed to (i) the presence of Fe-reducing conditions resulting in P release as a result of reductive dissolution of Fe minerals, (ii) the application of FePs as powders which highly increased its solubility due to increased soil-fertilizer contact, (iii) the synchronization between the P release from FePs and the P demand of rice. With this study, we have shown how FePs can be effectively utilized as a P fertilizer, highlighting their potential to close the P cycle by linking P recovery from waste streams with P reuse in agriculture.
Circular Economy Approach to Enhance Soil Fertility Based on Recovering Phosphorus from Wastewater, Tolulope Ayeyemi, Ramiro Recena,Ana María García-López, Antonio Delgado 2023	P	2023	24/4/24	No	No	Phosphorus (P) is a non-renewable resource whose future scarcity will constrain agricultural sustainability. Thus, to ensure this sustainability, a circular economy approach involving the use of recycled P sources is needed. The objective of this study was to assess the fertilizer effect of two recycled P products that can be obtained from water purification: vivianites and struvites. Five vivianites (one synthetic, one obtained from industrial process, and three from water purification) and two struvites (named A and B) from diverse origins were compared with soluble mineral P fertilizer (superphosphate) in a pot experiment using wheat at two P rates (50 and 100 mg P kg−1) in two Mediterranean soils. Struvites performed similarly to superphosphate and outperformed all types of vivianites in terms of dry matter (DM) yield and P uptake. Industrial and synthetic vivianites, led to higher DM yield and P uptake by plants than vivianites from water purification. Synthetic and industrial process vivianites increased Olsen P in soils after harvesting, relative to non-fertilized soils. Differences between vivianites can be explained by the different Fe2+ to Fe3+ ratios, the different crystal sizes, and morphology. Struvite B can replace 65–92% superphosphate on a P uptake basis, and 94–154% on a DM yield basis (the range depends on the P rate). Vivianite from industrial process can replace 54–75% of superphosphate on a DM basis, depending on the P rate. Thus, struvites were as efficient as superphosphate as P fertilizer. However, the results obtained with industrial process vivianite are promising with a view to its potential use in agriculture.
Kinetics of Phosphorus Release from Vivianite, Hydroxyapatite, and Bone CharCompounds Elisabeth Schütze, Stella Gypser, Dirk Freese,2020.	p	2020	24/4/24	No	No	The availability of P is often insufficient and limited by accumulation in soils. This led to the necessity of solutions for the recovery as well as recycling of secondary P resources. Batch experiments were conducted with CaCl2 and citric acid to characterize P release kinetics from vivianite, hydroxyapatite, and bone char. While the P release during the CaCl2 treatment was so low that only vivianite and hydroxyapatite showed a slightly higher release with increasing CaCl2 concentration, the increase of dissolved P was more pronounced for citric acid. The application of citric acid resulted in a 32,190-fold higher P release for bone char. Fourier-transform infrared spectroscopic data suggested higher instability of hydroxyapatite than for bone char. The kinetic data showed that bone char, especially at a lower particle size, had a higher long-term P release than hydroxyapatite or vivianite. The suitability of hydroxyapatite and bone char as a poorly soluble, but sustainable P source is better than that of vivianite. However, the efficiency as a P fertilizer is also dependent on present soil P mobilization processes. The results underline the importance of the accessibility of fertilized or naturally bound P for plant roots to benefit from the excretion of organic acids.
Phosphorus release from vivianite and hydroxyapatite by organic and inorganic compounds, Stella Gypser, Dirk Freese 2020	p	2020	24/4/24	no	No	Based on recent mining rates and the exhaustion of global phosphorus (P) reserves, there is a need to mobilize P already stored in soils, and its recovery from secondary resources such as Ca- and Fe-phosphates is important. The Ca-phosphate hydroxyapatite forms a good fertilizer source, while vivianite is formed in waterlogged soils and sediments. During sludge treatment, the formation of vivianite has been identified, being mainly Fe-phosphate. Long-term P release from both hydroxyapatite and vivianite was studied using different inorganic (CaCl2 and CaSO4) and organic (citric and humic acid) reagents during batch experiments. Reagents CaCl2 and CaSO4 represent the soil solution, while citric and humic acids as organic constituents affect P availability in the rhizosphere and during the process of humification. Additionally, the flow-through reactor (FTR) technique with an infinite sink was used to study the long-term P release kinetics. The cumulative P release was higher by organic acids than by inorganic compounds. The cumulative P release rates were higher in the FTR with CaCl2 as compared to the batch technique. The infinite sink application caused a continuously high concentration gradient between the solid and liquid phases, leading to higher desorption rates as compared to the batch technique. The predominant amount of the total P released over time was available for a short term. While inorganic anion exchange occurred at easily available binding sites, organic acids affected the more heavily available binding sites, which could be embedded within the mineral structure. The results showed that organic compounds, especially citric acid, play a superior role as compared to the inorganic constituents of the soil solution during the recovery of already stored P from the tertiary phosphates vivianite and hydroxyapatite.

Recycling of phosphorus from dredged lake sediment: Importance of iron-bound phosphates for plant growth, Haasler, S., Kragh, T., Magid, J., Gunnarsen, K. C., Müller-Stöver, D., Klamt, K. Krigstrup, U.G. Nielsen & Reitzel 2024 doi.org/10.1080/27658511.2024.2362503	P	2024	24/4/24	No	No	Phosphorus (P) is critical for food production. However, it has been managed unsustainably for decades and geopolitical challenges complicate its availability. While accessible P-rock deposits are linearly exploited, excessive fertilization practices lead to P loss from land to water, and thus, eutrophication. The release of legacy P from sediments to the water column, i.e., internal P loading, sustains global eutrophication issues. Sediment removal and its subsequent reuse as soil amendment can simultaneously lower internal P loadings and create a new P resource. However, the plant bioavailability of sedimentary P, especially Fe-P, is rather controversial. In this study, the direct P fertilizer effect of fresh lake sediment, lake sediment after Fe-P removal, amorphous Fe-P, and the reduced Fe-P mineral vivianite on barley was investigated and compared to the conventional mineral P fertilizer triple superphosphate (TSP). Fresh sediment, amorphous Fe-P, and vivianite fertilization significantly increased biomass and P uptake compared to the 0-control, while the Fe-P removal from the sediment reduced both effects. The P use efficiency was generally lower than for TSP and decreased in the order amorphous Fe-P > fresh sediment > vivianite > sediment after Fe- P removal. In a parallel soil incubation without barley growth P diffusion from the tested alternative substrates was not observed. We conclude that fresh lake sediment has P fertilizer potential with amorphous Fe-P as a significant contributor. Further, fertilization with fresh sediment and Fe-P can increase soil adsorptive capacities potentially reducing leaching but also creating dependency of plant P bioavailability on plant-soil interactive mechanisms.
Assessing microbially mediated vivianite as a novel phosphorus and iron fertilizer , Lordina Ekua Eshun, Ana Maria García-López, Ramiro Recena Victoria Coker, Samuel Shaw, Jonathan Lloyd and Antonio Delgado, 2024	P	2024	24/4/24	Yes	No	Microorganisms can transform phosphorus (P)-enriched iron (Fe)-oxide sludge into products with higher P concentration or can directly promote the precipitation of P-rich compounds from water. However, there is no evidence of these products' efficiency as fertilizers. This study aimed to assess the effectiveness of microbially mediated vivianite (biovivianite) as P and Fe fertilizer for durum wheat and white lupin, respectively.. To this end, two completely randomized block experiments were conducted with wheat (phosphorus (P) experiment) and white lupin (iron (Fe) experiment). The P and Fe sources used included biovivianite produced by microbial reduction of P-containing ferrihydrite at pH 6.5 (VivInsol6.5) and pH 7.0 (VivInsol7.0), biovivianite produced with soluble Fe(III) citrate (C6H5FeO7) in the presence of soluble phosphate at pH 7 (VivSol), and vivianite from a commercial company (ComViv). Potassium dihydrogen phosphate (KH2PO4) was used as a reference fertilizer in the P experiment, and Fe-EDDHA and Fe(II)-sulfate (FeSO4.7H2O) were used in the Fe experiment. Total P uptake by wheat plants from the product dominated by vivianite and phosphate-green rust (VivSol) was not significantly different from KH2PO4. The relative P use efficiency, i.e., the equivalence in terms of P recovery of VivSol was 74% of KH2PO4, making VivSol the effective P source for durum wheat among the products tested (aside from KH2PO4). For Fe uptake, product dominated by vivianite and metavivianite (VivInsol7.0), was the most effective Fe source for white lupin followed by Fe-EDDHA, ComViv, and VivSol with VivInsol6.5 as the least effective but without significant differences with Fe(II)-sulfate. The average crystallite sizes of the biovivianite were 59 nm, 63 nm, and 66 nm for VivSol, VivInsol7.0, and VivInsol6.5, respectively. Concluded: The mineral constituents of the biovivianite coupled with their nano-crystallite sizes explained its effectiveness as P and Fe fertilizers. The results reveal that biovivianite production is a novel way of producing efficient P and Fe fertilizers from P-enriched Fe sludge or P-rich water. Thus, it can be used for producing fertilizers with high P and Fe concentrations from water purification, providing new tools for a circular economy approach in the use of a non-renewable resource such as P. • Vivianite is a sink for phosphorus (P), a scarce and non-renewable resource. • Microbially mediated vivianite (biovivianite) was tested as P and Fe fertilizer on wheat and lupin. • Biovivianite could replace soluble P (KH2PO4) by 74% as a P fertilizer for wheat. • Biovivianite was a more efficient P source than chemically synthesized vivianite. • The nano-crystallite size and mineral phases of biovivianite influenced its efficiency as P and Fe fertilizer.

BCE input on draft 2nd NMI interim report – 6/2/2026

"*Technical study to support the inclusion of new materials and processes under the Fertilising Products Regulation (FPR)"*

*Studies **NOT** in GREEN were **NOT** mentioned in the NMI 2nd report 1st draft as circulated.*

The second NMI interim report raised the following questions about the possible inclusion of sewage sludge Biochar in CMC14:

1. *There is no consensus on what acceptable PFAS concentrations are in soil, water, or fertilisers. Therefore, an acceptable contaminant load cannot be determined.*
2. *Pyrolysis at temperatures > 600 °C did not consistently result in full elimination of PFAS. As the PFAS are forever chemicals, application can lead to build up of these chemicals in the soil.,*
3. *Not all process parameters that affect the presence of PFAS in the final material seem to be fully understood. Besides the high temperature, parameters such as residence time or the presence of a carrier gas seem to affect PFAS concentrations.*

The fact that there might be no consensus on what acceptable concentrations in fertilizers might be is not a reasonable argument against biochar. It is widely known that soils, drinking water, most accepted organic fertilizers, … contain PFAS without their use in agriculture beeing in question. International research groups worldwide have shown that Biochar produced with a sufficient temperature and residence time in contrast to other organic fertilizing products contains almost no PFAS with reduction rates of >99% compared to the used sludges. In some EU-countries there are already limits in place for example Austria Düngemittelverordnung 2004, BGBl. II Nr. 100/2004, limits were established in 2010 for PFOA and PFOS: 0,1 mg/kg DM in fertilizers measured according to DIN 38414-14:2011.

The thermochemical decomposition of the components through high temperature and sufficient residence time is clearly evident and proven for all previously known organic contaminants using all globally recognized measurement methods. The probability of finding a previously unknown contaminant that is not destroyed is similarly low as with direct combustion.

The 2024 and 2025 BCE (Biochar Europe: The European Biochar Industry Consortium) Position Paper on Sewage Sludge Biochar concludes that biochar derived from sewage sludge should be classified under the Component Material Category 14, with a thermochemical conversion process requirement that should occur under oxygen-limiting conditions at **temperatures >600°C for a minimum duration >10 min**. Such additional process conditions would secure the safety of biochar from sewage sludge use in agriculture.

The effectiveness of pyrolyses on the removal of PFAS is conclusive.

Pyrolysis emerges as a potent method for eradicating pollutants inherent in diverse organic waste materials while contributing to climate goals as IPCC Negative Emission Technology. **[16]**

Recent scientific research underscores its efficacy in tackling a wide array of contaminants typically found in sewage sludges **especially per- and polyfluoroalkyl substances (PFAS).**

PFAS are eliminated from the biochar bythe process of pyrolysis. Kundu et al. (2021) found that > 90 % of PFOS and PFOA in sewage sludge were destroyed in a pyrolysis-combustion integrated process**. [1]**

Evidence from the US EPA Office of Research and Development (2021) carried out on the US-based company Bioforcetech’s commercially installed pyrolysis plant manufactured by PYREG shows that pyrolysis at 600°C for 10 minutes and combustion of pyrolysis gases at 850°C eliminate PFAS from sewage sludge. Bioforcetech (2021) has reported 38 PFAS compounds that were all kept at or removed to below detection limit in the biochar in their pyrolysis and pyrolysis gas burning process. **[2] [3]**

At the Fårevejle wastewater treatment plant in Denmark, sewage sludge pyrolysis at a temperature of 600-650°C and a residence time of more than 3 minutes, with subsequent incineration of the pyrolysis gas at 850°C for more than 2 seconds, has showed to eliminate all 7 PFAS compounds, previously detected in the sewage sludge, from the biochar. This experiment has been reproduced several times and showed how all PFAS detected in the sludge were eliminated (to below detection limit of target molecules) both in the biochar and in the flue gas. **[4]**

Sørmo et al. , 2023 studied decomposition and emission factors of a wide range of PFAS during full-scale pyrolysis of wastes, including 4 sewage sludges.
Concentrations of PFASs in the biochar samples were 1–3 orders of magnitude less than the concentrations in the original feedstocks, achieving removal efficiency higher than 96 % when pyrolyzed at 500 °C and higher than 98 % when pyrolyzed at 700 °C and higher.
Authors state “Considering the results from the present and previous studies, pyrolysis of

contaminated organic waste should be operated at a minimum of 600 °C in order to properly decompose PFAS and other organiccontaminants to non-detectable levels." **[5]**

Burning the pyrolysis gas destroys PFAS potentially present in the pyrolysis gas. A 2023 study carried out by US-EPA showed that the influents into the incinerator were analyzed for PFAS and compared to emissions (gaseous, liquid and solids) PFAS content to determine the PFAS destruction. Along with measuring the PFAS in the gas phase emissions with Other Test method (OTM)-45, the emissions were also characterized for fluorinated products of incomplete destructions (PIDs) using OTM-50 and Method 0010/8270. To help evaluate the performance of the HWI, C2F6 was injected and measured using Fourier transform infrared spectroscopy (FTIR) and OTM-50. It was found that most of the PFAS that were a a high enough concentration in the influent to effectively calculate were better than 99.999% destroyed. Along with the high destruction, no PIDs were observed. This indicates that most (over 99%) of the compounds were completely destroyed, or mineralized. **[6]**

2025 Moško and Gerber studied the effect of pyrolysis temperature and residence time on the properties of sludge biochar, including organic pollutants such as PAHs, PCBs, **and 53 different PFASs**. The pyrolysis was performed in a screw type reactor PYREKA at target temperatures 500, 600, and 700 °C and residence times 5, 10, and 15 minutes. The study, yet in plan to be published, revealed that when pyrolysing for 5 minutes at minimum 600°C, and 10 and 15 minutes at minimum 500°C, the studied PFASs **were below detection limit.** The results from combination of 500°C and 5 minutes revealed detection of PFOS 3, thought it was below the limit of quantification, other studied compounds were below the detection limit. **[7]**

In the study (McNamara et al., 2023) pyrolysis removed more than 99 % of targeted PFAS and PFAS precursor compounds from the solid phase during pyrolysis of biosolids at 500, 650 and 800 °C. The treatment (drying and carbonization) of contaminated sewage sludge was conducted with a PYREG pyrolysis unit, no reportable PFAS were found in produced biochar of the treated sewage sludge. Of the four studied innovative technologies to eliminate the PFAS problem, pyrolysis of sewage sludge was the only one achieving a TRL of 7 (operational environment). **[8]**

