# SANIRESCH – Brownwater treatment plant

SANIRESCH

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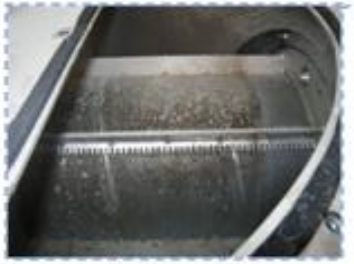
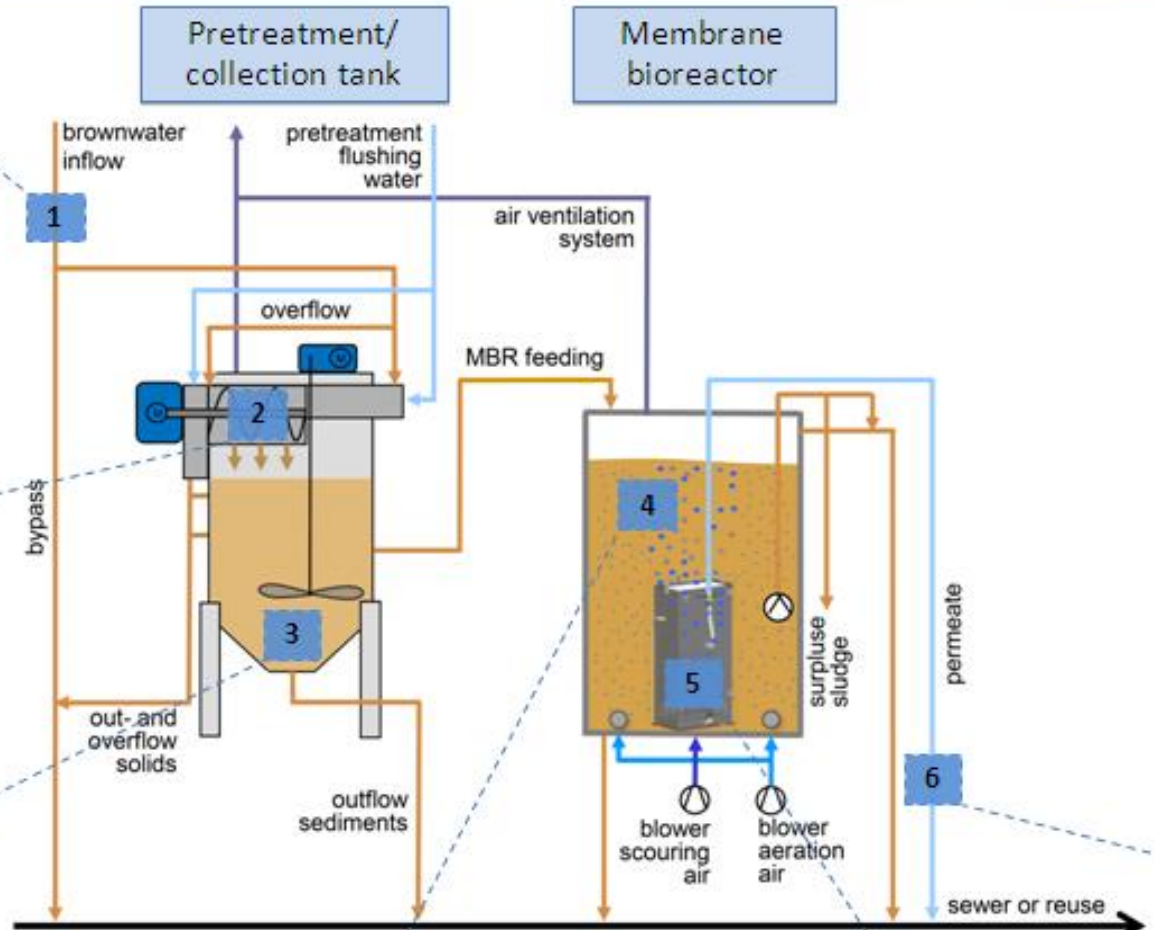
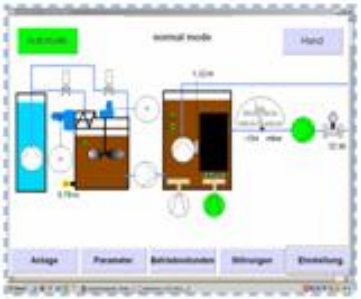
1 - Brownwater
From NoMix toilets: ~ 2000 l/d



2 - Screen basket with screw
For solids separation (hole size: 3 mm)

