On-site greywater treatment systems - influent and effluent quality

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Study Description

The dataset presented here consists of raw data on the quality of influent and effluent greywater from eight on-site greywater treatment systems situated in Södertälje municipality, Sweden. These on-site treatment systems included three types of commercially available package-plants and one sand filter. The influent and effluent samples were taken as grab samples between August 2020 and December 2021 and analysed for organic material, nutrients, pathogens, anionic surfactants, salt and (for wo of the eight on-site systems) microplastics. Supporting parameters, e.g. suspended solids and pH, are also included. Further, for microplastics, results from blank samples are included.

This dataset was used to evaluate the treatment efficiency of the on-site greywater treatment systems and to assess the suitability of the treated water for reuse.

Methods

Each treatment system was sampled on four to five occasions. The on-site systems had a septic tank followed by a biological treatment step. Influent greywater was sampled from the septic tank using a Ruttner sampler. The effluent sample (approximately 3L) was collected by placing a bucket at the outlet pipe. The pH, turbidity and conductivity of the samples were measured on site. For analysis of the other parameters (Table 1), samples were sent to external accredited laboratories, SGS Analytics Sweden and ALS Scandinavia.

For analysis of microplastics, two on-site systems were sampled three times. 1 L influent from the septic tank was collected while the effluent volume sampled varied and was up to 56 L. The effluent volumes sampled and filtered are presented in the dataset. The effluent samples were filtered on-site using 10 µm stainless steel filters which were transported to the laboratory at Luleå University of Technology for rinsing and sonicating before preparing a 250 ml sample for microplastics analysis. The samples were analysed at the external laboratory SGS Analytics Sweden. In addition, blanks were prepared, one using tap water to determine potential contamination by the filtration system used for filtering the effluents (system blank), one dry blank sample at each site to determine airborne microplastic contamination during sampling and filtration (dry blanks), and one blank for the Ruttner sampler used for influent collection. For further details about the sample preparation and microplastics analysis refer to the article in the publication section.

Analyses

Standard analytical methods were used for the analysis of the different parameters (Table 1). The pH was measured using a WTW pH3110 pH meter and SenTix®41 electrode. Turbidity was measured using the Hach 2100Qis turbidimeter and conductivity was measured using the WTW Cond 3110 meter with TetraCon®325 electrode. Samples for the analysis of dissolved organic carbon (DOC) and dissolved phosphorus (dissolvedTP) were filtered through 0.45 µm filters and analyzed as TOC and TP

For the microplastics analyses, the thermal extraction desorption gas chromatography-mass spectrometry (TED-GCMS) technique was used for the quantification of nine polymers: polyvinylchloride (PVC), polystyrene (PS), poly-ethylene-terephthalate (PET), polyethylene (PE), polycarbonate (PC), natural rubber/gum (NG), poly-methyl methacrylate (PMMA), polypropylene (PP), and polyamide 6 (PA6).

Table 1: Standards and methods used for analyzing greywater quality parameters.

Parameter	Methods
Total suspended solids, TSS (mg/l)	SS-EN 872 (modified)
Biological oxygen demand, BOD_7 (mg/l)	SS-EN ISO 5815-1:2019
Chemical oxygen demand, $COD_{(Cr)}$ (mg/l)	ISO 15705:2002
Total organic carbon, TOC (mg/l)	SS-EN 1484 utg 1
Total nitrogen, TN (mg/l)	SS-EN 12260:2004
Total phosphorus, TP (mg/l)	SS-EN ISO 15681-2:2018
Ammonium nitrogen, NH_4-N (mg/l)	ISO 15923-1:2013
Sodium, Na (mg/l)	ISO 11885 (acid digested)
Chloride, Cl (mg/l)	SS-EN ISO 10304-1:2009
E.coli (cfu/100 ml)	SS028167-2
Enterococci (cfu/100 ml)	SS-EN ISO 7899-2
Surfactants, (LAS) (mg/l)	CSN ISO 16265
Microplastics (µg)	*TED-GCMS analysis based on* Duemichen et al. (2019)

Variable Information (Greywater Characteristics_updated)

See Table 2 below.

References

Duemichen, E., Eisentraut, P., Celina, M., & Braun, U. (2019). Automated thermal extraction-desorption gas chromatography mass spectrometry: A multifunctional tool for comprehensive characterization of polymers and their degradation products. *J. Chromatogr. A*, *1592*, 133–142.

Table 2: Variable Information - Greywater Characteristics_updated

Column Header	Variable	Units
Sampling Date	Sampling Date	YYYY-MM-DD
Treatment Units	Treatment Units	(see Legends)
pH	pH	pH
Conductivity	Conductivity	µS/cm
Turbidity	Turbidity	FNU
TSS	Total Suspended Solids	mg/l
Cl	Chloride	mg/l
NH4-N	Ammonium	mg/l
TP	Total Phosphorus	mg/l
TN	Total Nitrogen	mg/l
NO3-N	Nitrates	mg/l
NO23-N	Nitrite-Nitrate	mg/l
NO2-N	Nitrite	mg/l
Na	Sodium	mg/l
BOD7	Biological Oxygen Demand (BOD_7)	mg/l
COD	Chemical Oxygen Demand	mg/l
TOC	Total Organic Carbon	mg/l
DOC	Dissolved Organic Carbon	mg/l
DissolvedTP	Dissolved Phosphorus	mg/l
Surfactants	Anionic Surfactants	mg/l
E. coli	E. coli	cfu/100ml
Enterococci	Enterococci	cfu/100ml
PVC	Polyvinylchloride	µg
PS	Polystyrene	µg
PET	Polyethylene terephthalate	µg
PE	Polyethylene	µg
PC	Polycarbonate	µg
NG	Natural Rubber/gum	µg
PMMA	Poly-methyl methacrylate	µg
PP	Polypropylene	µg
PA6	Polyamide 6	µg
VolumeSampled	Volume Sampled	L
VolumeFiltered	Volume Filtered	L

Legends:

In = Influent

Out = Effluent

ND = Not Detected

NA = Not Applicable

* Samples taken during the microplastics sampling campaign