Bioforcetech and the Environmental Protection Agency (EPA) in the USA have shown PFAS degradation to non-detectable levels in both biochar flue gas and scrubber water emissions with pyrolysis at 600 °C for 20 minutes and subsequent thermal oxidation at 850 °C at a full-scale pyrolysis plant in California, USA. For the flue gas FTIR, analysis was performed to detect 18 C1-C8 PFAS components, showing all content values below detection limit. **[9][10]**

Bamdad, H.; Papari, S.; Moreside, E.; Berruti, F. High-Temperature Pyrolysis for Elimination of Per- and Polyfluoroalkyl Substances (PFAS) from Biosolids. Processes 2022, 10, 2187. https://doi.org/10.3390/pr10112187 Citation: “Biosolid samples were pyrolyzed at two different temperatures, 500 and 700 °C, in a continuous benchscale pyrolysis unit. The major finding is that the treatment process at higher pyrolysis temperatures can remarkably reduce or eliminate the level of PFAS (by ~97–100 wt%) in the resulting biochar samples.” **[11]**

Hušek, M., Semerád, J., Skoblia, S. et al. have 2024 shown removal of per- and polyfluoroalkyl substances and organic fluorine from sewage sludge and sea sand by pyrolysis. *“Based on our analyses, we determined that a temperature greater than 400 ° C is imperative for effective PFASs and organic fluorine removal. The results were verified by analyzing samples from a commercial sludge pyrolysis unit at the Bohuslavice-Trutnov WWTP, which confirmed our measurements. In light of these results, it becomes evident that sludge pyrolysis below 400 ° C is unsuitable for PFAS removal from sewage sludge.”* **[12]**

Arturo A. Keller, Weiwei Li, Yuki Floyd, James Bae, Kayla Marie Clemens, Eleanor Thomas, Ziwei Han, Adeyemi S. Adeleye, have shown in 2024
Elimination of microplastics, PFAS, and PPCPs from biosolids via pyrolysis to produce Biochar. *“Pyrolysis eliminates >99 % of PFAS microplastics and PPCPs from biosolids. Pyrolysis can generate revenue for wastewater treatment plant. “* **[13]**

SUEZ lab trials 2025 Sid Ahmed KESSAS, Helen Coarita Fernandez, Hugues Vanden Bossche: “Regarding the PFAS, PFOS was identified as the most prevalent substance in dried sludge. Between 11 and 29 µg/kg of PFAS was detected in the dry sewage sludge. The pyrolysis of the 6 samples of dried sludge at 600°C and with a solid residence time between 15- and 20-minutes leads to the production of a biochar completely free of the micropollutants analyzed and detected in the raw sludge in this study” **[14]**

SUEZ industrial scale trials 2025 at WWTP Kleve/Germany.
Sid Ahmed Kessas et. al.: All Solid flows: Sludge, Biochar and Exhaust gas bag filter dust were analyzed in two different laboratories, ALS France & Eurofins Germany. The focus was on 50 different PFAS compounds.
16 PFAs compounds detected in sludge: PFHxA; PFOA; PFNA, PFOS, PFDA; PFUnDA, PFDoDA; H4PFDS, 8:2 FTS; 10:2 FTS; N-MeFOSAA ; N-EtFOSAA; PFOSA ; 5:3 FTCA ; 7:3 FTCA; PFTeDA; 6:2 FTS.

No PFAS compounds were detected in the Biochar at pyrolysis temperature 600°C and 10 min retention time. **[15]**

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De: Anita Beblek <anita.beblek@agrathaer.de>
Envoyé: jeudi 12 février 2026 13:21
À: info@phosphorusplatform.eu
Objet: AW: Proposals to include or not new materials into the EU Fertilising Products Regulation (FPR)
Pièces jointes: P2G GE NMI answer_03022026.pdf; Attachement 1.pdf

Dear Chris,

thanks for the possibility to give feedback.
As P2GreeN we have been in direct contact with NMI over the last couple of months and we share your assessment regarding NMIs approach especially in terms of "inadequate data".
For our P2GreeN fertilisers we have submitted a lot of information and especially data to NMI which was partially considered (for 2 fertilisers) and partially not (for the humus fertiliser) without a clear rationale why some information was considered and other not. This led to NMI concluding that Aurin and Granurin from vunanexus and S360 should be considered as new CMCs whilst humus fertiliser from human f excreta should not be included as new input for an existing CMC due to inadequate data and no market potential.
We have now submitted to NMI a detailed dossier which I attach to my email.
Feel free to also use our legal & regulatory arguments for the general feedback from ESPP to NMI. And as this is important from our side we would ask you to reconsider your assessment that you agree with NMI that for humus fertiliser from human faeces there is inadequate data and no market for it.

Kind regards

Anita Beblek | Geschäftsführerin

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agrathaer
PROJEKTTRÄGER
im Auftrag des Ministeriums für Land- und Ernährungswirtschaft, Umwelt und Verbraucherschutz des Landes Brandenburg

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Von: ESPP <info@phosphorusplatform.eu>
Gesendet: Donnerstag, 5. Februar 2026 23:19
An: ESPP <info@phosphorusplatform.eu>
Betreff: Proposals to include or not new materials into the EU Fertilising Products Regulation (FPR)

Dear all,

Members of the EU Fertilisers Expert Group received 27 January (end afternoon) the draft 2nd report from NMI proposing which materials/processes from those submitted in the EU 2022 survey should be included into the EU FPR, and for some proposing criteria wording.
Our input on this 180 page document was requested for Friday 6th February. We have, in agreement with several industry federations, requested an extension of this deadline, which we consider unreasonable for a report including proposed technical wordings and which is underway for nearly three years. To date we do not have an answer regarding extension of the comments deadline, but clearly we are NOT ready to submit comments by tomorrow.

The report is available here https://circabc.europa.eu/ui/group/36ec94c7-575b-44dc-a6e9-4ace02907f2f/library/85bea61b-6eca-4717-9370-78766d1147f8/details

I have spent some time going through the proposals in this report and attach a summary of its conclusions (as I understand them), for each material/process considered. I wanted to do this rather than simply sending you the report and saying “good luck with that by next week”.

My analysis suggests:

- As in the first interim report, many materials/processes rejected because of “inadequate data”, often despite the final material being well known (potassium chloride), despite input from industry, and despite EU-funded projects which have generated data (conclusions, such projects are a waste of public money ?)

- This illustrates the fundamental problem that there are no clear criteria as to what data are sufficient to admit a new material/process, so it is very frustrating to submit data which are rejected as inadequate, without knowing what is actually needed

- A number of materials/processes submitted by ESPP in 2022 are simply not considered – with no explanation – despite our previously raising these points

- The proposed criteria wordings from NMI are generally very restrictive, for no clear reason – so are not technology neutral, not open to innovation, and are often unclear (CMCs become inputs to reactions …) or rely on legal interpretations which we consider dubious

Please look in detail at the (generally few) pages of the draft report concerning for materials/processes of interest to you and **send to me by 15th February**

- **Any comments or corrections to my attached summary table**
- **For materials/processes which conclude “inadequate data”, any studies or other data references which you consider are relevant and are NOT considered in the report**
- **Any other input, comments or proposals**

Thanks in advance

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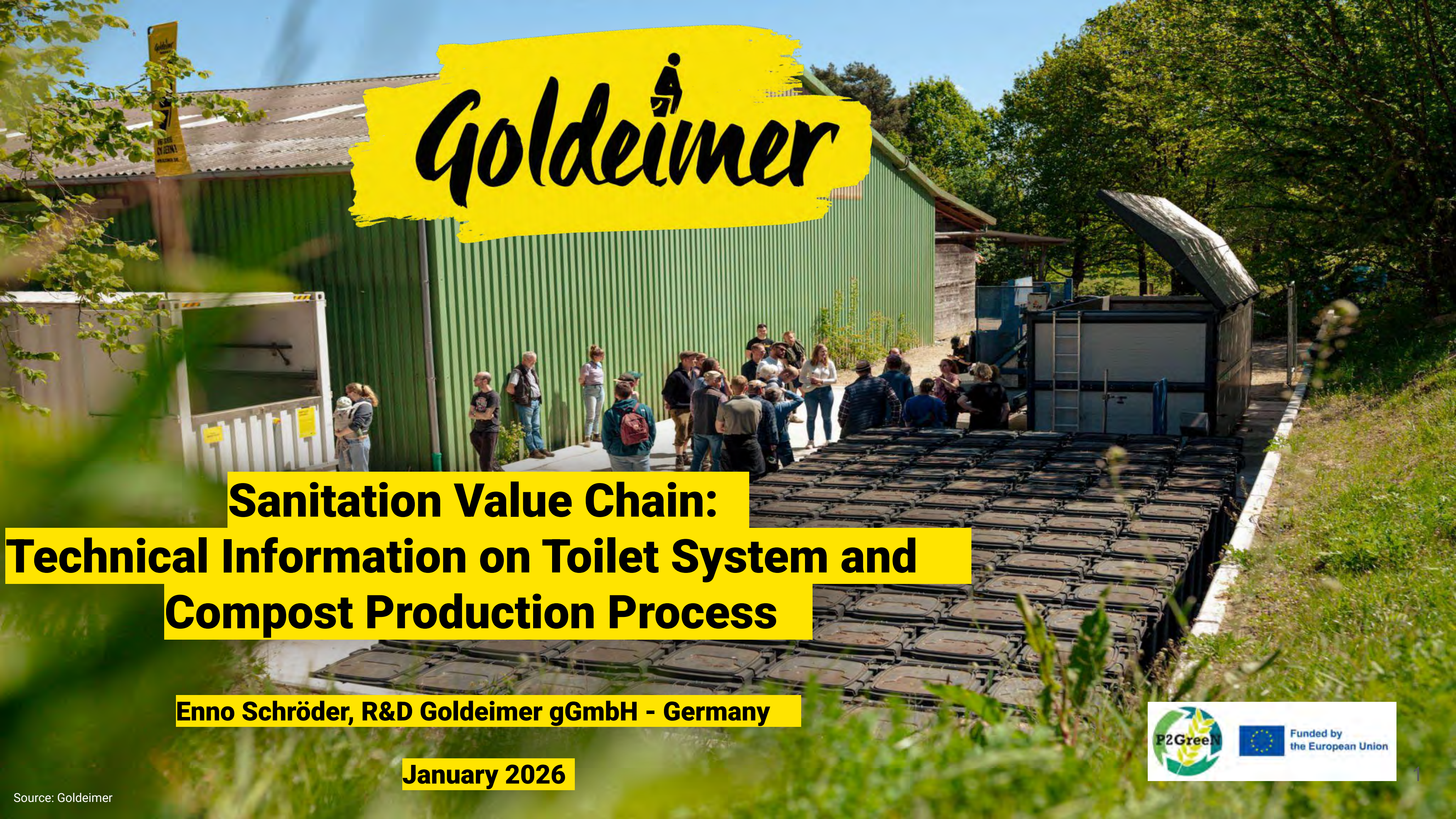

Goldeimer

Sanitation Value Chain: Technical Information on Toilet System and Compost Production Process

Enno Schröder, R&D Goldeimer gGmbH - Germany

January 2026

P2GreeN
Funded by the European Union

Source: Goldeimer

Structure

- Definition of Container based Sanitation
- Toilet - Flat packing model
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Definition of Container based Sanitation

- The Goldeimer sanitation system follows the logic of a **Container-Based Sanitation System**.
- **Definition**: "*Container-based sanitation (CBS) consists of an end-to-end service in which excreta are hygienically collected in sealable, removable containers (also called cartridges) at the user interface and then transported to treatment facilities where they are safely disposed of or converted into various resources.*" (World Bank. 2019. Evaluating the Potential of Container-Based Sanitation.)
- **Relevance**: "*…nearly half (46%) of the world's population is not connected to a sewer, and that number is increasing twice as fast as the population with connections.*" (Strande, L. Integrating recent scientific advances to enhance non-sewered sanitation in urban areas. *Nature Water* 2, 405–418 (2024).

WATER GLOBAL PRACTICE

Evaluating the Potential of

Container-Based Sanitation

WORLD BANK GROUP

nature water

Review article

Integrating recent scientific advances to enhance non-sewered sanitation in urban areas

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Check for updates

Linda Strande

Half of the world's population is now served by non-sewered sanitation, yet the field remains fragmented, with a focus on individual research agendas, and prevalence of imprecise terminology that hinders scientific learnings and leads to misconceptions. The field is at a decisive juncture, with scientific knowledge taking off that holds the potential to fulfil the urgent need for inclusive sanitation in a rapidly urbanizing world. In this critical Review, relevant and diverse research results are assembled with findings translated to one consistent terminology, to provide scientific evidence to draw out interlinkages and learnings, debunk common misconceptions and identify key research needs. Properties of non-sewered wastewater are highly variable, and degradation during storage has a direct impact on greenhouse gas emissions and downstream treatment processes, which facilitate different resource recovery. New technologies and wastewater-based epidemiology can help to address the lack of monitoring. The findings are presented by wastewater properties, biological processes during storage, treatment processes and monitoring.

Toilet - Flat packing model

- Flexible system. Built up and take down by own staff - without need for external machinery (fork lift / crane)
- 12 Toilets fit on one 3,5 t trailer
- 6 hours for built up and ready to use

Toilet - 20 Ft container model

- 12 toilet cabins integrated in one container
- Innovative slide-out system
- Energy autarky
- Higher user comfort
- 2 h to position and ready to use
- Less flexibility due to dependence on truck/crane

Toilet - Functional principle

- The toilets are classified as **Urine Diverting Dry Toilets (UDDT)**
- The toilet seat is standard - without urine diversion option. (= robust event option)
- Urine diversion takes place at later stage at the bottom of the collection container (next slide)
- The collection container is located underneath the toilet seat (see logo print)
- After using the toilet, a dose of litter (straw cuttings) are added. Aim: Cover excreta Functions: odour prevention, no flies, composting additive

Toilet - The dry toilet contents

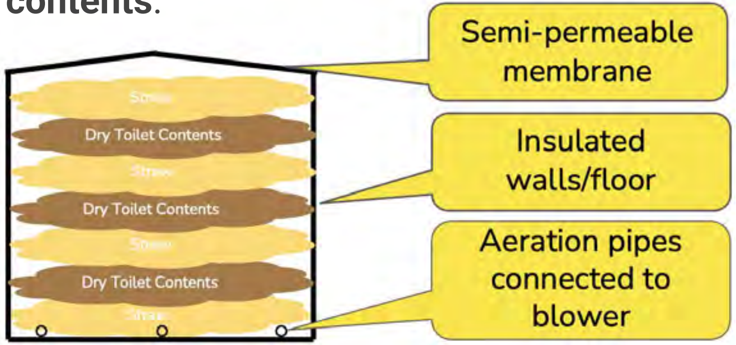
- The content of the collection containers can be described as follows:
    - **50 % volume of straw cuttings**
    - **20 % volume of faeces**
    - **20 % volume toilet paper**
    - **10 % volume of straw**
- Excess **urine is drained out of the containers via a “plug and play” piping system and collected separately in IBCs** for i.e. further processing i.e. using the Aurin recycling technology by VUNANEXUS.

Toilet - The collection containers

- Regardless of the toilet model (previous slides): **Goldeimer uses the same collection containers for faeces.**
- Standardised 200 l containers with wheels, designed to contain liquids/sludgy materials
- Lid can be closed and snap-locked
- Seal prevents liquids / odours to escape - even in case of falling over
- Spherical base enabling easy and hygienic cleaning on Goldeimer’s container washing facility.

The Composting Process - Delivery and filling of Sanitisation Container

- The collection containers are delivered to the composting facility by articulated trucks
- Containers are then filled into Sanitisation Container (CSC - Compost Systems)
- The **highest temperatures** reached during sanitisation are achieved through **alternating layers of straw and dry toilet contents**.



Cross section through filled Sanitisation Container

The Composting Process - Collection container washing

- After emptying, the collection containers are thoroughly washed with a dedicated container washing facility (Feistmantl Cleaning Systems)
- The inside of the container is cleaned with an automatic high-pressure nozzle that rotates 360°.
- The less polluted outside is cleaned simultaneously with manual high pressure spray lance.
- After being cleaned, collection containers are returned to other events or off-grid locations for further collection of dry toilet contents.

