



Compost Filters

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~~Depending on the initial situations and respective local circumstances, there is no guarantee that single measures described in the toolbox will make the local water and sanitation system more sustainable. The main aim of the SSWM Toolbox is to be a reference tool to provide ideas for improving the local water and sanitation situation in a sustainable manner. Results depend largely on the respective situation and the implementation and combination of the measures described. An in-depth analysis of respective advantages and disadvantages and the suitability of the measure is necessary in every single case. We do not assume any responsibility for and make no warranty with respect to the results that may be obtained from the use of the information provided.~~



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1. Concept

Introduction

- Relatively new pre-treatment method for household waste water
- Mainly used for decentralised wastewater treatment facilities for small communities (e.g. after a simplified sewer system or as an on-site treatment, typically applied prior to constructed wetlands)
- Aerobic process → no biogas emission (in contrast to septic tanks), no bad odours
- Two different types:
 - **Two Chamber Compost Filter**
 - **Compost Filter Bags**

1. Concept

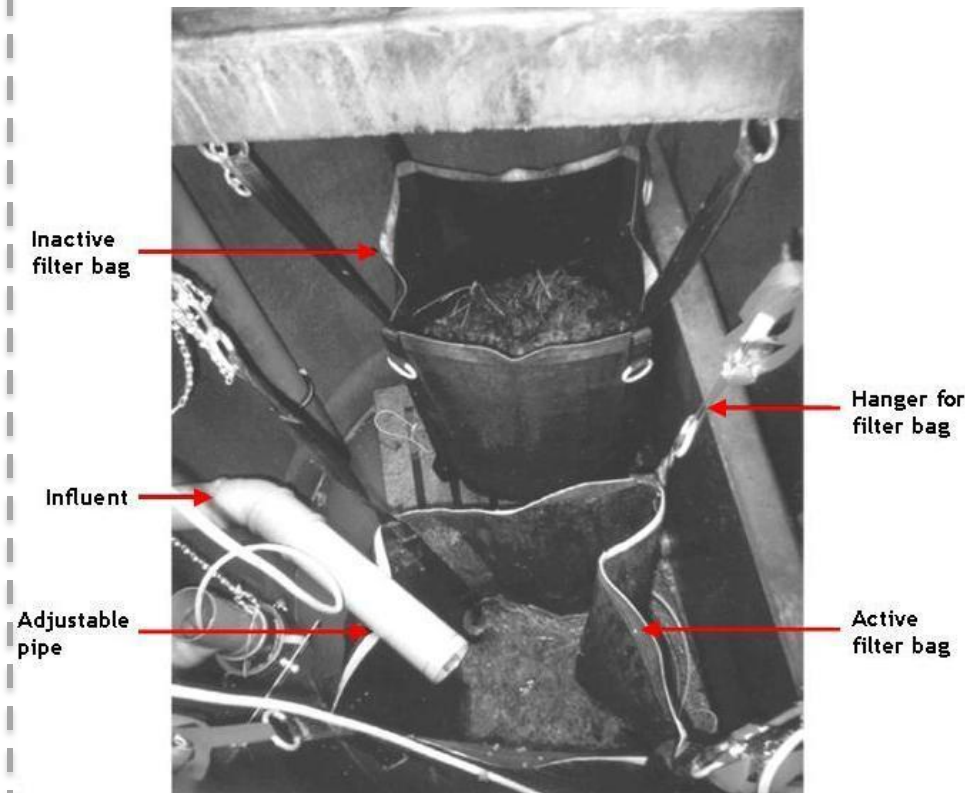
Compost Filter Types

Two Chamber Compost Filter



Source: STAUFFER (2011)

Compost Filter Bags



Source: GAJUREL (2003)

2. How it can optimise SSWM

Reuse Water and Nutrients



Low flush toilet with urine diversion, vacuum toilet, etc.; shower, kitchen sink, etc.

Urine diversion



Compost Filter

Liquid effluent:
constructed wetland



Produce high quality fertiliser!!



