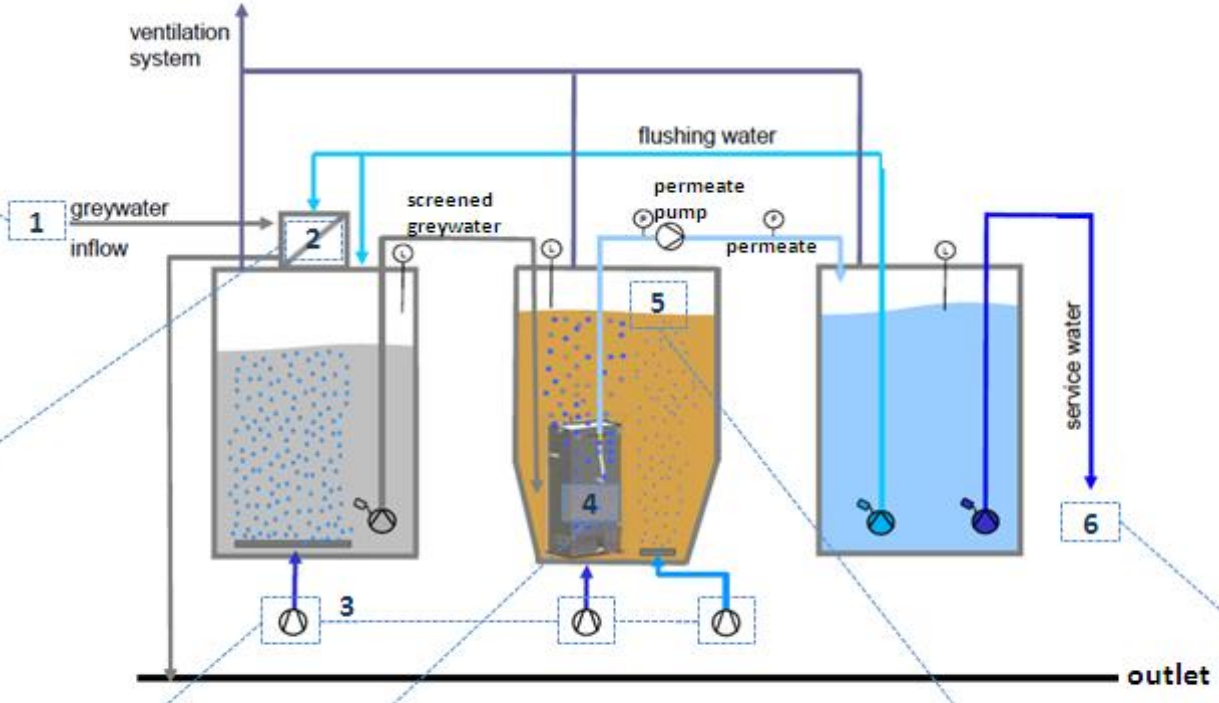
SANIRESCH - Greywater treatment plant (MBR)

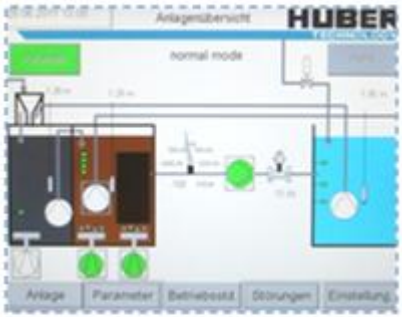
SANIRESCH

SPONSORED BY THE
Federal Ministry of Education and Research

Collection tank | Membrane bioreactor | Storage tank | Remote control

1 - Raw greywater
COD 450 - 1000 mg/l

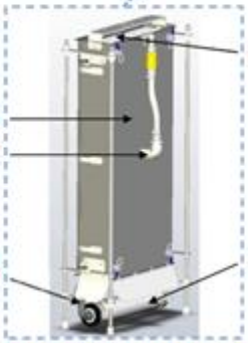




Control panel

2 - Preceding screen (3 mm)