Goldeimer

The Composting Process - Sanitisation (step 1)

- To log temperature of the **sanitisation batch**, sensor is placed in Sanitisation Container (slide 9)
- Sanitisation begins when container is filled up by activating the blower unit
- Oxygen rich air is blown into Sanitisation Container via pipes (see diagram on slide 9)
- **Hence, temperature rises due to optimised microbiological activity and reaches up to 65 °C (threshold line) for at least 5 days according to FPR CMC 3 and German BioAbfV.**
- **Temperature-time profile is logged in cloud**

Von
22.6.2025

Bis
16.8.2025

Chart Profile
COMPOtainer_3

The Composting Process - Loading of Composting Container

- After the sanitisation process, the hygienised contents of the Sanitisation Container are emptied on an **concrete slab to prevent groundwater pollution**.
- The **Composting Container** ([Earth Flow - Compost Systems]) now receives biomass on a **continuous basis**.
- The following mixture of biomass and additives produces stable composting conditions:
    - **Approx. 10 % by volume of Biochar (EBC certified)**
    - **45 % by volume of hygienised dry toilet contents**
    - **45 % by volume of shredded green waste**
    - **Less than 1 % by volume of bentonite**

The Composting Process - Composting (step 2)

- Same as in step 1 (Sanitisation Container) the **walls and floor of the Composting Container are insulated and an active aeration system provides oxygen for improved microbial activity**.
- Additionally, the **mixing device homogenises the contents of the Composting Container at preset times + improving aeration**
- Also in this second step **temperature-time profiles as layed out in FPR CMC 3 and German BioAbfV are achieved.**
- The **Composting (step 2)** takes **8 to 12 weeks** - depending on the frequency of loading in of fresh biomass.

The Composting Process - Emptying of Composting container, screening and lab testing.

- After finalisation of the Composting Process, the **compost is emptied and screened** to remove foreign substances.
- The screened Compost product is sampled and **samples are lab tested according to DIN SPEC 91421.**
- Only compost complying with DIN SPEC 91421 is used in field trial **(No batch has been rejected so far).**

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P2GreeN

Comments on assessment from NMI on potential for inclusion of Goldeimer gGmbH compost fertiliser from human faeces in report on new materials for EU Fertilising Products Regulation (NMI report), email from NMI dated 16th of December 2025

On behalf of the P2GreeN project and partners we would like to support Goldeimer gGmbH (Goldeimer) in their proposal to be considered in the Technical study on new materials and processes under the FPR.

Therefore the responsible partners within the P2GreeN project working on the legal and regulatory aspects (SustChem, UCD, NUIM), the scientific partner (IGZ) responsible for the design, implementation, testing and analysis of the compost fertiliser from Goldeimer as well as the Coordinator of P2GreeN (agrathaer) together with Goldeimer wish to submit further information to substantiate the Goldeimer proposal concerning the interpretation of criteria's specified in the FPR as well as detailed technical information on the process, starting with the collection system, and the characteristics of the fertiliser itself (see Attachment 1). Here specifically the safety of the fertiliser is addressed.

The response from NMI in the email sent to Goldeimer dated 16th December 2025 addresses the following aspects: Firstly, humus fertiliser derived from human faeces is regarded as a regional bioeconomy product and therefore does not require regulation under the FPR but may instead be placed on the market under national fertiliser legislation. Furthermore, it is explained that the provided information on the safety of the materials is fragmented, and from projects and pilots with diverse mixes of materials, process conditions.

In view of our analysis, collected data and transdisciplinary expertise within the P2GreeN project we deem it necessary to support Goldeimer in this matter. In contrast with NMI's conclusions, we consider that (i) while, in principle, alternatives to the FPR exist nationally through national authorisation procedures and mutual recognition, they are limited and are constrained by a narrow approach to the FPR that is then mirrored nationally and also by the potential to still be considered 'waste'. A pathway to certification under the FPR is essential. In support of this, (ii) there is both existing and future cross-border/EU market potential but, even if there weren't such potential, limited or no EU market potential should not lead to a substance automatically being excluded from the FPR. Further, (iii) the evidence demonstrates safety of both Goldeimer's product and other varied but related products. Together these justify the inclusion of human excreta (urine and faeces) in the FPR either under a new CMC or within an existing CMC to facilitate the furthering of the EU's goals of a clean and circular economy and zero pollution.

With respect to the comments on the applicability of the UWWTD and the suggestions for development of regulations and frameworks linked to it: while this is a significant issue, it is unclear whether the UWWTD is applicable to faeces collected separately (as in the case of Goldeimer) and this is also not the focus of the issue here. That legislation addresses treatment of wastewater to ensure safety of discharges into the water, whereas here we are concerned with developing and commercialising useful fertilising products.

We would like to provide the following reasoning for consideration in the next interim report:

I. Lack of viable alternative avenues and the significance of the FPR

Innovators in sustainable technologies and products face considerable challenges in developing and upscaling, irrespective of how desirable the final product might be for stakeholders and society. They need clear, certain frameworks that are easily understandable and that, following appropriate testing and evidence gathering, facilitate their eventual commercialisation locally and internationally. Goldeimer's compost fertiliser and other similar products could make a significant contribution on multiple fronts, but the legal hurdles at EU and national level are significant. Two interrelated areas are particularly relevant here, which emphasise the importance of having an EU pathway and not simply leaving it to the regional/national level: fertilisers and waste. The latter is as human faeces would appear to be a form of waste and fall within the EU waste regime, in some fashion. If so, they remain waste until they fulfil the requirements of Article 6 of the Waste Framework Directive. Our research within P2GreeN highlights that an EU pathway would be a major step towards facilitating upscaling and the cross-border market for such products. In contrast, national regimes are limited, complex and provide little assurance of success.

It is understandable that the priority lies in materials that are well known and/or already established on the EU market. After all, national laws can also apply to regulate products locally. However, most national regimes are outdated, so innovative approaches and materials are not provisioned. For certain materials, such as those derived from waste, secondary raw materials, or human excreta, national authorities often lack the tools, resources, or established methodologies to comprehensively assess their safety and regulate their use. As a result, they now advise economic operators to follow the Fertilising Products Regulation (FPR) where possible. Some national fertilising products regimes have developed in such a way as to mirror the nature and content of the FPR, with the result that narrow approaches in the FPR will frequently lead to narrow approaches nationally. I.e. if there is not a route via the FPR, there is likely not to be a route via many national regimes, e.g. in Germany where several requests from both national research projects and P2GreeN between 2021 and 2023 were rejected by the Federal Ministry of Agriculture and the Federal Environment Agency with reference to the non-inclusion of humus fertiliser (derived from human faeces) in the FPR. So, at this point it seems generally unlikely that any national frameworks will be amended to accommodate such materials if they are not first permitted under the FPR. The influence of the FPR is backfiring in this respect, as it is limiting the level of innovation nationally and the potential for new fertilisers to be authorised in several Member States and thereby demonstrate desirability and an established market. Exceptions do exist, but the impact is nonetheless significant. In contrast, if the FPR were sufficiently flexible, this would translate also to flexibility domestically.

Second, even if authorised in one Member State, the innovators/producers then need to engage in the long, complex and costly process of seeking mutual authorisation in multiple other Member States, including through other languages and where unfamiliar with that legal system or processes. Also, several Member States either lack an established mutual recognition procedure or apply additional national requirements, effectively limiting the applicability of mutual recognition and requiring compliance with national legislation. In contrast, the FPR certificate of conformity would automatically ensure legal access across all Member States and simplify the matter greatly.

Third, there is the issue of waste, where the legal issues are highly complex, but where we will assume for the time being that human faeces are waste (and Member States are likely to consider this). In that case, they and any resulting product are deemed to remain waste until they fulfil the relevant requirements of Article 6 of the Waste Framework Directive. If authorised as a fertiliser under a national regime, the product is likely to be deemed to no longer be waste there, but this is likely to require further applications and resources. Very importantly, this status *only* applies within that Member State unless other Member States are willing to recognise that change in status. I.e. an innovator could have a declaration of end-of-waste status in Member State A, but then not have it recognised in another Member State, with impacts on cross-border trade once more. There is the potential for EU end-of-waste criteria that would apply across the EU, but these are very rare and have not been developed for human faeces. However, a signed declaration of conformity under FPR automatically means that the final fertilising product is not deemed waste and this applies across all EU Member States once more, thereby facilitating market uptake and enabling upscaling of these technologies.

Throughout our research, a recurring theme has been that one of the main challenges is the inconsistent and frequently incoherent regulatory framework at EU and Member State levels. The effect of these regulatory barriers on start-ups, young companies and small-sized businesses is much more pronounced compared to established medium- and large-sized businesses as they neither have the personnel nor the financial resources to mitigate the effects by mandating and consulting legal experts to establish a permissible path to authorisation for selling their product in the Single Market. Ultimately the regulatory barriers and heterogenous national regulations concerning the same end-product, human excreta- based fertiliser, significantly hinder the transition from innovation to full market commercialization.

Consequently, while we would acknowledge that there is either no or very limited cross-border trade at present of such innovative technologies and products – which have not yet been mainstreamed – this is due to their innovative nature and complex legal frameworks. This should not be viewed as a justification for declining the eligibility to be regulated within the FPR and should not prejudice the inclusion of new products in the FPR. Especially diverting any legal regulation to the Member State level is hampering market potential and market uptake.

An avenue via the FPR would open the door to green technologies and products in this field. Clearly, maintaining standards regarding the environment, human health and usefulness of the final product is essential. Amending the FPR to facilitate products such as Goldeimer's faecal compost would not undermine these standards, as the CMC could and should include such criteria. Indeed, it would be feasible for the EU regulators to set specific safety criteria if needed, in line with the approach already applied to other higher-risk materials under CMC3 or other CMCs. We are confident that Goldeimer would meet any reasonable such criteria, as noted below.

II. Lack of significant EU market potential

For the legislative reasons outlined above, fertiliser derived from human excreta, despite containing valuable nutrients for crops, providing benefits to soil health, and contributing to recycling and pollution reduction, are effectively excluded from the market. Moreover, without market access due to legal constraints, promising technologies cannot be upscaled, and as a result, they remain excluded from future regulatory updates-creating a continuous, self-perpetuating loop. This essentially leads to circular exclusion, rather than a circular economy.

We nonetheless believe that there is evidence of an existing EU market that can be tapped into and developed, if and when products such as Goldeimer's can follow FPR.

First, similar products, such as compost derived from plant and animal materials (mainly animal manure), are routinely transported and placed on the market across borders as agricultural fertiliser. This is demonstrated by the recent increase in animal manure trade amongst EU Member States. According to data from the Netherlands Enterprise Agency (RVO), exports of processed manure increased by 27% to 1.91 million tonnes in the first half of 2025 compared to the same period last year. For the first half year of 2025 exports have already reached 70 per cent of the volume for the 2024 calendar year. The exported volume of manure contained 20.89 million kg of nitrogen and 18.88 million kg of phosphate. Germany is by far the largest buyer of Dutch farm manure, well ahead of France and Belgium. In the first half of 2025, around 40 per cent of foreign deliveries went to Germany.

Second the statement that toilets without sewer connection are typically found in remote, sparsely populated locations and the resulting conclusion that it is therefore unlikely that there will be a market potential in future for collecting and processing compost from such installations and transporting this across national borders does not take into account that one of the main areas for the collection of human faeces in dry toilets are national and international music festivals. Both German producers of compost fertilisers from human faeces, Goldeimer and Finizio, main collection points are from dry toilet at the campsites on the festival grounds. Contrary to the "remote, sparsely populated locations" these festivals are either located in big cities or close to big cities and involve a large amount of festival visitors in very short time using the dry toilets, e.g. the Hurricane festival which was operated by Goldeimer dry toilets had 65.000 visitors during one weekend (https://hurricane.de/de/) or the Berliner Karneval der Kulturen which was operated by dry toilets from Finizio had 650.000 visitors in 2024 for the Pentecoast weekend in Berlin. It is also possible to install dry toilets alongside public sewers in urban conglomerations. This clearly entails a shift in approach to human waste management and development of relevant infrastructure, but this is possible and should not be considered a limiting factor to exclude faecal compost from the FPR. Indeed, local municipalities can struggle to deal with increased loads in public sewers and diverting faeces before they enter would help reduce pressures. It is also of note that dry toilets could, for instance be installed in places such as large public parks in cities such as Berlin, where there is considerable need for toilet facilities – as they don't need to be connected to sewers (https://www.berlin.de/sen/uvk/mobilitaet-und-verkehr/infrastruktur/oeffentliche-toiletten/klimafreundliche-parktoiletten/).

Furthermore, we would emphasize that the focus on the collection points for the input material as the main reference point to assess the cross-border market potential is questionable as it does not take into consideration that it is the end product, here the fertiliser from human faeces that will be sold and marketed. Even if the collection of the input material would be from remote sparsely populated locations the fertiliser could be used in all EU MS like other fertiliser for agriculture. Hence this should be the reference point for the market potential.

Third, the multiple pilots and projects, which vary in specifics but are all based on compost from human faeces, demonstrate the viability, interest and acceptability with key stakeholders of these types of (Varjú, V. From fork to farm, locally: social acceptance pathways for human excreta-derived fertilisers across three European regions. Socio Ecol Pract Res 7, 419–437 (2025). https://doi.org/10.1007/s42532-025-00236-x). The acceptability and desirability of such products can only increase where CE marking is possible (thereby providing confirmation of compliance with relevant environmental and human health standards), including through the multiple benefits of EU-wide end-of-waste status. Social acceptability is a key focus for P2GreeN partners, including Goldeimer, with research focusing on how to communicate the environmental and societal benefits of the products.

The market is likely to increase in the near future. There is a clear need for an increased supply of EU-produced, sustainable fertilisers from a relatively short, reliable supply chain. This need is increasing through pressures such as the war in Ukraine and other global instability, the impacts of climate change, growing populations, and the limited supply of substances such as phosphorous within the natural environment. This is exemplified by the EU including phosphorous as a 'critical raw material' within the Critical Raw Materials Regulation, as well as numerous references to the importance of the circular economy and conserving natural resources within EU law and policy, including the European Green Deal. Compost derived from human faeces is nutrient rich, respects the circular economy, and contributes to zero pollution.

This market, currently and in the future, can only be enhanced by the existence of a pathway through the FPR. Even if such solutions were considered "regional" currently, the existence of a pathway via the FPR would facilitate the adoption by multiple operators across the EU, enabling a meaningful contribution to the circular economy all over the EU. It should also be borne in mind that each Member State is not a separate island. Waste, including human waste, already crosses borders. It is clearly feasible for farmers on one side of a border to receive and use fertilisers created just across the border in another Member State, which would be facilitated by EU-level certification. On this basis, there does not appear to be a strong justification for excluding them solely due to their perceived regional character. Without such a pathway, the market is excessively restricted in a manner that hinders EU objectives.

III. Safety of materials and scattered pilot processes

As noted, we are focussing in our response here on Goldeimer’s product, where there is significant evidence to demonstrate its safety and more generally to support the adoption of a CMC on human faeces within the FPR.

However, we also consider, as outlined below that the existence of multiple projects with varying materials and process conditions should be considered as further support for a flexible CMC on human faeces – varying materials, temperatures and processes can all lead to a viable fertiliser that is environmentally friendly, safe and useful. While CMC3 is limited in its approach to production methods, treatments etc, other CMCs demonstrate more flexibility.

(a) Goldeimer compost fertiliser

Data relating to the Goldeimer technology as well as to comparable technologies that involve the composting of human faecal matter originating from source-separated or dry toilet systems was already provided in autumn 2025. As noted in the report, the terminology used to describe these toilet systems varies, as there is currently no official terminology under a specific legislative framework. Nevertheless, the initial starting material across most of these systems consists of human faeces with or without urine, together with toilet paper and carbon-rich bulking materials such as straw or sawdust. In some technologies, additional materials, for example green waste, are introduced at a later stage for co-composting, with the aim to further increase nutrient retention and carbon sequestration potential. Such additional materials may be added provided they are permitted input materials under CMC 3.

In the case of the Goldeimer technology, the starting material consists of human faecal matter mixed with toilet paper and straw, with residual amounts of urine remaining after pumping out the percolated urine at the bottom of collection vessels. An initial composting step of the starting material is carried out in accordance with the process requirements and time–temperature profiles specified under CMC 3. This is followed by a second composting step, during which additional input materials are added to the already composted initial material, and which is likewise conducted in compliance with the applicable CMC 3 process requirements and time–temperature profiles. Further details on the process are provided in Attachement 1.

