Decentralised wastewater treatment in an urban setting – Results from a full-scale demonstration project

SPONSORED BY THE Federal Ministry of Education and Research

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INTRODUCTION

In order to “lead by example” GIZ installed a urine diversion system to showcase the potential of such systems for urban areas in the developed as well as developing world. The system is treating and recycling the urine, brown- and greywater collected in the office building on demo scale. The urine’s phosphorus is recovered by a struvite reactor and the brown- and greywater treated in membrane bioreactors. Urine and struvite are reused in agricultural trials while the water produced by the MBRs reaches service water quality.

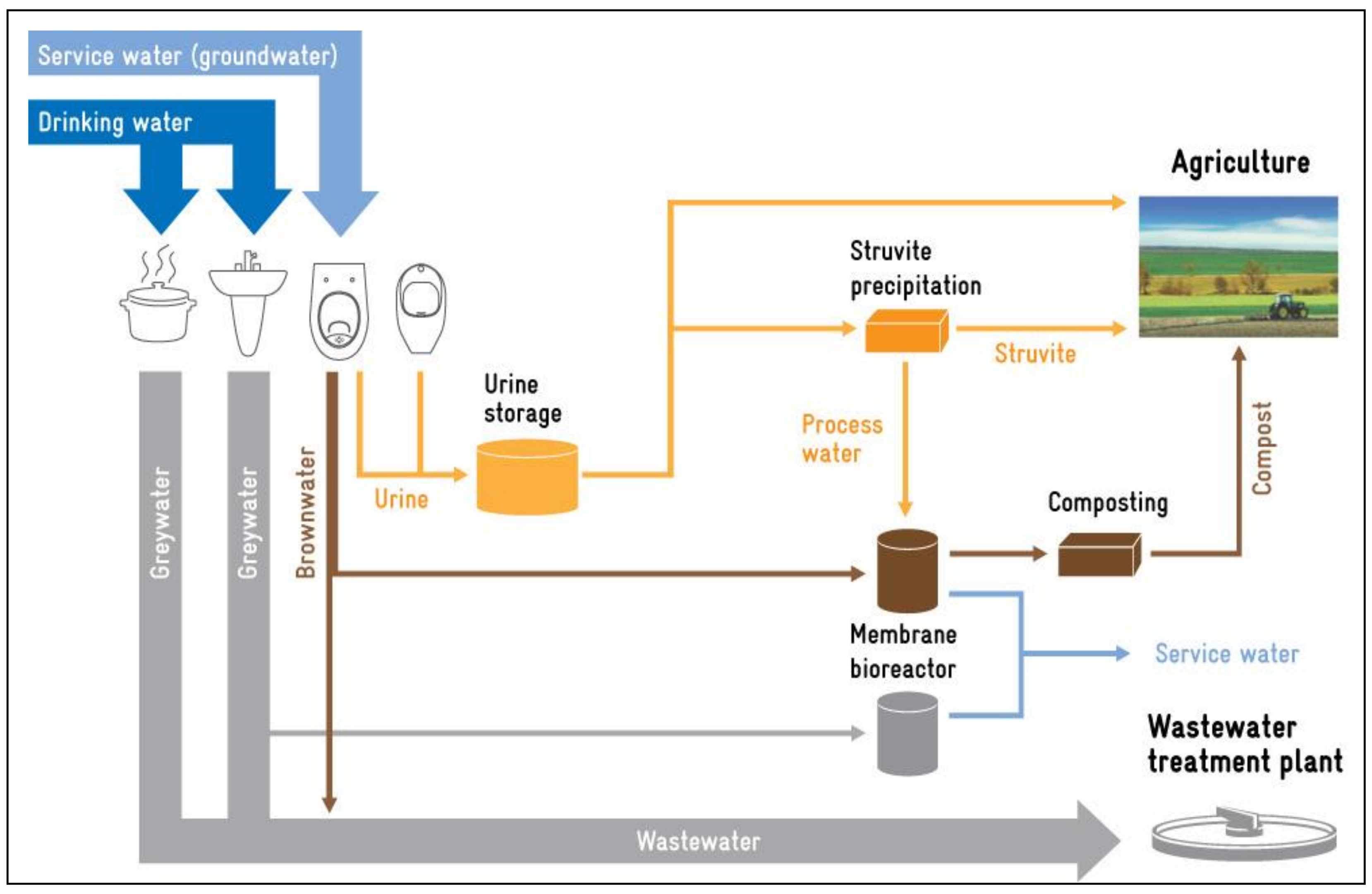

Figure 1 provides a system overview on the collection of the different wastewater streams and their respective treatment and recycling.

RESULTS AND DISCUSSION

Plant technology

Phosphorus recovery out of urine is achieved by struvite precipitation. During a typical week about 2,000 l of urine can be treated thus generating about 2.5 kg dried struvite. 95% of phosphate are recovered in the product on lab and 60% on pilot scale. For the treatment of brown- and greywater membrane bioreactors were chosen.

Product quality

The recovered struvite is applicable in agriculture and does not contain pharmaceutical residues or pathogens after washing.

The cleaned brown- and greywater reaches the EU bathing water standards and can be used as service water. Regarding brownwater an additional UV treatment is recommended to guarantee the product safety.

Figure 2 shows the harvest of summer wheat.

Agriculture

The fertilising effect of urine was reproved in field trials for summer wheat, barley, fava bean and maize. Additionally, the fertilising effect of MAP was shown. Moreover, the uptake of carbamazepine, a pharmaceutical “naturally” present in urine could be detected in wheat samples.

Social acceptance

The acceptance by users in the building and farmers was investigated. It became obvious that the users were unsatisfied with the NoMix toilets due to daily difficulties (2-3 flushes were necessary after usage, impression of untidiness). Nevertheless, the users clearly support the idea of this new approach of wastewater handling. Farmers, however, were quite positive towards the reuse of the products as long as safety concerns are fulfilled.

Economic feasibility

The dynamic project costs for the sanitary installations (toilet rooms and pipes) are 0.086 EUR/use compared to 0.071 EUR/use for a conventional one. The application costs of urine in agriculture are comparable to those of mineral fertiliser whereas struvite is a lot more expensive due to manual work required and installation costs of the treatment.

Figure 3 shows campaign to inform GIZ users.

CONCLUSION

The project proved that from the technical point of view the installation of a source separation system for/in an office building within an urban setting works well. Although the process of struvite recovery needs further elaboration to reduce costs. Depending on the legal situation, the products produced may be used as fertiliser and service water. However, the success or failure depends strongly on the acceptance by the users of the sanitary facilities.

PROJECT PARTNERS

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ACKNOWLEDGEMENT

This work is part of the project Sanitary Recycling Eschborn, short “SANIRESCH” supported by the BMBF (Federal Ministry of Education and Research, Germany), grant No. 02WD0947. More details are available here: www.saniresch.de/en.

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