Hygiene of greywater

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Greywater

- Wastewater formed from kitchen and bathroom, washings cloths, cleaning floors etc. (but no toilet waters).

Greywater

- Greywaters can be hot and partly they contain detergents which inactivate cell structure of microorganisms. Especially dish washing waters from dish machine are often hot with pH 10-11.
- Laundry waters often tend to be at 30-60^{o}C with modern textiles and detergents.
- Greywater from food processing can contain nutrients and be at 20-40^{o}C.

In Finnish rural areas

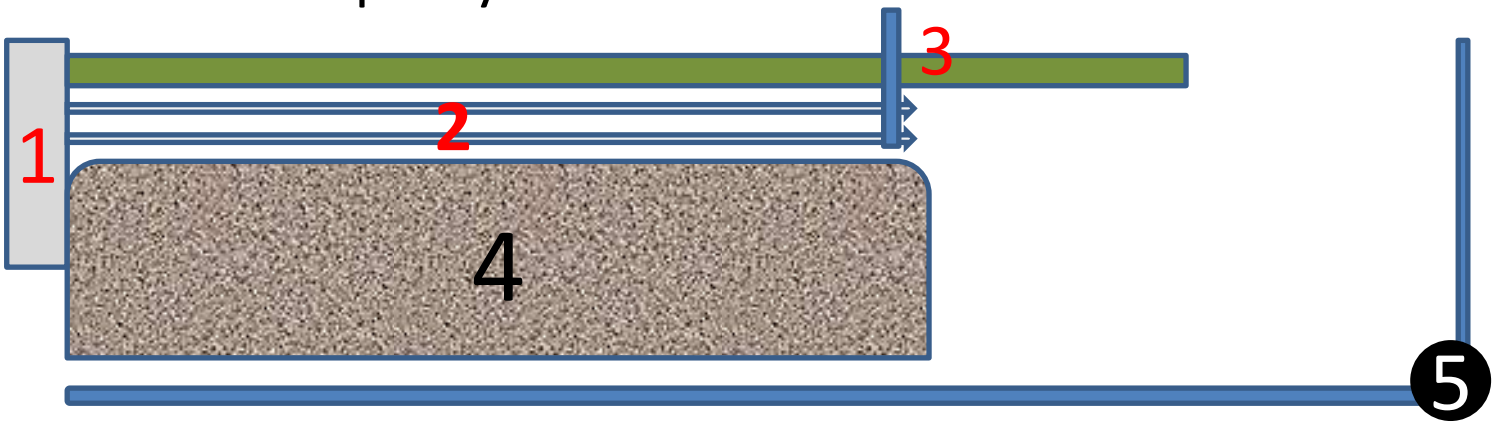
In the case a house is situated outside of wastewater treatment pipes, it must self treat the wastewaters with methods selected by it but which is shown to be effective.

Wastewater parameters	Assumed to be formed in a day by one person g	Must be reduced % (allowed to waters in a day g)	In specific areas must be reduced % (allowed to waters in a day g)
Organic matter	50	80 (10)	90 (5)
P	2.2	70 (0.7)	85 (0.3)
N	14	30 (9.8)	40 (8.4)

If the household has a dry toilet, it can reach these claims easily. Often these rural households have a soil filter to treat greywaters, which can be lead after that to surface waters or to soil.