The final compost complies with the limits for macroscopic impurities greater than 2 mm and PAH16 concentrations. Further, the stability criteria were met based on the self heating factor with Rottegrad V.General safety criteria from PFC3 on heavy metal concentrations and pathogens analysed so far, show compliance for the limits of cadmium, mercury, nickel, lead, inorganic arsenic, copper, and zinc. Salmonella. E.coli, and Enterococci were analysed in two independent samples so far and complied with the limits. The analysis of hexavalent chromium will be done during the first quarter 2026 but total chromium, for which the safety reference of the German BioAbfV was applied, was measured and was within the limit from the German BioAbfV of 100 mg/kg DM.

(b) Diverse, but related, processes --> support for a *flexible CMC*

“Human excreta and residues of dry toilets/ECO-toilets, or diapers“ are being reviewed in the NMI report as a potential new input material for inclusion under CMC 3 and CMC 5.

Within the NMI report, multiple proposals referring to dry toilets, human faecal matter, diapers, and similar materials are assessed together for potential inclusion under CMC 3 and CMC 5. As a result, a wide variety of input materials and treatment approaches are examined within a single existing analytical framework, making it difficult for a single consolidated conclusion to fully capture the diversity of the proposed materials and processing approaches, and thereby highlighting the importance of focusing regulatory assessment on permitted input materials and the eventual quality of the products, rather than on individual technologies.

These existing CMCs are also simply too rigid, with unnecessary restrictions, for instance, with respect to the treatments permitted and the order of steps involved. This rigidity thereby excludes variations of inputs, treatments and processes that nonetheless produce a safe and useful product. This issue is reflected within, for instance, the EU’s Joint Research Centre’s research and proposals with respect to new CMCs. In 2019, the JRC published a technical report for new fertilising materials, on STRUBITE, encompassing struvite, biochar and incineration ashes. Section 5.2 of that report addresses ‘cross-cutting items and other major issues’, where the first sub-section focusses on ‘scope widening and a principal focus on ‘safety’ criteria. The report notes that ‘*The STRUBIAS subgroup members highlighted the need to broaden the scope of the STRUBIAS CMC, expanding the eligible input materials and reduce limitations on process conditions, with the major objective to increase the recycling of nutrients, especially P.’* Key steps they took to achieve this included: *‘Setting process and material requirements to ensure that value-added materials that can contribute to nutrient recycling in a circular economy can enter the internal fertilising market*’. Crucially ‘*The proposals for the recovery rules have been developed considering the principle of a neutral stance towards existing and future technological developments. The production process conditions have been designed with a large focus on the quality of the end materials, rather than on the production process conditions. A relevant example is the use of the H/Corg parameter for pyrolysis & gasification materials as a parameter for C stability instead of imposing strict time-temperature profiles*.’ This approach can now be seen reflected in CMCs 12, 13 and 14.

The JRC report is also of particular relevance because it expressly addresses fertilisers being developed from waste. It acknowledges the need for relevant standards and restrictions on inputs. For instance ‘The fundamental principles of environmentally sound waste management imply that provisions are required to avoid materials that do not meet the criteria outlined above being used in EU fertilising products.’ Likewise, we by no means are suggesting that there should not be controls or limitations within any new CMC, but simply that some greater flexibility should be integrated with a focus on the quality of the end products and meeting appropriate health and environmental standards, rather than excessively restrictive process conditions.

More generally, it should be emphasised that, within the framework of the FPR, the exact technology applied and the specific configuration of the treatment process are of secondary importance, provided that all input materials are permitted under the Regulation and that the applicable processing requirements are correctly and consistently fulfilled. If human faecal matter with or without urine combined with toilet paper were to be recognised as an allowable input material under the FPR, a wide range of treatment technologies could, in principle, achieve compliance and be eligible for CE marking in the future. In such a case, conformity would be determined primarily by compliance with the relevant CMC input material requirements, prescribed processing conditions, and final product quality criteria, rather than by the specific technical characteristics of individual technologies.

IV. Conclusion

While Category 2 or Category 3 materials or derived products under the ABPR, such as manure, may be composted and placed on the market provided they have reached a recognised end point in accordance with Regulation (EC) No 1069/2009, this regulatory pathway does not apply to human faecal matter.

There is also some incoherence between, for instance, the potential to use animal manure as an ingredient, but not to use the equivalent from humans. While these substances are not identical, similar nutritional benefits and environmental and health concerns and benefits arise. It is possible to also include criteria and controls to ensure that any reasonable concerns are addressed. Significantly, enabling the use of human excreta as a CMC, subject to suitable conditions, would help the reclamation of valuable nutrients from human waste and thereby the implementation of the circular economy. It would simultaneously help reduce costs for municipalities treating wastewater and reduce the reliance on livestock manure and chemical fertilisers (including imported fertilisers).

Based on the information provided we would deem Goldeimers fertiliser within the scope of the FPR and would appreciate it if to be considered for further inclusion in the next interim report of NMI.

The P2GreeN Coordinator agrathaer GmbH on behalf of the P2GreeN partners SustChem, NUIM, UCD, IGZ, Goldeimer

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Cc : Ludwig Hermann <l.hermann@proman.pro>
Objet : DRAFT Second Interim report

Dear Chris,

After having read the document *DRAFT Second Interim report; Assessment of market perspective, Agricultural efficacy and Environmental Safety* I must say that I do not agree with its conclusions regarding vivianite. This material is a very efficient and necessary source of available Fe for crops in most soils of the Mediterranean area. Iron is the most limiting micronutrient in this area and affects almost all crops, with particularly relevant cases such as olive, citrus, and grapevines. At Fertiberia we have been using vivianite (which we commercially call "carbolita") as a component of NPK compound fertilizers for 15 years. We initially developed a process to obtain it from wastewater, specifically from phosphogypsum ponds; and later, when that water source was no longer available, through synthesis.

The most important fertilizer has been an NPK 17-8-10 (25) with B, Fe, and Zn, providing 0.5% Fe using vivianite as the iron source. This iron has proven to be stable and effective, as it remains in the soil as Fe(II). The product has been very well received in the market and has improved fertilization efficiency and the nutritional status of crops.

Regarding the issue of Fe concentration in vivianite, it should not be considered a problem, since if it is considered and used as an Fe source, the amount of vivianite applied to the soil should be determined by the Fe dose required. As in the example above with NPK 17-8-10, this represents only a few kilograms of Fe per hectare, which corresponds to an efficient Fe source.

Kind regards,
Javier

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R&D&i Director

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GrupoFertiberia

NETZERO
BY 2035

Jaroslav Moško, UCT Prague – University of Chemistry and Technology, Prague

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Input to NMI 10/2/26

Response in blue (comment/opinion/statement):

"The effectiveness of pyrolysis on the removal of PFAS is not conclusive. Several studies show effective removal of PFAS by pyrolysis, especially at higher temperatures (> 500 °C). Ineed, low temperature process may not be efficient. I believe, conclusions are clear. *It cannot be concluded that the risk to the environment and human and animal health with the proposed process conditions is acceptable. This has several reasons:*

1. *There is no consensus on what acceptable PFAS concentrations are in soil, water, or fertilisers. Therefore, an acceptable contaminant load cannot be determined.* – PFAS concentration in soil, water, or fertilisers will obviously vary based on local conditions, industry load in the region, wastewater treated, etc. "Therefore, an acceptable contaminant load cannot be determined." – PFAS are not present in sewage sludge only, but everywhere in the environment, therefore reasonably this shall not apply to biochar only, but in general to fertilising products at whole.

   "There is no consensus on what acceptable PFAS concentrations are in soil, water, or fertilisers." That shall not touch biochars only, should it? It is not fault of biochar that there are already PFAS (and other contaminants) present in soil, water, etc.
2. *Pyrolysis at temperatures > 600 °C did not consistently result in full elimination of PFAS. As the PFAS are forever chemicals, application can lead to build up of these chemicals in the soil.,* – Pyrolysis at temperatures > 600 °C resulted in satisfactory elimination of PFAS in most cases. The differences are given mostly by the different concept of pyrolysis and analysis, however, in general we may conclude, the removal is sufficient.

   "As the PFAS are forever chemicals, application can lead to build up of these chemicals in the soil." – this however is not the problem of PFAS only. How about other contaminants? E.g. heavy metals. Why sewage sludge ash is acceptable then? Why other biowaste materials are acceptable? – since we have the limits set for those, either set PFAS limits for all as well, or do not set PFAS limits to sludge biochar only.
3. *Not all process parameters that affect the presence of PFAS in the final material seem to be fully understood. Besides the high temperature, parameters such as residence time or the presence of a carrier gas seem to affect PFAS concentrations.* – Yes, other process

parameters will have effect on PFAS, however, temperature is the most influencing one given the concept of commercial pyrolysis unit producers.

Methods for assessing PFAS concentrations in the matrices sewage sludge and biochar are still developing. A lack of harmonised standards makes it more difficult to compare studies and interpret their findings. It will also make it very difficult to set criteria on PFAS contents for either of these matrices. The methods for assessing PFAS concentrations in sewage sludge are rather lacking in Europe. On contrary, US-EPA already has its standardized method - Method 1633 (I attach it in the mail). Nevertheless, there are not standardized methods for biochar matrices, therefore, the methods used in the literature are often modified methods from existing standards and methods. I agree, there shall be unified methodology for assessment of PFAS concentration in different matrices – nevertheless, it is not fault of biochar that there are not existing ones.

The pyrolysis of sewage sludge with the proposed process criteria does not consistently result in full elimination of all PFAS compounds. With the current available information, it cannot be concluded that pyrolysis with specific processing parameters sufficiently achieves PFAS removal. – This looks like the BCE's (Biochar Europe) position paper was not considered properly. The paper discusses way more studies than those referenced in the NMI report – attachment BDE Biochar Europe input to NMI 6_2_26.

With the precaution principle, the use of sewage sludge as an input material for pyrolysis would require threshold criteria for PFAS in CMC 14 materials. The knowledge base to formulate threshold criteria for PFAS contents in pyrolysis materials is however inadequate – Why should this touch pyrolysis and gasification materials only? How about precipitates, ashes, and other ones? *There are no agreed upon EU-wide safe levels of PFAS in soil or growing media.* – Why should this touch pyrolysis and gasification materials only? Should not this be an issue of all fertilising products then? *In addition, there are no standard analytical methods for the measurement of PFAS in biochar.* – true

In conclusion no criteria are set for sewage sludge as an input for pyrolysis under CMC 14. – BCE suggest to set them. How is that reflected? *Instead, we recommend reassessing this method in due time when there are clear standards for PFAS concentrations in soil and or fertilising products, analytical methods for measuring PFAS in sewage sludge and biochar are* *more standardised, and other process parameters that affect PFAS concentrations are better understood and optimised"*

Overall comment:

It seems to me that the opposition to the use of sludge biochar under FPR is not entirely fairly, as standards to it are above those applied to other fertilizer products.

A few points to consider:

- Why is there such strong attention to PFAS in sludge biochars “only”?
    - Why PFAS is not considered in other fertilizer products (sludge ash, precipitates, etc.) in relatively similar position as in case of sludge biochar?
- How thoroughly was BCE’s position paper examined and considered?

I attach one more paper which might be of an interest, regarding PFAS analysis in sludge biochar analysis – in the end, concluding the same – lack of approach, gaps towards the analysis. Shall this be somehow considered and discussed?

VaLoo
Circular Sanitation Network Switzerland
Réseau suisse pour un assainissement circulaire
Netzwerk für kreislauffähige Sanitärsysteme Schweiz

Louise Carpentier – Advocacy coordinator
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Zürich, 12.2.2026

Comments by VaLoo for human excreta – Table 4.1 in NMI report.

The response focusses on human excreta – including faeces and refers to 5.1, page 73.

Introduction:

VaLoo asks ESPP to support **source-separated human excreta**, also feces as a CMC, either under CMC 3 or as a new CMC. Since 2022, substantial additional data have become available, and the conclusion of “inadequate data” is no longer needed.

The argument of “no market/trade” does not reflect the intended application model, which is primarily local nutrient recycling rather than cross-border trade. In several Member States as well as in Switzerland, practical implementation is already underway, but regulatory progress is hindered by the absence of a dedicated CMC. National environmental and agricultural authorities refer to existing CMCs when classifying biogenic waste and evaluating fertiliser permits; without EU-level recognition, safe circular sanitation systems cannot scale.

Failing to establish a CMC for source-separated human excreta risks blocking innovation and local nutrient cycle closure, contrary to the objectives of the EU Fertilising Products Regulation and broader Circular Economy and Green Deal policies.

In detail:

- VaLoo supports the ESPP response, though regrets that ESPP accepts the NMI statement under 5.1.
- See Table 4.1 in Draft 2 – this entails: «Human excreta or Source-separated human excreta - Treated or untreated urine, faeces, or mixture from separated, dry or water-saving toilets or urinals, with or without residues such as toilet paper, straw etc.» However, later human excreta, which includes faeces, is only described as: «5.1 CMC 3 and CMC 5: human excreta and residues of dry toilets/ECO-toilets, or diapers».
- VaLoo agrees that «5.1 CMC 3 human excreta and residues of dry toilets/ECO-toilets, or diapers» is more difficult to evaluate. However, the available experience and data should instead be assessed under a CMC “Source-separated human excreta” as described in Table 4.1. This would be more appropriate.
- Section 5.1 CMC 3 in NMI draft 2 report receives a very negative evaluation. However, research has been conducted and data collected in recent years (see below).
- If the NMI report is not adapted, this will hinder local nutrient cycling, as national agricultural and environmental authorities refer to existing CMCs when classifying biogenic wastes or issuing fertiliser permits.

Data:

Results from a Swiss pilot:

- Report of two tested batches, finalised in 2025 (German). It describes the collection and treatment process as well as the product quality.
- A third batch has confirmed these results, and the data are currently being prepared for a fertiliser permit application (in preparation).
- Overview of fertilizers from human excreta in attached ppt, VaLoo-Eawag PEAK Course 2026
- We attached Kompotois company portrait. This company has 1000 mobile toilets and similar companies are also growing. This should underline that there is a market potential. Toilets, and the seperate collection of source-seperated human excreta are no longer a niche in rural settings.

Research studies:

- Häfner F, Monzon Diaz OR, Tietjen S, Schröder C and Krause A (2023), Recycling fertilizers from human excreta exhibit high nitrogen fertilizer value and result in low uptake of pharmaceutical compounds. Front. Environ. Sci. 10:1038175. https://doi.org/10.3389/fenvs.2022.1038175
- Schinkel and Eberhard et al. (2025) Antibiotics and other micropollutants in Swiss sewage sludge and fecal compost. Chemosphere Volume 375. https://doi.org/10.1016/j.chemosphere.2025.144216
  > see also slides in presentation products from human excreta for this study that state a clear take-home message regarding safety in relation to antibiotics compared to animal manure

Market potential:

- Our primary application perspective is local nutrient recovery, for example for city greenery, sponge city concepts, or agriculture. Close to he collection points of source-separated human excreta, composting facilities can use the material at up to 20–25% in their composting process. This enables nutrient recovery (currently not possible via the wastewater pathway) and ensures short transport distances.
- **Today**, there are about 1,500 dry toilets in Switzerland already collecting source-separated human excreta.
- **In total**, an estimated 30,000 mobile toilets exist in Switzerland, representing significant growth potential. A second important market is fixed public installations, where demand is increasing.
- **Within 10 years,** we estimate a total of 6,000 toilets in Switzerland, including conversion of chemical toilets. This would result in up to 400 t/year of source-separated human excreta (including paper and plant material), generating at least 130 t/year of compost.
- This **growth** is only feasible if the treatment of waste into fertiliser enables nutrient cycling.
- Besides composting, there are other treatment trains turning human excreta in fertilizers. Pioneers develop these

Agronomic potential, fertilizer quality:

- *Urine shows comparable plant availability to urea or NH4 + -containing mineral fertilisers (Kirchmann & Pettersson, 1995; Jönsson et al., 2004) and struvite (Arnold & Schmidt, 2012). Due to its good fertilising properties, urine is therefore suitable as a substitute for synthetic fertilisers for the cultivation of maize, beans, spring wheat or miscanthus, among other things (ibid.). Krause (2019) also discussed the possible positive effects of adding urine to composting to increase the N content in compost and to regulate the water content in the heap during composting.*

  Faeces show slower nutrient availability for plants compared to urine (Jönsson et al., 2004). However, they are characterised by possible positive effects on organic soil matter and thus improve soil structure, increase water retention capacity and buffer capacity (ibid.). The positive fertilising effect of faecal composts in horticultural use and the sufficient nutrient availability, especially of P from human faeces, has also been empirically demonstrated (e.g. Andreev et al., 2016; Krause et al., 2016; Krause & Klomfaß, 2015; Richert et al., 2010)

Krause, A. et al. (2020) Qualitätssicherung von Recyclingprodukten aus Trockentoiletten zur Anwendung im Gartenbau (DIN SPEC 91421:2020-12).

