



# GERBIO

German Society for Sustainable  
Biogas and Bioenergy Utilisation



环境可持续排水技术研究中心  
Centre for Sustainable Environmental Sanitation



## Circular Economy in Agriculture: Utilizing Residues

- International Collaboration from the  
Centre for Sustainable Environmental  
Sanitation (CSES), University of Science and  
Technology Beijing (USTB)

Heinz-Peter Mang (CSES, UPM GmbH & German Society for Sustainable Biogas and Bioenergy Utilisation)  
and & Prof. Dr.-Ing. Zifu Li (CSES), Bengbu, November 2023



# Introduction



Global waste  
management  
challenges



Transition from  
linear to circular  
economy



Role of  
agriculture in the  
circular economy

# Importance of Circular Economy



Reducing environmental  
footprint

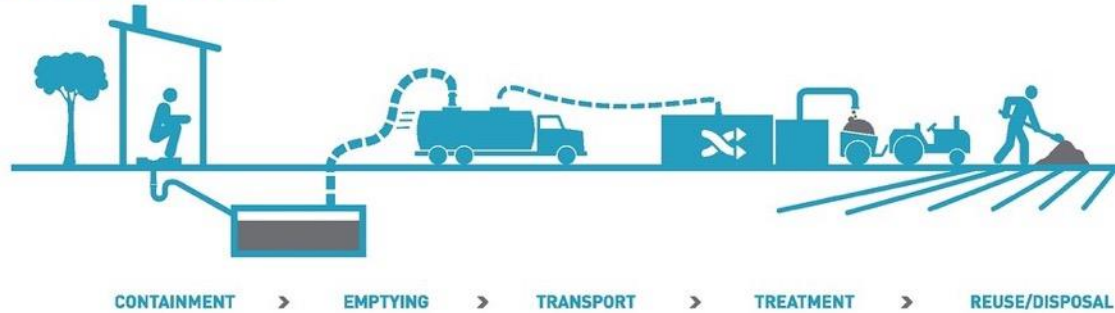


Resource optimization



Economic benefits and  
sustainability

Sanitation Value Chain



# The Sanitation Issue

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Understanding waste and its impact

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Value of nutrients lost in sanitation

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Need for sanitation reforms



# Nutrient recovery

- ▶ Separation and utilization of nutrients required
- ▶ Addressing the challenges of the 19<sup>th</sup> century
- ▶ The transition from risk to resource

# Recycling Toilet sub-products



Converting human waste into fertilizer



Hygienization of feces



Modern methodologies ensuring safety





## Humus fertilizer's potential

- ▶ Bolstering soil health and resilience
- ▶ Mitigating climate change impacts
- ▶ Water retention and improved yield

## Contribution of the Leibniz Institute for Vegetable and Ornamental Crops (IGZ)

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16 October 2023: Commissioning of the first German research facility in Eberswalde to produce recycled fertilisers from dry toilet contents

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Supporting urine and feces treatment projects to produce fertilizer

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Coordination of the zirkulierBAR (circulAR) project, funded by the German Federal Ministry of Education and Research (BMBF)

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Promoting links between local agriculture and waste management





# References

## ► IGZ press release

► <https://igzev.de/aktuelles/presse-mitteilungen/2023-10-16-inbetriebnahme-der-ersten-deutschen-forschungsanlage-zur-herstellung-von-recyclingduengern-aus-trockentoiletteninhalt>

Inbetriebnahme der ersten deutschen Forschungsanlage zur Herstellung von Recyclingdüngern aus Trockentoiletteninhalten

16.10.2023

Im Rahmen des Forschungsprojekts zirkulierBAR, das am Leibniz-Institut für Gemüse- und Zierpflanzenbau (IGZ) koordiniert wird, wurde heute auf dem Gelände der Kreiswerke Barnim GmbH in Eberswalde feierlich eine Urinaufbereitungsanlage sowie ein Humusregal zur Verwertung von Inhalten aus Trockentoiletten eröffnet. Mit der Inbetriebnahme ist das zirkulierBAR Reallabor nun komplett. Die Fertigstellung ist ein wichtiger Meilenstein für Forschung und Praxis im Bereich der regionalen Kreislaufwirtschaft.

Bei der Eröffnung der Anlage waren hochrangige lokale, kommunaler Landes-, Bundes- und EU-Vertreter\*innen geladen. Es sprachen **Michael Kellner**, Parlamentarischer Staatssekretär im Bundesministerium für Wirtschaft und Klimaschutz (BMWK) und Mitglied des Deutschen Bundestages, **Tobias Dünow**, Staatssekretär im Ministerium für Wissenschaft, Forschung und Kultur des Landes Brandenburg (MWFK), **Dr. Wolf Junker**, Leiter des Referats Ressourcen, Kreislaufwirtschaft; Geoforschung im Bundesministerium für Bildung und Forschung (BMBF), **Daniel Kurth**, Landrat des Landkreises Barnim, **Götz Herrmann**, Bürgermeister der Kreisstadt Eberswalde sowie **Christian Mehnert**, Geschäftsführer der Kreiswerke Barnim GmbH. **Prof. Dr. Nicole van Dam**, wissenschaftliche Direktorin des koordinierenden IGZ, leitete in die Forschungsthematik ein.



v.l.n.r. Christian Mehnert, Dr. Ariane Krause, Prof. Dr. Nicole van Dam, Michael Kellner, Florian Augustin, Dr. Wolf Junker © Torsten Stapel

# Regulatory Landscape



CURRENT LEGAL  
CONSTRAINTS



POTENTIAL  
PATHWAYS FOR  
INTEGRATION



UNDERSTANDING  
THE COMPLEXITIES  
OF WASTE AS A  
RESOURCE

# DIN SPEC 91421:2020-12

Product standard on the definition of the quality of recycled fertilizers - made from human faeces from dry toilets.