3 - Pretreatment tank
Volume of tank: ~ 400 l

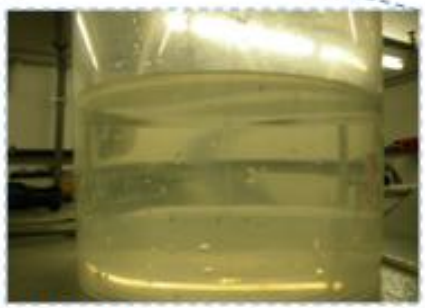


Control panel touch screen

4 - Membrane bioreactor
Volume of tank: 710 l


5 - Ultrafiltration module
Plate membrane: 3.5 m², pore size: 38 nm



6 - Permeate
Treated brownwater, COD: ~ 18 mg/l

HUBER TECHNOLOGY giz THM RWTH AACHEN UNIVERSITY

www.sanitesch.de

# Brownwater treatment (MBR)

## 1 Technology

| | |
|---|---|
| Source of brownwater: | 38 Urine diverting flush toilets (Model NoMix, Roediger Vacuum) and 14 conventional toilets (BW from 32 toilet is discharged via the sewer system) |
| Brownwater inflow$_{average}$: | 2300 l/d |
| Flowrate of permeate$_{average}$: | 725 l/d (Difference to the total daily brownwater inflow is discharged via the sewer system) |

### 1.1 Volume

| | |
|---|---|
| Pretreatment tank: | 400 l |
| Membrane bioreactor$_{average}$: | 670 l |

### 1.2 Pretreatment

| | |
|---|---|
| Hole size in the screenbasket: | 3 mm |
| Screen rotation$_{day}$: | 15 s operation, 60 s break |
| Screen rotation$_{night}$: | 15 s operation, 3600 s break |
| Flushing of screen: | 10 s inflow, 10 s break, 10 s outflow (10 times/24h) |
| SS in filtrate: | 400 - 450 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 (Polyethylensulfone) |
| Scouring air$_{regular}$: | continuously |
| Scouring air$_{energy\ saving}$: | 60 s operation, 60 s break |
| Oxygen concentration: | 6.3 mg/l |
| MBR feeding pump: | Automatically regulated according to filling level of MBR |
| Permeate pump: | 19 h/d filtration: 270 s operation, 30 s break<br>5 h/d relaxation (no operation) |
| Operation of permeate pump$_{net}$: | 17 h/d (taking breaks into account) |
| Flowrate of permeate: | 44 l/h; equivalent 725 l/d (19 h of operation) |
| Transmembrane pressure$_{net}$: | |
| ➢ average | -50 mbar |
| ➢ maximum possible | -350 mbar |
| Flux$_{net}$: | (Flow rate of permeate through membrane) |
| ➢ average | 12.6 l/(h x $m^2$) |
| ➢ maximum possible | 30 l/(h x $m^2$) |
| Concentration of activated sludge: | 5 - 11 g/l TS |
| Removal of excess sludge: | 15 l/week (automatically) |

### 1.4 Differences in operation of grey- and brownwater treatment

Apart from the pretreatment, the grey- and brownwater plants are technically similar. However, due to different characteristics of the influent the operation differs accordingly:

| | Permeate pump | Permeate flowrate |
|---|---|---|
| **Greywater treatment** | 270 s operation; 120 s break | 26 l/h |
| **Brownwater treatment** | 270 s operation; 30 s break | 44 l/h |

## 2 Analyses*

| | COD (mg/l) | $N_{total}$ (mg/l) | $NO_3$-N (mg/l) | $NH_4$-N (mg/l) | $P_{total}$ (mg/l) |
|---|---|---|---|---|---|
| **$Inflow_{after\ pretreatment}$** | 829 ± 236 | 63 ± 23 | 2.2 ± 1.1 | 42 ± 14 | 23 ± 7 |
| **Permeate** | 22 ± 7 | 66 ± 21 | 65 ± 21 | 0.02 ± 0.02 | 19 ± 9 |

* Concentrations with 95% confidence intervals

| | E. coli (n/100ml) | Intestinal enterococcus (n/100ml) | Coliform bacteria (n/100ml) |
|---|---|---|---|
| **Permeate** | 16 | 23 | 219 |

COD- removal efficiency:
**97 %**

Nutrient ratios in inflow:
**C : N : P = 100 : 8.6 : 1.3**

## 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, irrigation

Use in GIZ:
Due to technical reasons there is currently no reuse taking place.

## 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
Analyses: 3 - 4 h/week
Checking the operation: 3 h (divided over two days per week)

## 5 Energy consumption

The energy consumption is mainly due 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: 1.74 kWh/d (equivalent to 637 kWh/a)
Specific energy consumption: 2.9 kWh/m³
Energy costs: 159 €/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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92334 Berching

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## 8 Contact

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