> *RFs (Anm.: recycling fertilizers), and particularly NUFs (Anm.: nitrified urine fertilizers) alone or in combination with fecal compost, were revealed to be viable alternatives to commercial fertilizer products. The N fertilizer value of the NUFs was comparable to vinasse, and, in combination with fecal compost, resulted in comparable cabbage yields. The soil texture influenced the performance of the NUFs and vinasse (sand > loam), whereas compost application alleviated the soil effect.*

Häfner, F. et al. (2023) Recycling fertilizers from human excreta exhibit high nitrogen fertilizer value and result in low uptake of pharmaceutical compounds Frontiers in Environmental Science Vol. 10/2022.

Creating Value

VaLoo

from what ends up in the Loo

Produkte aus menschlichen Ausscheidungen

PEAK-VaLoo Kurs

Eawag in Dübendorf

Louise Carpentier – Geschäftsleiterin VaLoo
20.1.2026

O. Schüpbach

Mein Hintergrund

Nährstoffe für 2.5 Baguettes, pro Person und Tag.

Msc. Bio Science Engineering, Boden- und Wasser, *UGhent Belgien*

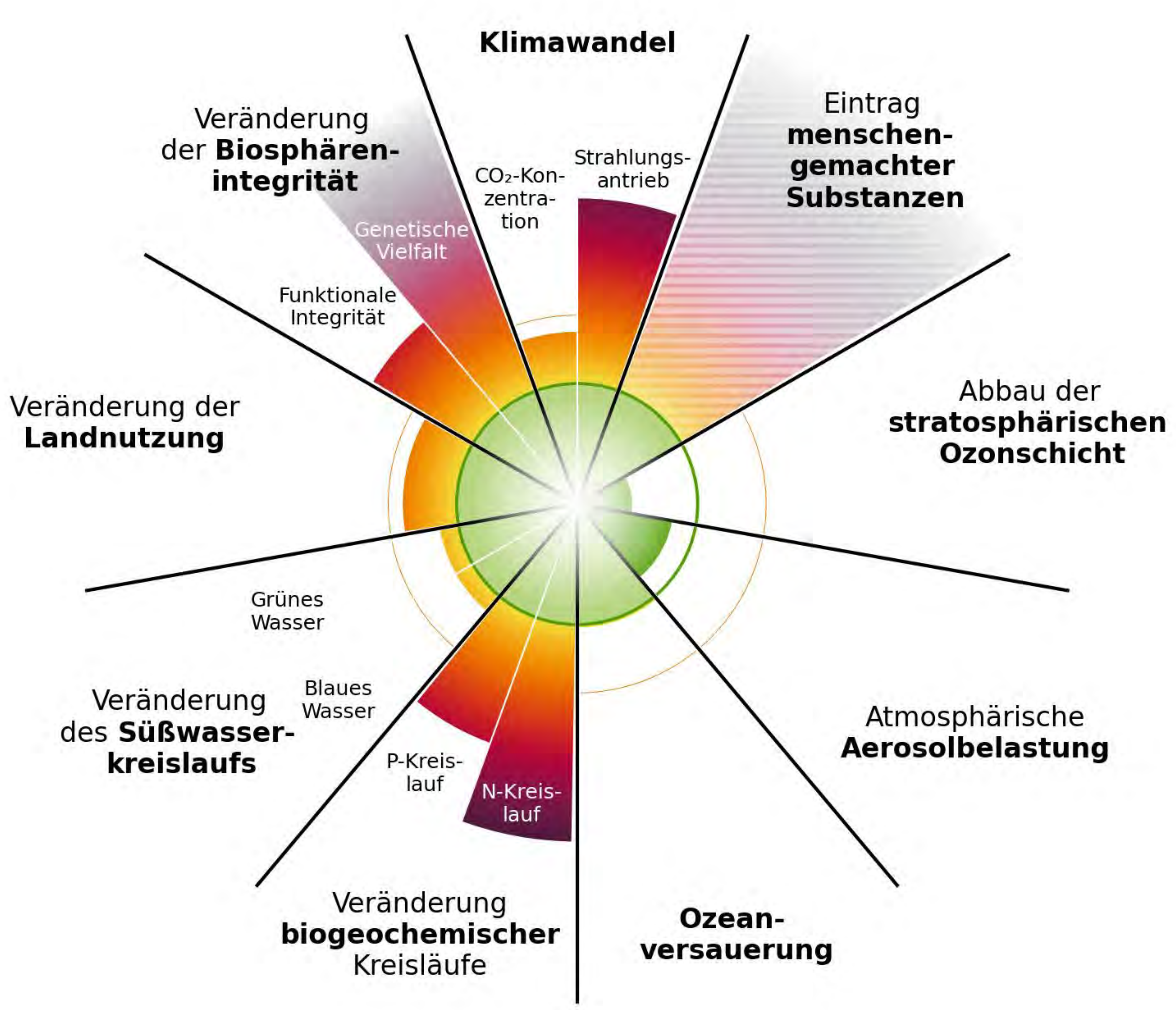
Projektmitarbeit in Forschung/Consulting zu:

- ➢ Nährstoffkreislaufwirtschaft in der Landwirtschaft
- ➢ SDG6 - Wasser - und Sanitärversorgung
- ➢ Bewillingspfad Recyclingdünger
- ➢ Ressourcenorientierte Sanitärsysteme

Mitgründerin & Geschäftsleiterin VaLoo seit 2021

Jo Mitchell - www.textularia.com

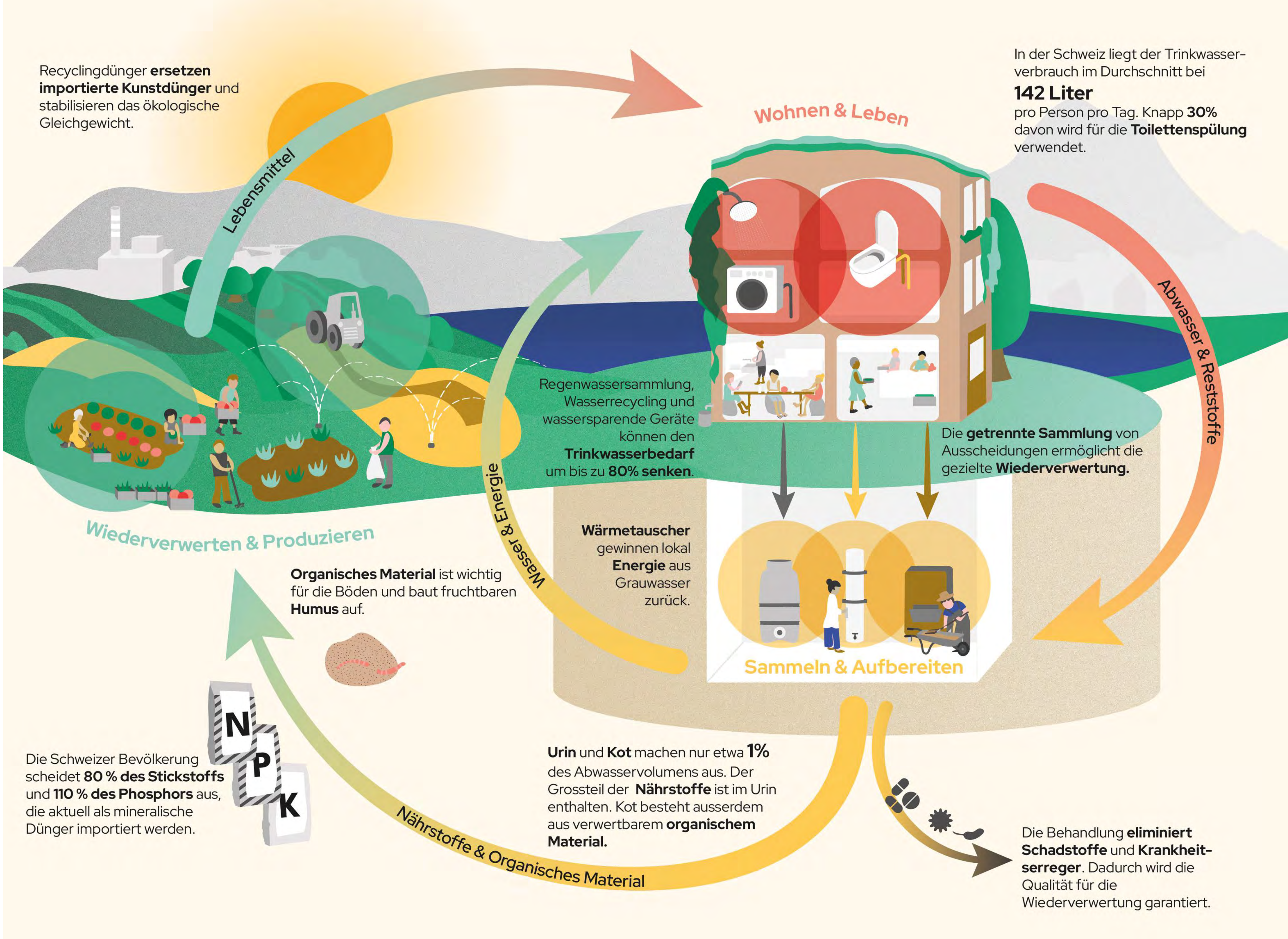
Belastbare Grenzen der Erde



- Grenze für P- und N-Kreisläufe überschritten
- Die Verdünnung des Urins durch Abwasser erschwert die Verwertung der Nährstoffe.

Potsdam Institute for Climate Impact Research (PIK), 2025, link
Prolog 03.02.2025 Hubaux, A+G lien

Potenzial Vision



Recyclingdünger **ersetzen importierte Kunstdünger** und stabilisieren das ökologische Gleichgewicht.

In der Schweiz liegt der Trinkwasserverbrauch im Durchschnitt bei

142 Liter

pro Person pro Tag. Knapp **30%** davon wird für die **Toilettenspülung** verwendet.

Regenwassersammlung, Wasserrecycling und wassersparende Geräte können den **Trinkwasserbedarf** um bis zu **80% senken.**

Die **getrennte Sammlung** von Ausscheidungen ermöglicht die gezielte **Wiederverwertung.**

Wärmetauscher gewinnen lokal **Energie** aus Grauwasser zurück.

Organisches Material ist wichtig für die Böden und baut fruchtbaren **Humus** auf.

Die Schweizer Bevölkerung scheidet **80 % des Stickstoffs** und **110 % des Phosphors** aus, die aktuell als mineralische Dünger importiert werden.

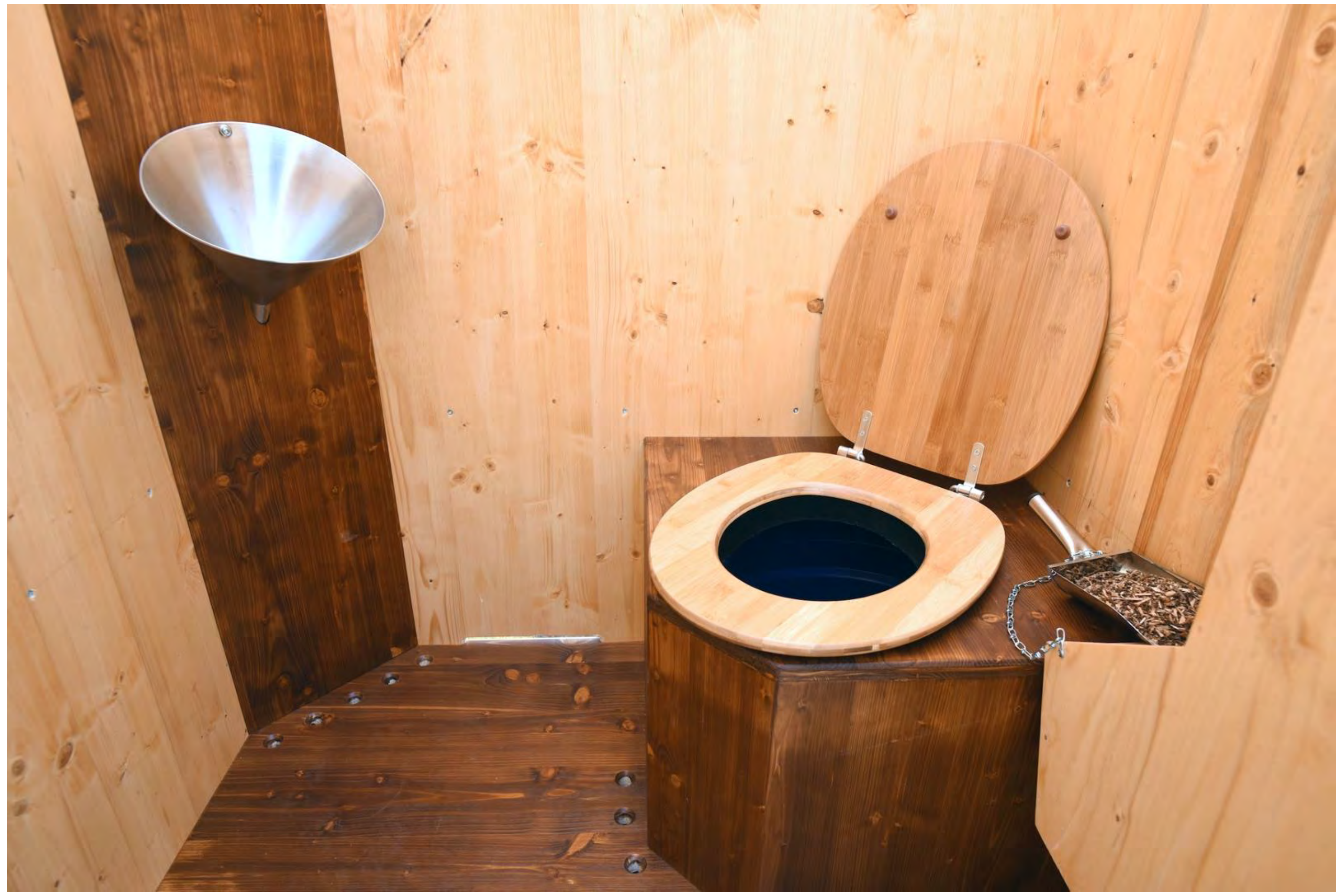
Urin und **Kot** machen nur etwa **1%** des Abwasservolumens aus. Der Grossteil der **Nährstoffe** ist im Urin enthalten. Kot besteht ausserdem aus verwertbarem **organischem Material.**

Die Behandlung **eliminiert Schadstoffe** und **Krankheitserreger**. Dadurch wird die Qualität für die Wiederverwertung garantiert.