3 - Aeration blowers



4 - Ultrafiltration module
Plate membrane 3.5 m² / pore size 38 nm

5 - Membrane bioreactor (MBR)
Volume of tank 480 l

6 - Permeate
280 l/day
COD < 30 mg/l

HUBER TECHNOLOGY | giz | THM | RWTH AACHEN UNIVERSITY | www.saniresch.de

Greywater treatment (MBR)

1. Technology

Source of greywater:	7 kitchenettes with sinks and dishwashers, 2 sinks, 19 hand washbasins in toilets rooms, 10 washbasins for cleaning purposes
Greywater $inflow_{average}$:	approx. 500 - 600 l/d
Flowrate of $permeate_{average}$:	approx. 480 l/d

1.1 Volume

Pretreatment tank:	480 l
Membrane $bioreactor_{average}$:	440 l (controlled by COD, TS and throughput)
Tank for service water:	480 l

1.2 Pretreatment

Mesh size of sieve:	3 mm
Cleaning of filter unit:	3 times per day for 10 s
Aeration of collection tank:	30 s/h (for mixing)
SS in filtrate:	120 - 220 mg/l

1.3 Membrane filtration module

Type of membrane:	Plate membrane (MembranClearBox ®)
Membrane surface & pore size:	3.5 m^2, 38 nm
Material of membrane:	PES (Polyethylensulfon)
Scouring $air_{regular}$:	continuously
Scouring $air_{energy\ saving}$:	60 s operation, 60 s break
Oxygen concentration:	8.1 mg/l
MBR feeding pump:	Automatically regulated according to filling level of MBR
Permeate pump:	16 h/d filtration: 270 s operation, 120 s break 8 h/d relaxation (no operation)
Operation of permeate $pump_{net}$:	11 h/d (taking breaks into account)
Flowrate of permeate:	26 l/h; equivalent 480 l/d (16 h of operation)
Transmembrane $pressure_{net}$:	
➢ average	-60 mbar
➢ maximum possible	-350 mbar
$Flux_{net}$:	(Flow rate of permeate through membrane)
➢ average	7 l/(h x m^2)
➢ maximum possible	30 l/(h x m^2)
Concentration of activated sludge:	5 g DM /l
Removal of surplus sludge:	40 l/week (automatically)

Greywater treatment (MBR)

2. Analyses*

	COD (mg/l)	N_{total} (mg/l)	NO_3-N (mg/l)	NH4-N (mg/l)	P_{total} (mg/l)
Inflow	620 ± 190	14.6 ± 5.5	0.7 ± 0.3	0.6 ± 0.06	19 ± 10
Permeate	29 ± 7.8	11.9 ± 4.9	6.8 ± 4.4	0.02 ± 0.02	15 ± 5

* Concentrations with 95% confidence intervals.

COD-removal efficiency:
95 %

Nutrient ratios in inflow:
C : N : P = 100 : 2.3 : 1.2

Effect of dishwasher tabs:

P_{total} - content (mg/l)	Inflow	Permeate
Containing phosphate	35 ± 7.7	16 ± 3.3
Not containing phosphate	19 ± 10	15 ± 5

3. Use of permeate

Possible areas of application:
(Complying with quality standards e.g. EU Bathing water directive)
Process water for toilet flushing, heating, air conditioning, wash machines, irrigation

Uses in GIZ:
Scouring for the pre-treatment of the brownwater plant

4. Time spent on operation

The standard operation requires one scheduled maintenance event per year at which time an effluent sampling can also be analysed. Due to the research activities the time consumption is calculated as follows:

Maintenance: 2 days every six months
Analysis: 3 - 4 h/week
Control of operation: 3 h (divided over 2 days per week)

5. Energy consumption

The energy consumption is related to the plant component membrane bioreactor (see figure). These are design values, because no measures were done. The energy consumption can be higher than normal due to research activities.

Energy consumption: 1.58 kWh/d (equivalent to 575 kWh/a)
Specific energy consumption: 5.3 kWh/m³
Energy costs: 145 €/a (0.25 €/kWh)

6. Investment costs (without pretreatment)

Container, plant unit, control unit, membrane module
5,990 € (net, ex factory)

7. Project partners (all in Germany)

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8. Contact

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