**PRODUCT  
SPECIFICATION  
OVERVIEW**



**EPIDEMIOLOGICALLY  
HARMLESS FERTILIZERS**



**QUALITY STANDARDS  
BASED GERMAN AND  
EUROPEAN LEGISLATION**

# Not yet evolved to an EN or ISO Norm.

- ▶ Pathogens must be eliminated by appropriate treatment in preparing contents from dry toilets. To prevent the transmission of diseases, products used as recycled fertiliser in horticulture must be harmless in terms of epidemic hygiene. The product is analyzed for a selection of “indicator organisms” to provide this proof.
- ▶ If plant additives are used for treatment (e.g., green cuttings in composting), the treatment process must ensure the elimination of weed seeds and the killing of phytopathogens.
- ▶ Organic trace substances such as pharmaceuticals and hormones are particularly relevant in recycled fertilizers from dry toilets; heavy metals and microplastics in human excrement do not represent a significant risk. In addition, the input of pollutants by toilet-related and recycling-related additives must be avoided.
- ▶ Depending on the content of the main nutrients nitrogen (N), phosphorus (P) or potassium (K) and their ratios to each other, certain fertiliser types can be assigned, e.g., NPK, PK, and NK fertilizers.



# About CSES

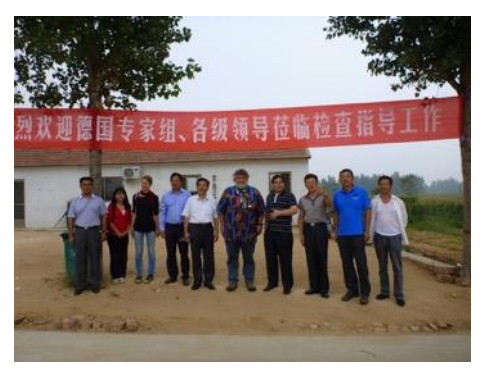
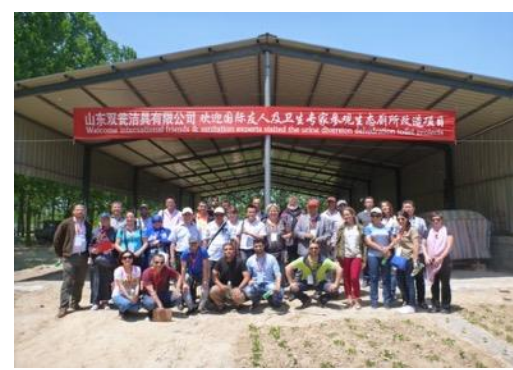
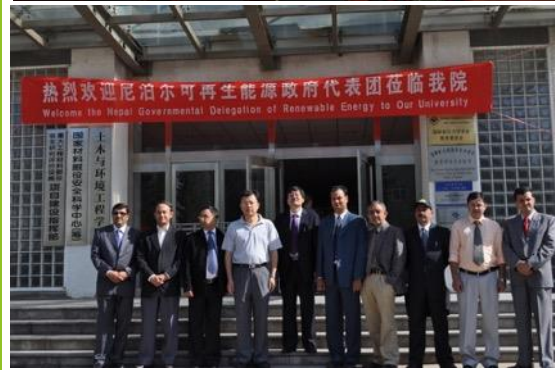


► The Centre for Sustainable Environmental Sanitation, integrated into the School of Environmental Engineering at USTB, was inaugurated in 2008 (*International Year of Sanitation*) to build capacity among Chinese and international Young Professionals in the interrelated sectors of sustainable environmental sanitation and bioenergy through “learning by doing” in international teamwork, together with experienced multidisciplinary Senior Experts.



► More than 200 master’s and PhD candidates have finished their research and project work in the centre under supervision by expert groups led by Prof. Dr.-Ing. Li Zifu.







# Contribution of the Centre for Sustainable Environmental Sanitation at the USTB

可持续排水技术  
Center for Sustainable Environm



Since 2008 cooperation agreement with the German Society for Sustainable Biogas and Bioenergy Utilisation (FnBB - GERBIO)

Since 2011, represented in the German Water Association working group „Agricultural reuse”, subgroup “Resource-oriented Sanitation Systems”

Collaboration with other research and training centers, consultant companies and industries for sustainable sanitation and bioenergy solutions.

Hosting the "China National Environment and Energy International Cooperation Base"

Hosting the "Beijing Key Laboratory of Disposal and Resource Recovery of Heavy Industry Typical Pollutants and Urban Organic Wastes"

Focus on sustainable sanitation systems including agricultural and bioenergy and the reuse of sanitized wastewater and waste.



# Conclusion

- ▶ The undeniable importance of circularity in agriculture
- ▶ The potential and challenges ahead
- ▶ A call to action for stakeholders



# Contact

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