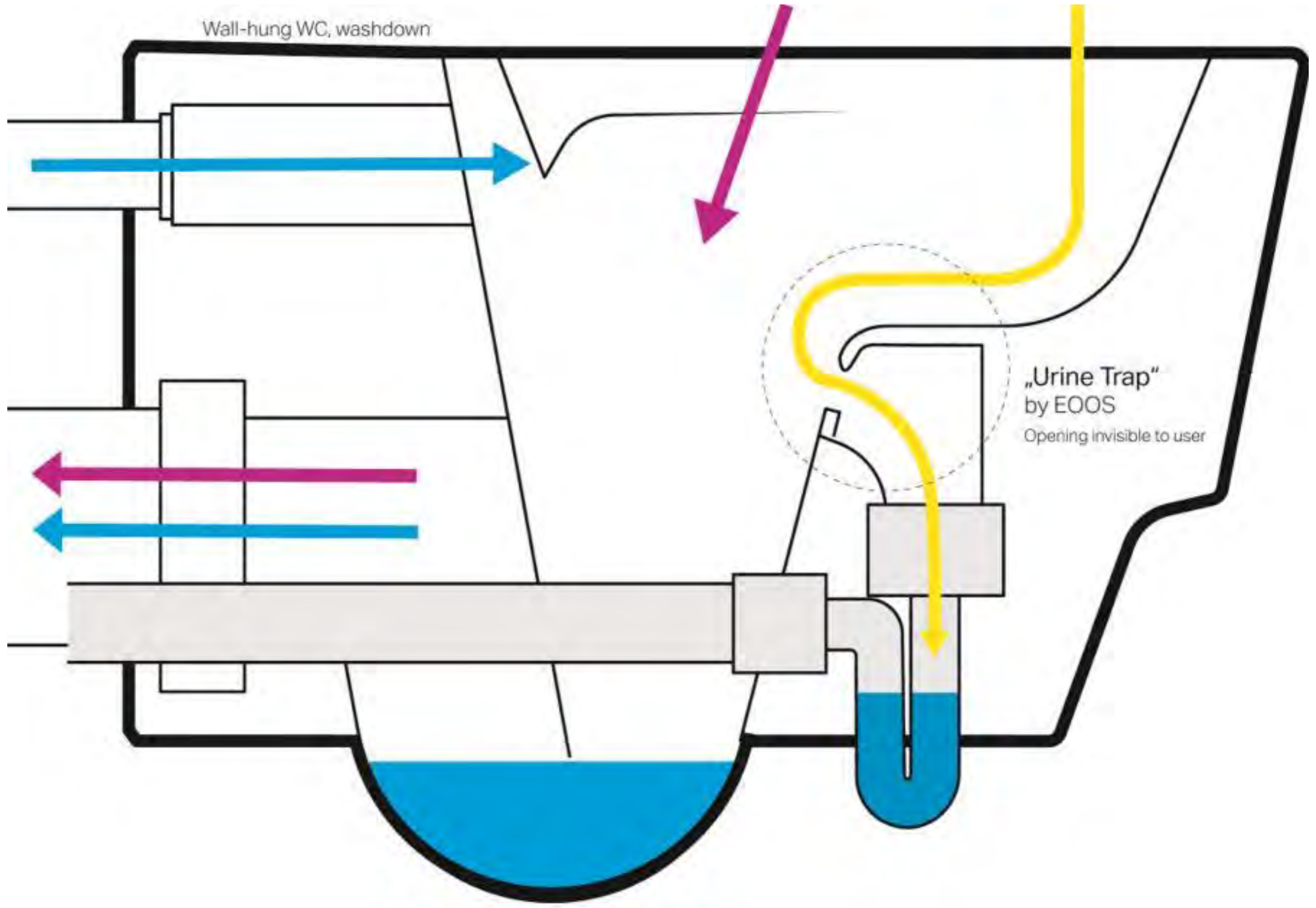
VaLoo 2024 Das Potenzial von zirkulären Sanitärlösungen in der Schweiz. Working Group Knowledge & Awareness

Trennung an der Quelle

- Urin und/oder Kot gelangen nicht ins Kanalnetz
- Es bestehen Toiletten mit Wasserspülung oder Trockentoiletten *(Präsentation Lukas Ulrich)*
- Pioniere entwickeln kontext-spezifische Toiletten, Aufbereitung und Düngemittel



Kompotoi - D. Laroche



Laufen Safe Urine Trap by EOOS

Urindünger

Name	**Aurin** 	**Pitribon** 	**Ogmo's harvest** 
Düngertyp	Flüssiger Stickstoff-Recyclingdünger	Flüssiger Recyclingdünger	Fester Recyclingdünger
Behandlung	• Nitrifikation im Bioreaktor • Aktivkohlefilter entfernt Mikroverunreinigungen • Eindampfung zur Hygienisierung und Volumenreduktion	• Nitrifikation auf passiv belüftetem Filter aus Pflanzenkohle	• Stabilisierung mit Pufferlösung inaktiviert Pathogene • Aktivkohlefilter optional • Evaporation für Volumenreduktion • Trocknung
Kontext	• > 200-500 EW • Wohnhäuser, Quartiere	• 1-500 EW • Einzelhäuser, Wohnhäuser	• Modular, Dezentral • Öffentliche Toiletten
Website	aurin.green	an-eco.ch/pitribon	ogmo

Bewilligung für alle Pflanzen in CH seit 2018 plus weitere Länder

Weitere Urindünger: Granurin von Sanitation360
EW = Einwohneräquivalent

Feststoffdünger

Name	**Kompost mit Trockentoiletteninhalte**	**Wurmkompost** aus Wurmfilter, Spültoilette	**Wurmkompost** aus Trockentoiletten
Düngertyp	Kompost	Wurmkompost	Wurmkompost
Behandlung	• Zentale Sammlung • Hitzekompostierung zur Hygienisierung • Nachrotte zur Stabilisierung	• Wurmfilter dient als Feststofftrennung • Sehr wenig Komposternte • Kompost wird 1-2 Jahre Nachgereift	• Wurmkompostierung von Kot und Toilettenpapier • Nachreifen
Kontext	• Mobile Toiletten • Öffentliche Toiletten	• 1-500 EW • Hütten bis Wohnkomplex	• 1-100 EW • Einzelhäuser, Berghütten, Mehrfamilien- oder Bürogebäude
Website	kompotoi	an-eco	vuna

Weitere Feststoffdünger: Biochar-basierte Dünger Mosan
EW = Einwohneräquivalent

Feststoffdünger

Wurmkompost aus Wurmfilter, Spültoilette
Kontext: Mehrfamilienhaus, Wohnkomplex
La Bistoquette:
103 Wohnungen + Gewerbe, 330 EW, Urban, seit 2025

Neuer Wurmfilter in La Bistoquette, an-eco

Wurmkompost aus Trockentoilette
Kontext: Trockentoilette, Berghütte
Grialetsch Hütte:
6000 Übernachtungen + zahlreiche Tagesgästen pro Saison

Kompostraum Grialetsch, Vuna

Qualitätssicherung

Dezember 2020

DIN SPEC 91421

DIN

ICS 13.030.50; 65.080

Qualitätssicherung von Recyclingprodukten aus Trockentoiletten zur Anwendung im Gartenbau

Quality assurance of recycling products from dry toilets for use in horticulture

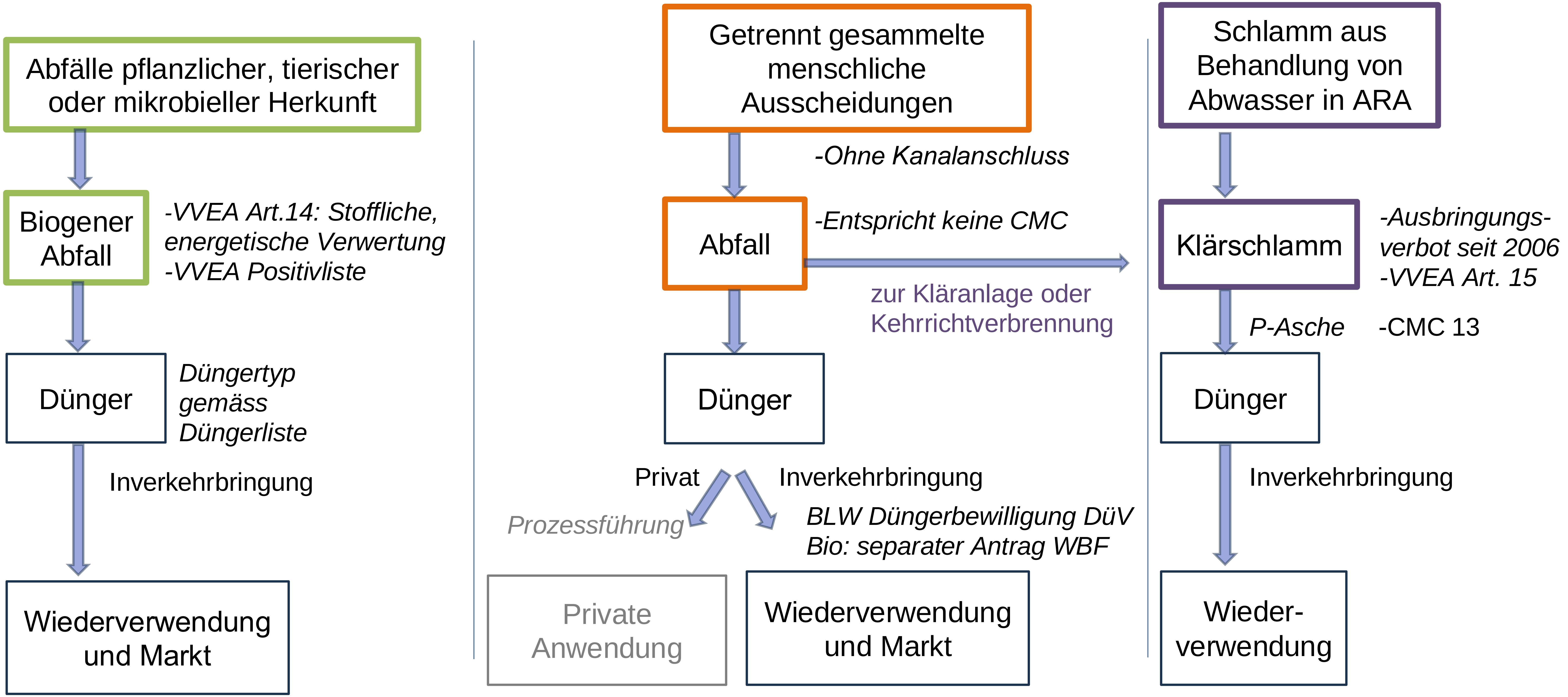
Assurance qualité du recyclage des produits des toilettes sèches pour l'horticulture

- DIN SPEC ist eine Produktspezifikation
- Ziel ist eine europäische Norm

an-eco

Krause, A. et al., (2020)
Krause, A. et al., (2021)

Rechtliche Lage



Abfälle pflanzlicher, tierischer oder mikrobieller Herkunft

Biogener Abfall

-VVEA Art.14: Stoffliche, energetische Verwertung
-VVEA Positivliste

Dünger

Düngertyp gemäss Düngerliste

Inverkehrbringung

Wiederverwendung und Markt

Getrennt gesammelte menschliche Ausscheidungen

-Ohne Kanalanschluss

Abfall

-Entspricht keine CMC

zur Kläranlage oder Kehrrichtverbrennung

Dünger

Privat

Prozessführung

Inverkehrbringung

BLW Düngerbewilligung DüV
Bio: separater Antrag WBF

Private Anwendung

Wiederverwendung und Markt

Schlamm aus Behandlung von Abwasser in ARA

Klärschlamm

-Ausbringungsverbot seit 2006
-VVEA Art. 15

P-Asche

-CMC 13

Dünger

Inverkehrbringung

Wiederverwendung

CMC: Komponentenmaterialkategorien

(Siehe auch Präsentation Philippe Reymond)

Kompost mit Trockentoiletteninhalte

Kompotoi

Kompotoi: 850 mobile Trockentoiletten in der Schweiz. Logistik ermöglicht die Sammlung und Verwertung auf industriellen Kompostierungsanlagen.

Trockentoiletteninhalte (TTI): ∼87% Hobelspäne, 10% Kot und Urin und 3% aus Toilettenpapier (vol%).

Zusammensetzung: 15-25% TTI; Grünabfälle, Erde, reifer Kompost. 1-3 % menschliche Ausscheidungen.

Ablauf: Einmischen, wenn die Temperatur erreicht ist, 6 Wochen Heissrotte (>55 ℃), 6 Wochen Nachrotte.

Datenlage: 3 beprobte Kompostchargen Uster und 1 Probe aus Versuch Luzern 2020

Analysenplan

Parameter-Gruppe	**Referenz**	Gemessen	**Grenz**- oder Richtwert
Trockensubstanz, Salzgehalt, Kessetest etc.	Qualitätsrichtlinie Kompost und Gärgut	✓	Ja
Nährstoffe	DüV, Qualitätsrichtlinie Kompost und Gärgut	✓	Ja
Schwermetalle	ChemRRV Anhang 2.6 Ziffer 2.2	✓	**Ja**
Organische Schadstoffe (PAK, Dioxine, Furane)	ChemRRV Anhang 2.6 Ziffer 2.2	✕	**Ja**
Fremdstoffe	ChemRRV Anhang 2.6 Ziffer 2.2	✓	**Ja**
Seuchenhygiene	DIN SPEC 92421	✓	**Ja**
Arzneimittelrückstände	DIN SPEC 92421	✓	Nein
PFAS	ChemRRV Anhang 1.16 Ziffer 1 - 4	✓	Ja/Nein

> Probenahme nach DIN SPEC 92421 Anhang B

Quellen siehe Handout

Seuchenhygiene

	Salmonellen	E. coli	Enterokokken	Clostridium perfringens	Somatische Coliphagen
Einheit	**n/g**	**KBE / 1g**	**KBE / 1g**	**KBE / 1g**	**k.A.**
Grenzwert	**0**	**1000**	**1000**	**0**	**-**
Uster1	neg / 25g	< 10	<100	<100	nicht bestimmt
Uster2	neg / 25g	20	<100	<100	nicht bestimmt
Uster3	neg / 25g	< 10	<100	<100	nicht bestimmt

Clostridium perfingens	- Bestimmungsgrenze kleiner als Grenzwert - standardmässig in Boden
Somatische Coliphagen	- kein Krankheitserreger, Indikator für Belastung durch Fäkalien - sehr teuer

✓ Qualitätsziel Seuchenhygiene erreicht

Studie finanziert durch das

Bundesamt für
Umwelt BAFU

Eawag
Das Wasserforschungsinstitut
des ETH-Bereichs

eawag
aquatic research

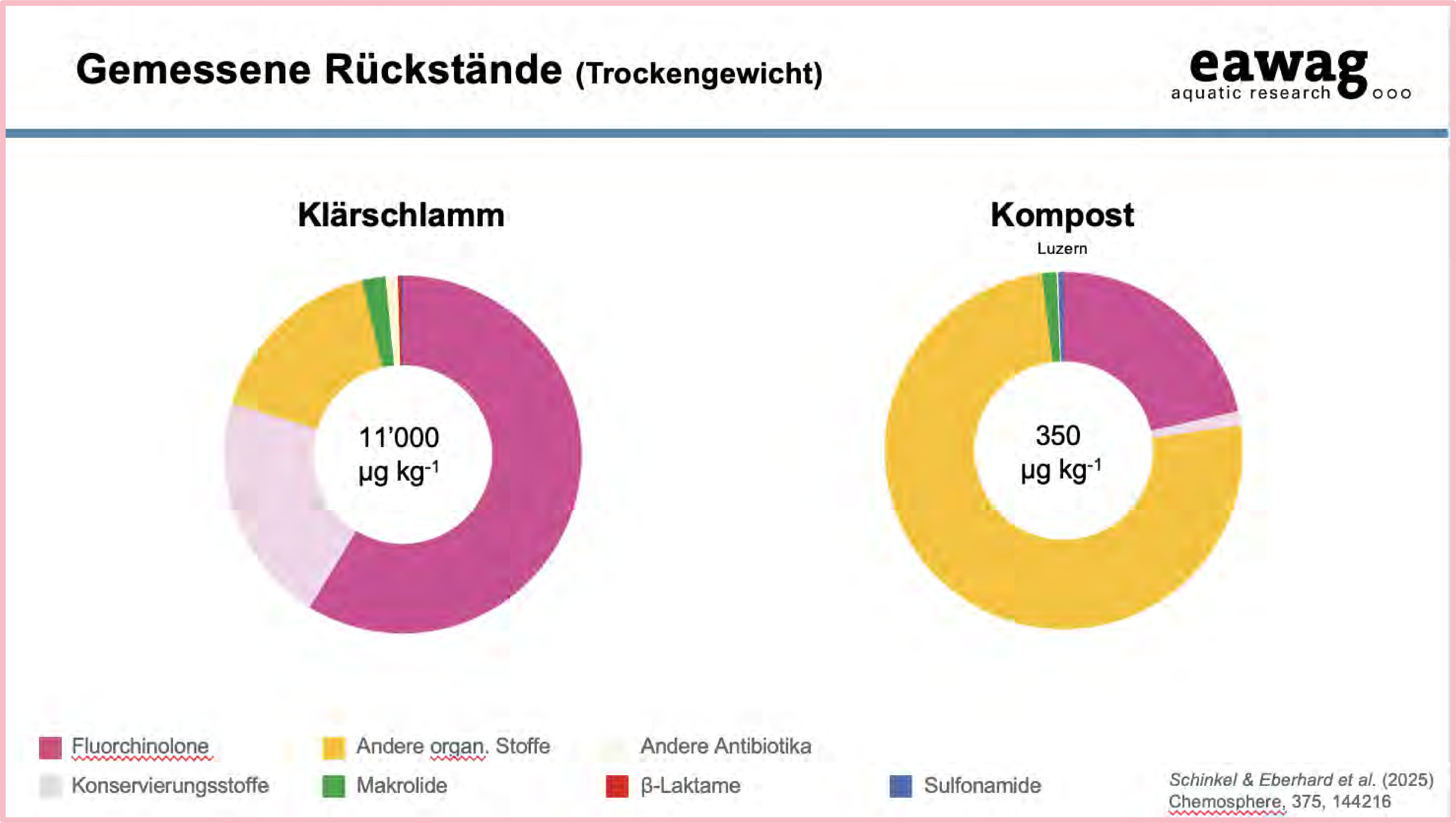
Sind Arzneimittelrückstände ein Problem?