Soil filters often scaled for 5 persons

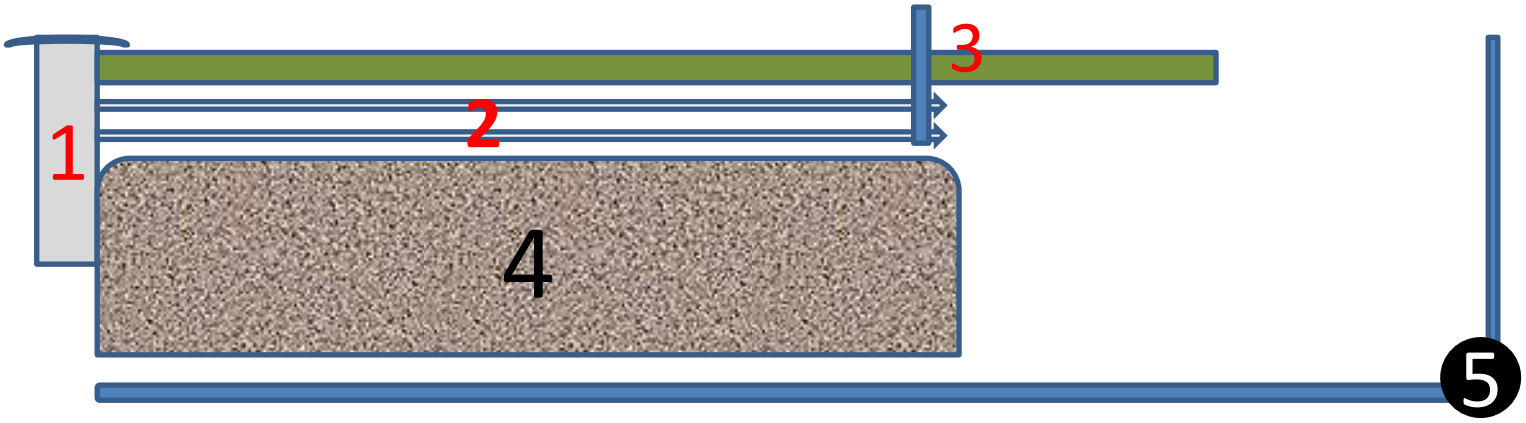
Wastewater is lead to a collection well (1). Then to diving percolated tubes (2) with aeration tube (3) and filtered through a course structure (sand, gravel) 4 and then pumped to surface waters (5). In the surface of gravel the microorganisms of biofilm degrade nutrients. The retention time is usually hours. What happens to pathogens if they enter to this simple system?



Soil filter sampling

Sampling of greywaters is difficult, since outlet pipes for the treated wastewater are narrow. Waste water influent sampling from collection well (1) is sometimes possible without touching to the walls.

Two households with covered wells, both in North Savo so that the driving to laboratory took a few hours. Sampling influents in May and August.



Microbiological analyses

- ✓ *Escherichia coli* (ChromoCult + Kovacs indole test)
- ✓ Enterococci (Slanetz-Bartley)
- ✓ Sulphite reducing clostridia spores (sulphite-iron agar after heat treatment + anaerobic incubation)
- ✓ F-specific coliphages (host ATCC 15997, single agar technique)
- ✓ Heterotrophs (R2A-agar)

Results

The numbers of indicator microorganisms and the heterotrophs in 100 ml of collection well of grey wastewaters. The detection limit is 1 CFU or PFU in 100 ml.

House-hold	Date	***E. coli***	Entero-cocci	Clost-ridia	F-specific coli-phages	Heterotrophs
Ra	May 6th	**3 200 000**	**2 300**	50	**25**	100 000 000
Ra	Aug 19th	**400 000 000**	**36 000**	<1	<1	250 000 000
Ku	May 6th	**95 000**	**11 000**	50	**25**	25 000 000
Ku	Aug 19th	**2 000 000**	**5 500**	<1	<1	430 000 000
Geo mean		**4 000 000**	**8400**	5	4	130 000 000

Faecal contamination of greywaters was very clear in all samples in both households and in both sampling time.

Only in May:
Coliphages were found only in May in both greywaters (all people do not emit them). Clostridia, which usually can survive well.

Found also in a Swedish study with E. coli and enterococci.

But how?

Children, patients, old people?

- Washing the anal area of small children after defecation? Washing the napkins faecally contaminated.
- Faecally contaminated cloths?

- OR PET ANIMALS? Cats, birds, rodents…

Other reasons

- **Washing dirty boots after walking in mud where dogs had run.**

Still

- If the families use to fish and the alimentary tract content of fish can contaminate the kitchen wastewater.
- Hunting birds in August (not in May) and their alimentary tract.

- In one case – NOT INCLUDED TO THIS EXPERIMENT – the urine of separating toilet was lead to greywater!
- If dry toilet is not a real dry toilet so that there is leachate this leachate could contain even 7 000 000 *E. coli*/100 ml.

As conclusion

- Greywaters need a treatment.
- They cannot be lead directly to a area where children play or if there is a risk to contaminate wells used for drinking.
- Greywaters cannot be used as irrigation water without any treatments for plants eaten without cooking due to microbiological reasons.
- Risks are higher at cold climate than at tropics.
- More studies should be done in order to know the quality of greywaters.