SANIRESCH

Research Project SanitaryRecycling Eschborn (SANIRESCH)

Project component: Plant Technology

1. Introduction

The objective of the research project SANIRESCH is the treatment and utilisation of the different wastewater flows which are generated in the main building of GIZ in Eschborn: yellow-, brown-, greywater. The greywater and brownwater flows are treated in a MBR (membrane bioreactor) process, a combination of biological wastewater treatment and membrane ultrafiltration. A MAP (Magnesium-Ammonium-Phosphate) precipitation reactor is used to treat the urine. The main task of HUBER SE within this project has been the installation and process engineering optimisation of the complete technical equipment.

2.Wastewater treatment concept and equipment

During the comprehensive renovation of one building of the GIZ headquarters in Eschborn, the middle part of this building was equipped with separate pipe systems for yellow-, brown- and greywater. The wastewater flows are discharged via three lines which lead into a technical installation room on the basement floor of the building. Within the SANIRESCH project HUBER SE installed the technical plants for the recovery of nutrients (phosphorus and nitrogen) from yellowwater and the production of process water from grey- and brownwater (Figure 1):

- MAP precipitation reactor for yellowwater treatment.
- Collection tank with integrated mechanical pre-treatment system and membrane bioreactor for brownwater treatment.
- Collection tank with integrated mesh screen, membrane bioreactor (MBR) and process water storage tank for greywater treatment.

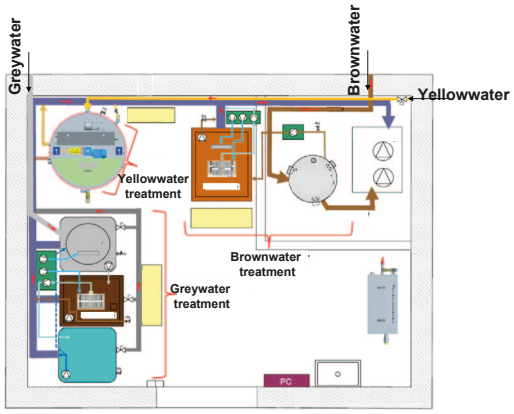
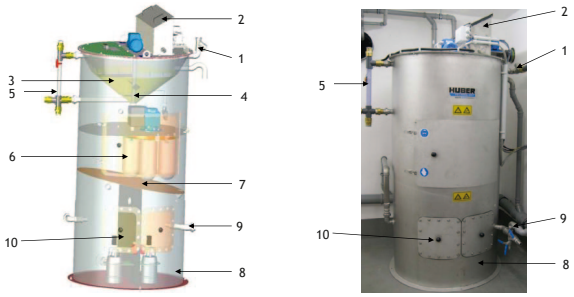


Figure 1: Potential hotspots for the implementation of all three analysed technologies.

2.1 Yellowwater treatment

The yellowwater is treated with a chemical-physical process in a MAP precipitation reactor which is specifically designed for the GIZ project requirements. By addition of powdery magnesium oxide (MgO) to undiluted or slightly diluted urine magnesium ammonium phosphate (MAP) in solid form is generated in the MAP precipitation process. This MAP is a high quality fertiliser which can be used in agriculture. The reactor consists of a precipitation tank with stirrer, a dosing system using bags and a filtration unit with filter bags (Figure 2 and Table 1).



1 Filler, 2 Dosing unit, 3 Precipitation tank (trough-shaped), 4 Stirrer, 5 Level probe, 6 Filter bag, 7 Collecting tray for process water, 8 Chamber for process water, 9 Outlet, 10 Inspection opening

Figure 2: HUBER MAP precipitation reactor installed in the technical installation room.

Table 1: Characteristic data of the MAP precipitation reactor.

Operation mode	Batch mode
Maximum amount of urine per cycle	50 l
Cycle duration (filling, stirring, sedimentation, draining supernatant urine, draining the urine enriched with MAP)	adjustable e.g. 135 min with 10 cycles a day

2.2 Brownwater treatment

A MBR plant with upstream mechanical pre-treatment system is used to treat the brownwater (Table 2). A small horizontal micro strainer with a 3 mm perforated plate retains coarse material and toilet paper. If required, the screenings can be collected separately to be composted. The prescreened brownwater is treated in a compact MBR with an integrated ultrafiltration unit to produce process water. Due to the high organics load (faeces) more aeration tank volume is required than in municipal MBR applications.

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Table 2: Characteristic data of the brownwater treatment system.

Pre-treatment	Perforation	3 mm diameter
Membrane	Pore size (nominal)	38 nm
	Membrane material	PES (polyether sulphone)
	Membrane surface	3.5 m^2
Volume	Collection tank	max. 400 l
	MBR tank	max. 700 l

2.3 Greywater treatment

The greywater from kitchens, hand wash basins and wash water sinks is treated with a mechanical pre-treatment system combined with the membrane bioreactor (Table 3). The mechanical pre-treatment system is a 3 mm mesh screen which retains disturbing coarse material and hair. The aerated collection tank serves as a buffer tank for the daily generated greywater volumes. It is in the compact MBR stage where the biological treatment of the pre-screened greywater takes place, followed by membrane ultrafiltration. The process water is stored and used to clean the mechanical pre-treatment system.

Table 3: Characteristic data of the greywater treatment system.

Pre-treatment	Mesh screen	3 mm
Membrane	Pore size (nominal)	38 nm
	Membrane material	PES (polyether sulphone)
	Membrane surface	3.5 m^2
Volume	Receiver tank	max. 480 l
	MBR tank	max. 500 l
	Process water storage tank	max. 480 l

3. Project specific requirements

A special challenge in this project has been the integration of the technical equipment into the existing building structure and remote control of the decentralised plants.

3.1 Equipment integration into the existing building structure

Only a small room (21 m^2) was most suitable to install the complete technical plants for the treatment of the individual wastewater flows. It was therefore a special challenge to integrate the equipment, including all associated pipelines, into the existing building structure. We planned in a way to ensure that access to the plants is possible at any time to carry out maintenance work, take samples or show the plants to visitors. Furthermore, all plant components are totally encased to avoid undesired odour annoyance during operation. All relevant technical DIN standards were taken into account when the installation work in the cellar room was carried out. We used preferably modular plant components which we adapted to suit the specific conditions in this office building in terms of size and design.

3.2 Control of operations including remote data transmission

Under this project the Technical University Mittelhessen (THM) was responsible for the operation of the complete technical installations. To ensure remote control of the automated plant operation the control systems of all plants are equipped with remote data transmission including fault reporting via SMS. This transmission technology provides access to all operating data of the decentralised plants from an external control station to evaluate their operating states. Regular data evaluation allows for the targeted control of equipment operation and early detection of certain trends. Undesired standstill times and extensive service work can be reduced to a minimum.

4. Summary

Under the SANIRESCH project the complete technical plant equipment for the treatment of yellow-, grey- and brownwater has successfully been integrated into the existing structure of the GIZ building in Eschborn. Due to the modular design of the plant components a high level of functionality could be achieved despite scarce space on site. To ensure remote equipment control the decentralised plants are equipped with remote data transmission including fault reporting via SMS. This minimises undesired standstill times and extensive service work. With the installation of these plants for the separate treatment of individual wastewater flows in the GIZ building HUBER SE has successfully contributed to establishing NASS (New Alternative Sanitation Systems) in existing buildings. Under this research project the basis has been laid for closing decentralised water and material loops in urban areas, with an office building as example. This demo project can constitute a new standard for future applications in so-called ‘green buildings’.

5. Acknowledgements

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