Ein Vergleich von Kompost und Klärschlamm

Lena Schinkel
Yves Eberhard, Andreas Maccagnan, Michael Berg, Christa McArdell

flaticon.com

Folien von Abschlussveranstaltung April 2025 link, Schinkel et al. 2025 link



Gemessene Rückstände (Trockengewicht)

eawag
aquatic research

Klärschlamm

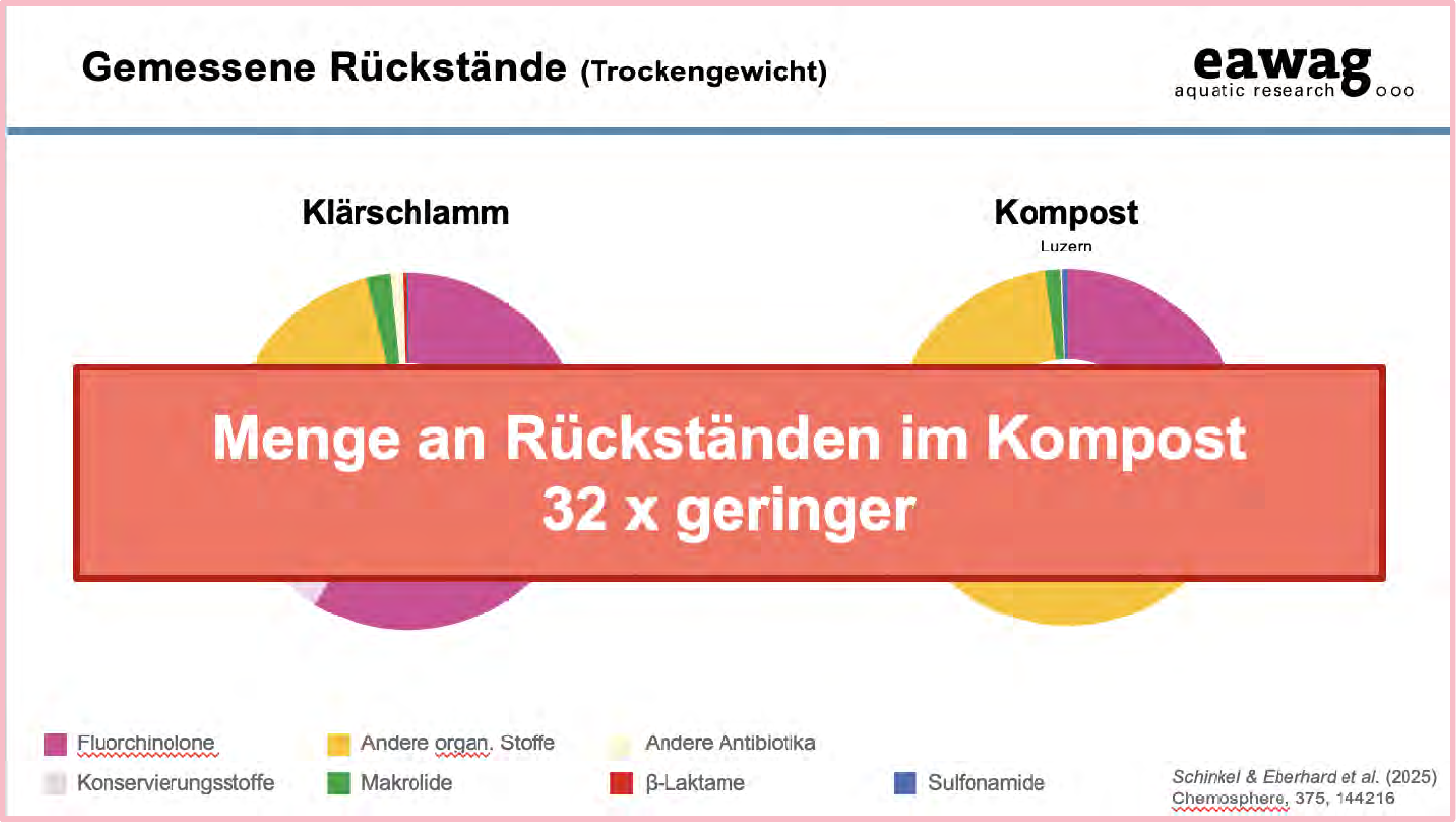
Kompost

Luzern

🟪 Fluorchinolone
🟨 Andere organ. Stoffe
⬜ Andere Antibiotika
⬜ Konservierungsstoffe
🟩 Makrolide
🟥 β-Laktame
🟦 Sulfonamide

Schinkel & Eberhard et al. (2025)
Chemosphere, 375, 144216

Schinkel and Eberhard et al. (2025) Antibiotics and other micropollutants in Swiss sewage sludge and fecal compost Chemosphere Volume 375 link



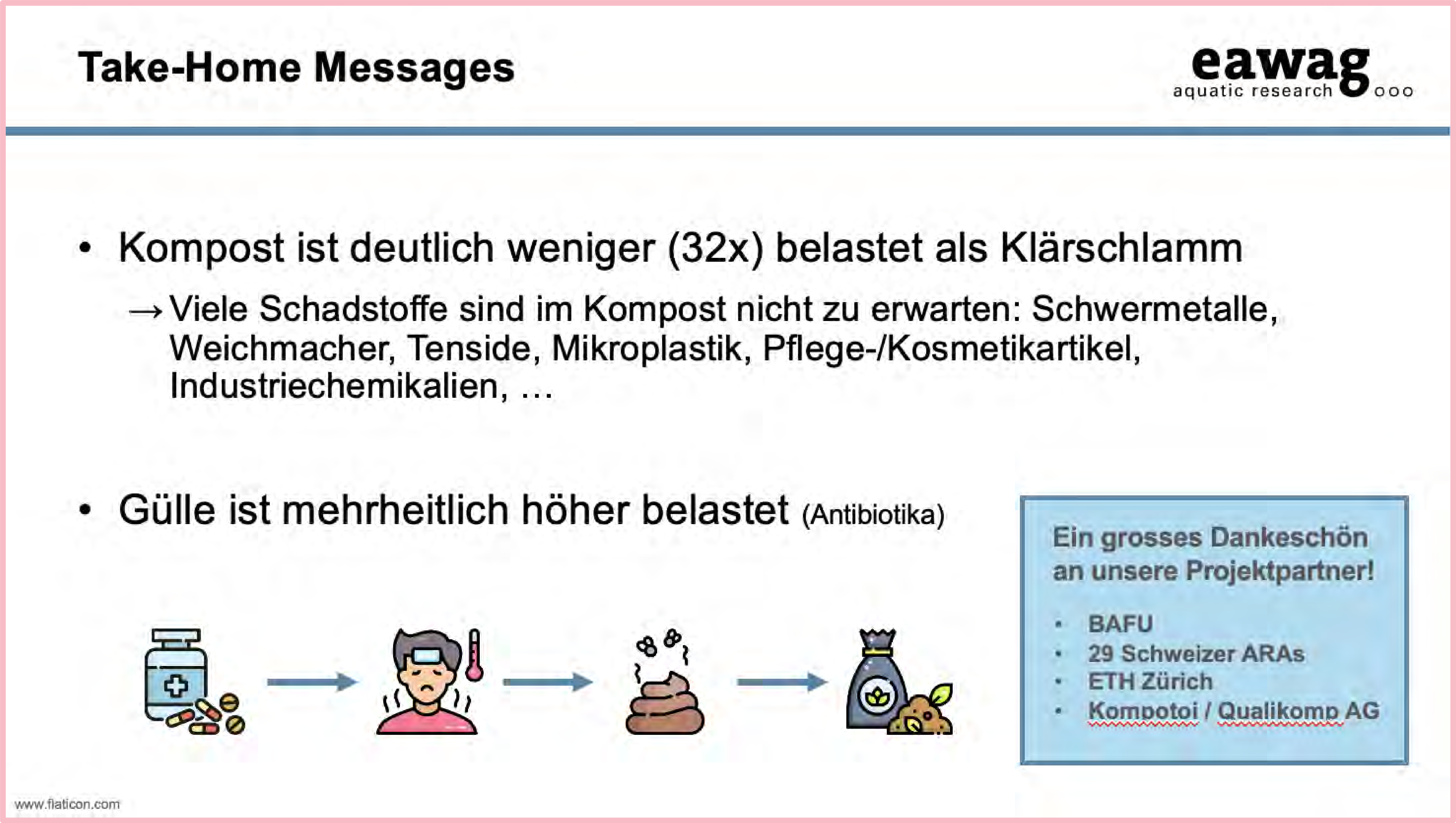
Gemessene Rückstände (Trockengewicht)

eawag
aquatic research

Menge an Rückständen im Kompost 32 x geringer

Schinkel & Eberhard et al. (2025)
Chemosphere, 375, 144216

Schinkel and et al. (2025) Antibiotics and other micropollutants in Swiss sewage sludge and fecal compost Chemosphere Volume 375 link



Take-Home Messages

- Kompost ist deutlich weniger (32x) belastet als Klärschlamm

  → Viele Schadstoffe sind im Kompost nicht zu erwarten: Schwermetalle, Weichmacher, Tenside, Mikroplastik, Pflege-/Kosmetikartikel, Industriechemikalien, …

- Gülle ist mehrheitlich höher belastet (Antibiotika)

Ein grosses Dankeschön an unsere Projektpartner!

- BAFU
- 29 Schweizer ARAs
- ETH Zürich
- Kompotoi / Qualikomp AG

www.flaticon.com

Schinkel and et al. (2025) Antibiotics and other micropollutants in Swiss sewage sludge and fecal compost Chemosphere Volume 375 link

Eignung als Dünger?

Bionika Kressetest

- Last but not least: Der Kressetest zeigt eine gute Keimung sowohl im offenen als auch im geschlossenen Glas.

- Fazit: Es gibt keine negativen Einflüsse von Trockentoiletteninhalten auf die Pflanzenverträglichkeit.

- Pilotbewilligung: Die Baumschule Kunz in Uster darf den Kompost mit kantonaler Einwilligung in der eigenen Baumschule einsetzen.

- Antrag Düngerbewilligung für Inverkehrbringung ist nächster Schritt

Perspektiven für die Anwendung

- Netto-Null in den Städten
- Abnehmende Tierbestände in der stadtnahen Landwirtschaft
- Zunehmende Stadtbegrünung dank Schwammstadtkonzept
- Kleingärten

> Ideale Düngemittel für z.B. Grünflächen, Kleingärtenvereine, aber nicht nur...

Nächste Schritte:

- Hin zu bewilligten Düngemittel
- Bio-Zulassungen, denn Städte setzen auf Bodenschutz

La Bistoquette – Genève: Produktion Urindünger Aurin

Züri-WC: Kompotois und Urindünger in Züri-WC Schindlergut – link

Kompotoi

Vielen Dank

Merci

Gemeinsam schliessen wir Kreisläufe
Ensemble nous bouclons les cycles
Insieme chiudiamo i cicli

Referenzen und Weiterlesen:

- BAFU 2025, Menschliche Ausscheidungen link
- Eawag Urine Factsheet 2019 link
- Häfner, F. et al. (2023) Recycling fertilizers from human excreta exhibit high nitrogen fertilizer value and result in low uptake of pharmaceutical compounds Frontiers in Environmental Science Vol. 10/2022 link
- KompostForum (2022) Komposte und Vergärungsprodukte – Eigenschaften, Qualitäten und Anwendungen Qualitätsrichtlinie der Branche 2022 link
- Krause, A. et al. (2020) Qualitätssicherung von Recyclingprodukten aus Trockentoiletten zur Anwendung im Gartenbau (DIN SPEC 91421:2020-12) link
- Krause. A. et al. (2021), Ressourcen aus der Schüssel sind der Schlüssel – Wertstoffe zirkulieren, Wasser sparen und Schadstoffe eliminieren, Diskussionspapier zur Sanitär– und Nährstoffwende, Berlin/Hamburg/Zürch 2021 link
- Krause, A. et al., (2021) Risikoanalyse zur Anwendung von Recyclingdüngern aus menschlichen Fäkalien im Gartenbau link
- Schinkel and Eberhard et al. (2025) Antibiotics and other micropollutants in Swiss sewage sludge and fecal compost Chemosphere Volume 375 link
- VaLoo Impact Projekt Kompostierung Uster (2025) link
- VaLoo 2024 Das Potenzial von zirkulären Sanitärlösungen in der Schweiz. Working Group Knowledge & Awareness link

Weiterlesen

Zirkulierbar.de und P2Green.eu sind spannende Forschungsprojekte

KOMPOTOI

Toiletten zum Wohlfühlen

WAS UNSER
BESOND

E TOILETTEN DERS MACHT…

Flair trifft auf Nachhaltigkeit

Die besten Botschafter:innen sind zufriedene Nutzer:innen

HOHER DESIGN- UND ÄSTHETIKANSPRUCH

Wir Trockentoiletten fallen schon von Weitem auf: Unser geschmackvolles Holzdesign und der geräumige Innenraum sorgen für Wohlfühlambiente. So wird das Geschäft zu einem angenehmen Erlebnis für Gross und Klein.

ÖKOLOGISCH UND GERUCHSARM

Wir funktionieren ohne Wasser, Chemie und Strom – und bleiben dennoch geruchsarm. Möglich macht das ein einfaches Prinzip: Das Abdecken mit Holzeinstreu bindet Feuchtigkeit und Gerüche und sorgt für einen natürlichen Holzduft! Und ja, es funktioniert wirklich.

ECHTES SCHWEIZER HANDWERK

Hinter jedem Kompotoi steckt echte Schweizer Qualität und Handwerkskunst. Seit 2022 ist **Blumer Lehmann**, das renommierte Holzbauunternehmen aus Gossau SG, unser Produktionspartner. Gemeinsam stehen wir für Langlebigkeit, Robustheit und hohe Qualität.

Tauchen Sie mit uns ein in die Kompotoi-Welt und erfahren Sie mehr über uns, unsere Partner:innen und unsere Vision. Werden Sie Teil einer zukunftsfähigen, sanitären Kreislaufwirtschaft.

Aus einer Idee...

Vom start-up...

2008 – DIE IDEE

Jojo Casanova
Mitgründer Kompotoi AG

PORTRAIT: VOM STILLEN ORT ZUM ZEICHEN FÜR NACHHALTIGKEIT

Die Idee zu Kompotoi entsteht 2008 bei einer Permakultur-Weiterbildung in Indien. Dort erlebt Jojo Casanova, wie aus menschlichen Ausscheidungen fruchtbare Erde wird – ein ebenso simples wie geniales Kreislaufsystem.

> *«Mit Kompotoi kann jeder Mensch wieder Teil des natürlichen Kreislaufs werden.»*
>
> *Jojo Casanova, Mitgründer Kompotoi AG*

Diese Erfahrung lässt ihn nicht mehr los. Zurück in der Schweiz baut Jojo mit Freund:innen den ersten Prototyp: eine mobile Komposttoilette – aus Holz, ohne Wasser, ohne Chemie.

2012 folgt der erste Auftrag: Jojo und seine Mitstreitenden Laila Rüesch und Marcos García Tomé werden angefragt, das legendäre Surfer-Event von Sudden Rush mit einer Komposttoilette auszustatten. Die drei Freunde nehmen die Herausforderung an. Die Gäste sind voll des Lobes über die Kompost-Toiletten und der Kunde überglücklich, dass seine Gäste nicht mehr die Plastik-Chemie-Toiletten benutzen müssen.

2012
ERSTER AUFTRAG & VEREINS-GRÜNDUNG

2013 - 2015
PROTOTYPING & 1. KLEINSERIE

- von 10 auf 35 Kompotois

2016-2017
PROFESSIONALISIERUNG & RÜCKENWIND

- von 50 auf 80 Kompotois

2018 - 2020
NEUE REKORDE

- 150 Toiletten, 20 Pissoirs, 10 barrierefreie Kompotois
- Standorte in Basel, Bern & Graubünden
- Anzahl Mitarbeitende 5-15

wird Kompotoi!

zum KMu

Der Erfindergeist der Initiant:innen ist geweckt. Ende 2012 gründen sie den Verein Kompotoi. Schon beim ersten Event-Einsatz ist klar: Die Zeit ist reif für eine neue Toilettenkultur.

Jojo Casanova ist bis heute das Gesicht hinter Kompotoi und treibt mit klarer Vision und viel Idealismus das Thema sanitäre Kreislaufwirtschaft voran.

2021- 2022
RICHTUNGSENTSCHEID & GRÜNDUNGEN

- 10 Jahre Kompotoi
- Produktion von 450 Kompotois
- Mitgründung Verein VaLoo
- Gründung Kompotoi Deutschland
- Anzahl Mitarbeitende 15-20

2023
NEUE STANDORTE

- 756 Kompotois im Einsatz
- Neue Standorte in Thun, Tessin
- Launch Kompotoi Petit
- Anzahl Mitarbeitende 25

2024
NEUER PRODUKTIONSPARTNER

- Mehr als 1000 Kompotois
- Blumer Lehmann AG übernimmt Produktion
- Launch Kompotoi Compo
- Auszeichnung mit Ethikpreis
- Anzahl Mitarbeitende 30

2025
VOM START-UP ZUM KMU

- Über 1200 Kompotois im Einsatz
- Launch Kompotoi Piazza
- Anzahl Mitarbeitende 35

Starker Partner

Aus gutem Holz!

Was bei Blumer Lehmann entsteht, wird mit Holz aus nachhaltiger Forstwirtschaft gefertigt. Für Projekte auf der ganzen Welt. In den unterschiedlichsten Dimensionen. Mit jeder Herausforderung verschieben sie die Grenzen des Machbaren. Für eine bessere, nachhaltigere Welt.

Hinter jedem Kompotoi steht nicht nur eine Idee, sondern auch echtes Handwerk und ein starkes Werteverständnis. Seit 2022 ist Blumer Lehmann, das renommierte Holzbauunternehmen aus Gossau SG, unser fester Produktionspartner – und ein wichtiger Verfechter unserer gemeinsamen Vision für eine zukunftsfähige Kreislaufwirtschaft.

Blumer Lehmann bringt dabei jahrzehntelange Erfahrung im Holzbau mit – und die Überzeugung, dass verantwortungsvolles Bauen heute Standard sein muss. So entsteht eine Zusammenarbeit, die auf Verlässlichkeit, Qualität und Haltung basiert und Produkte hervorbringt, die dauerhaft überzeugen.

Unsere Toilettenkabinen werden in den Produktionshallen von Blumer Lehmann aus FSC- und grösstenteil PEFC-zertifiziertem Holz gefertigt. Sie sind robust konstruiert, modular verarbeitet und am Ende wiederverwertbar.

> ***«Wenn Haltung und Handwerk zusammenkommen, entsteht etwas, das langfristig Bestand hat und wirkt.»***
>
> *Blumer Lehmann*

Blumer
Lehmann

Dachmontage

Die Kompotoi-Familie

Herzlich, robust, modular, ökologisch und wiederverwertbar!

Weitere Infos,
mehr Produkte:

Festinstallation

Classic

Pissoir

fürs Private

für öffentliche Orte

Uns kann man mieten und kaufen!

Das Kompotoi-Team berät Sie gerne:
vermietung@kompotoi.ch
044 273 30 30

Unsere Lieblings-destinationen

überall da, wo Menschen unterwegs sind

Wir sind robust, einfach zu benutzen und unkompliziert an unterschiedlichen Orten einsetzbar. Und Ja, wir sind teurer als unsere Plastik-Chemie-WC-Kollegen, denn Holz ist nunmal teurer als Plastik. Mit uns erhalten Sie eine flexible, ästhetische und umweltfreundliche Lösung für öffentliche Orte, Veranstaltungen, Baustellen und den privaten Gebrauch. Unser Mehrwert ist definitiv den „Preis wert". Denn Ihre Gäste verdienen eine anständige Toilette.

ÖFFENTLICHE ORTE
VERANSTALTUNGEN
BAUWESEN
UND ALLE ANDEREN

Service und Sauberkeit

Mit uns machen sie bestimmt ein gutes Geschäft!

FLEXIBILITÄT

Egal ob bei saisonalen Schwankungen für Gemeinden, in der Tourismus-Hochsaison oder für Events, wir Kompotois stehen für Sie bereit. Wir verstehen uns als die perfekte Lösung für Ihre sanitären Ansprüche.

KOMPETENTE BERATUNG

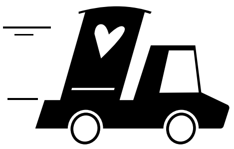
Sie wollen ein Kompotoi bestellen? Unser Team beantwortet gerne Ihre Fragen rund um die Bereitstellung von Kompostoiletten und hilft Ihnen bei der Planung für die richtige Anzahl an Toiletten.

SAUBER BIS INS DETAIL

Mit Hinstellen allein ist es nicht getan. Wir benötigen auch regelmässig Unterhalt. Ob gemietet oder gekauft, Kompotoi bietet verlässliche, flexible Wartungen je nach Beanspruchung. Denn Ihre Gäste verdienen eine saubere Toilette. Zu unserem Hygienestandard gehört auch Handdesinfektion in jedem Kompotoi.

UNKOMPLIZIERT UND SCHNELL

Der schnelle Service von Kompotoi wird sehr geschätzt. Unser Serviceteam reagiert innert Kürze: unkompliziert, auch am Wochenende. Auf unsere flexible Servicebereitschaft ist 100% Verlass.



Wir beraten Sie gerne:

vermietung@kompotoi.ch
044 273 30 30
kompotoi.ch

Fass mit 100 l Volumen für Feststoffe und ein 130 l Urintank.
Das entspricht rund 500 Nutzungen!

Anlieferung/Abholung

Fässertausch

Urintank-Entleerung

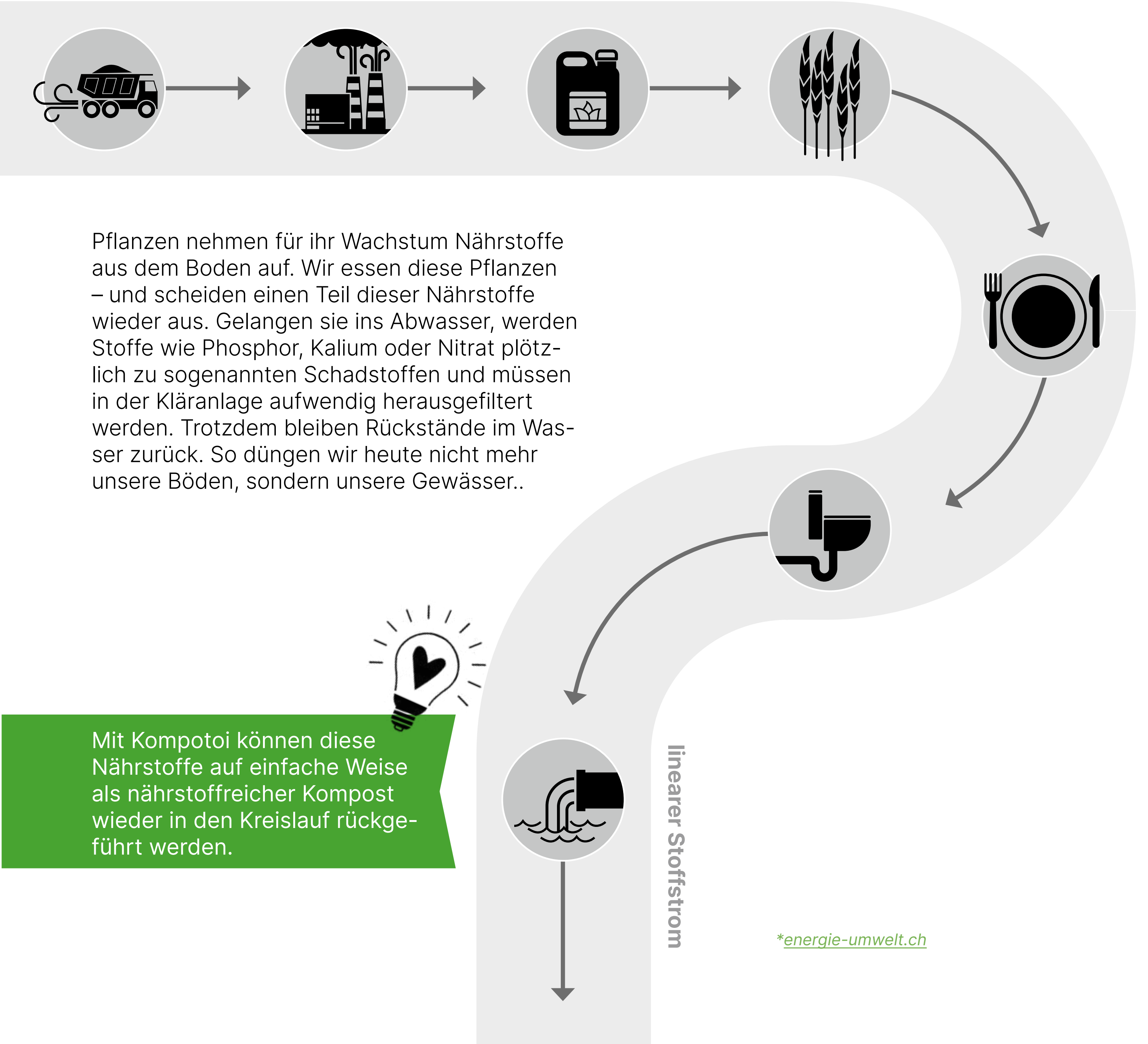
Shit happens

unsere Vision: Der Weg zu einer sanitären Kreislaufwirtschaft!

Bei einem konventionellen WC spülen wir bei jedem Toilettengang beste Nährstoffe mit sauberem Trinkwasser weg. Genau diese Nährstoffe werden im Ausland energieintensiv produziert und für unsere Landwirtschaft als Dünger teuer importiert.

Im Durchschnitt werden in der Schweiz ungefähr 40 Liter bestes Trinkwasser pro Person für die WC-Spülung verbraucht.*

linearer Stoffstrom



Pflanzen nehmen für ihr Wachstum Nährstoffe aus dem Boden auf. Wir essen diese Pflanzen – und scheiden einen Teil dieser Nährstoffe wieder aus. Gelangen sie ins Abwasser, werden Stoffe wie Phosphor, Kalium oder Nitrat plötzlich zu sogenannten Schadstoffen und müssen in der Kläranlage aufwendig herausgefiltert werden. Trotzdem bleiben Rückstände im Wasser zurück. So düngen wir heute nicht mehr unsere Böden, sondern unsere Gewässer..

Mit Kompotoi können diese Nährstoffe auf einfache Weise als nährstoffreicher Kompost wieder in den Kreislauf rückgeführt werden.

*energie-umwelt.ch

Let‘s use it!

FORSCHUNGSPROJEKT USTER: DER WEG ZUR ANERKENNUNG

In einem zweijährigen Pilotprojekt haben wir gemeinsam mit VaLoo, dem Netzwerk für kreislauffähige Sanitärsysteme, bewiesen, dass sich die Inhalte aus Trockentoiletten zu nährstoffreichem Kompost aufbereiten lassen.

WAS PASSIERT MIT DEN GESAMMELTEN AUSSCHEIDUNGEN?

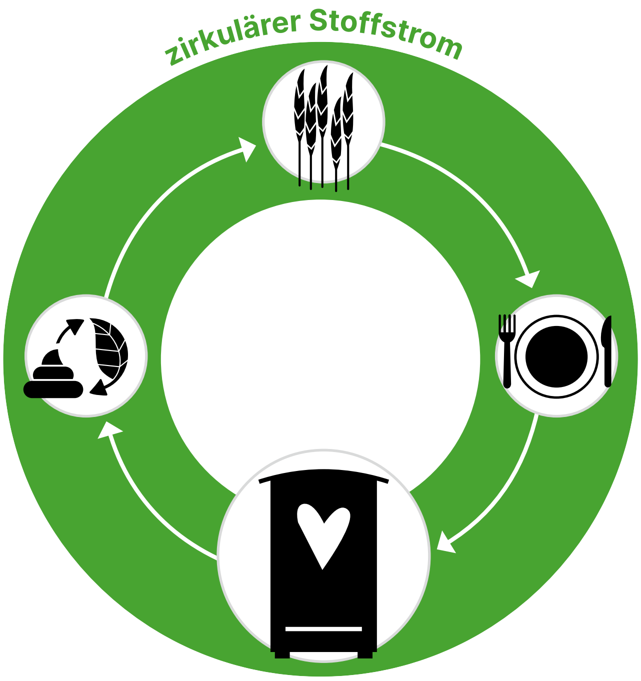
Im Kanton Zürich verfügen wir über eine Ausnahmebewilligung für die Kompostierung von bis zu 100 Tonnen pro Jahr. Das entspricht ungefähr der Menge der von uns jährlich gesammelten Stoffe. Ein Teil davon wird gegenwärtig noch thermisch verwertet.

DER URIN

kann zu hochwertigem Flüssigdünger verarbeitet werden, der in der Schweiz als Düngemittel zugelassen ist. Der Flüssigdünger Aurin ist bei uns im Onlineshop erhältlich.

DIE FESTSTOFFE

Durch kontrollierte Kompostierung entsteht ein nährstoffreicher Kompost. Dieser hilft, unseren Humus aufzubauen und speichert Co_2 langfristig im Boden.



Über VaLoo

Der Verband VaLoo vereint als Netzwerk Menschen aus Wissenschaft, Praxis und Wirtschaft, die gemeinsam zeigen: Unsere Ausscheidungen sind kein Abfall, sondern ein wertvoller Rohstoff. Als Gründungsmitglied bringt Kompotoi gemeinsam mit VaLoo das Thema aus der Nische ins öffentliche Rampenlicht, in die Fachstellen und ins Parlament.

VaLoo


Mit uns machen sie eine bessere Erde!

Seit 2012 machen wir eine bessere Erde.

Mit Komposttoiletten.

Auszeichnungen:

SCHWEIZER ETHIKPREIS
by HEIG-VD
2024

SWISS FUTURE AWARD

Lust auf noch mehr Kompotoi?

Alles über uns
und unsere Vision:

KOMPOTOI

verkauf@kompotoi.ch
044 273 30 30

kompotoi.ch

Unsere Sustainable Development Goals:

2 ZERO HUNGER

6 CLEAN WATER AND SANITATION

11 SUSTAINABLE CITIES AND COMMUNITIES

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

13 CLIMATE ACTION

14 LIFE BELOW WATER

15 LIFE ON LAND