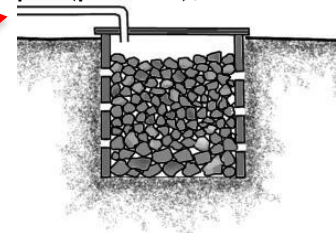
Solid material: Humus after secondary composting



Upgrade your soil quality and reuse treated wastewater for irrigation!!



Proper discharge:
Groundwater recharge, local surface water source, soak pit (picture), etc.



Irrigation water

Source: B. STAUFFER (2009/2010)

3. Design Principals

Main Components

- **Two Chamber Compost Filter:**
 - Two concrete chambers - one is in use (wastewater is passing through the filter layers).
 - The second (and already filled chamber) is dewatered and successively decomposed.
- **Filter Bags:**
 - Hanging bags act as compost filter. Liquid is collected below the bags, solids are retained by a strawbed.
 - The inactive bag is dewatered and successively decomposed.

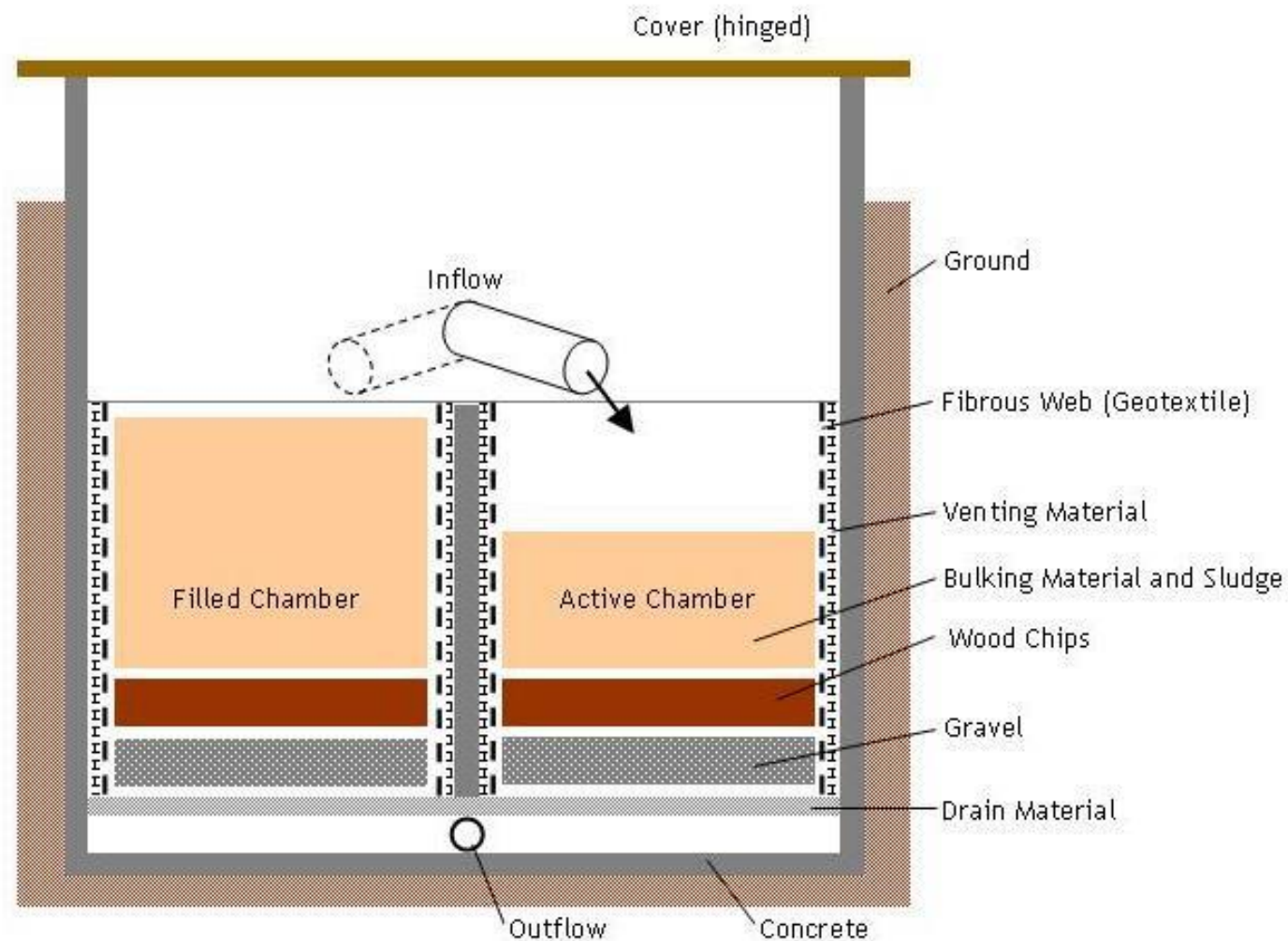
3. Design Principals

Two Chamber Compost Filter (Source: BALLY & BITTNER 2009)

- Correct filter medium is important:
 - Too coarse → bad filtering effect
 - Too small grained → clogging
- Low oxygen consumption due to a short filter passage
- High O₂ percentage in wastewater supports microbiological process in subsequent CW
- Well experienced pre-treatment solution up to 40 p.e. (persons equivalents)

3. Design Principals

Two Chamber Compost Filter



Source: STAUFFER (2010) adapted from LACK (2006)

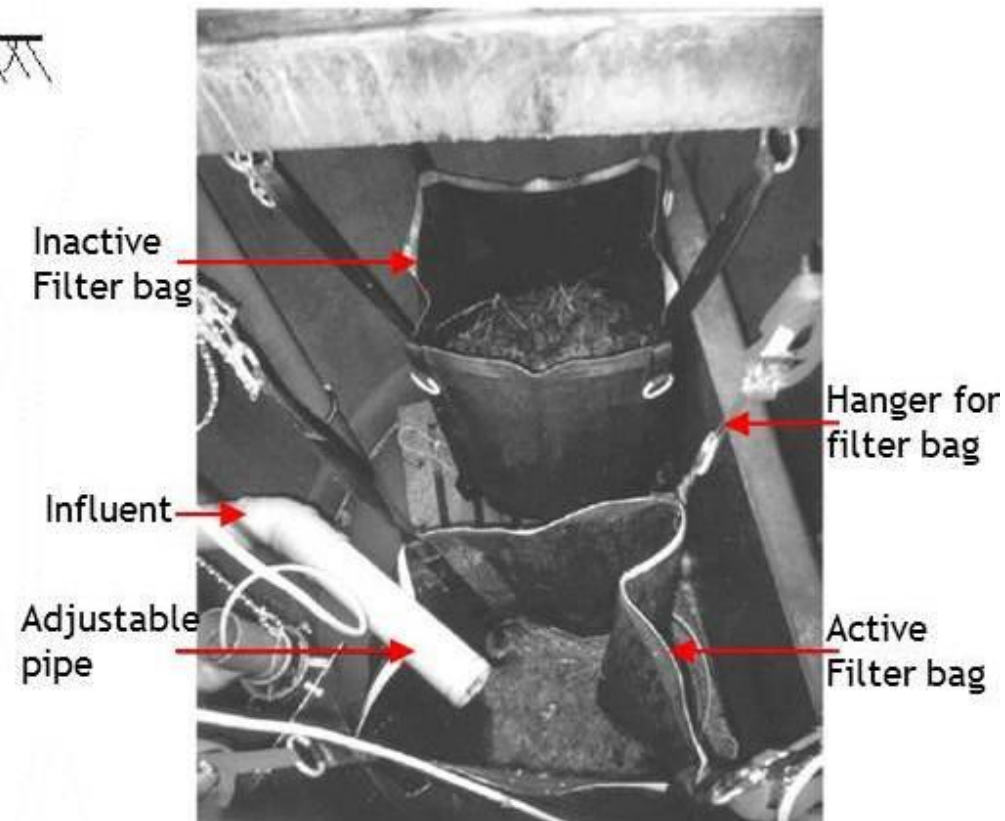
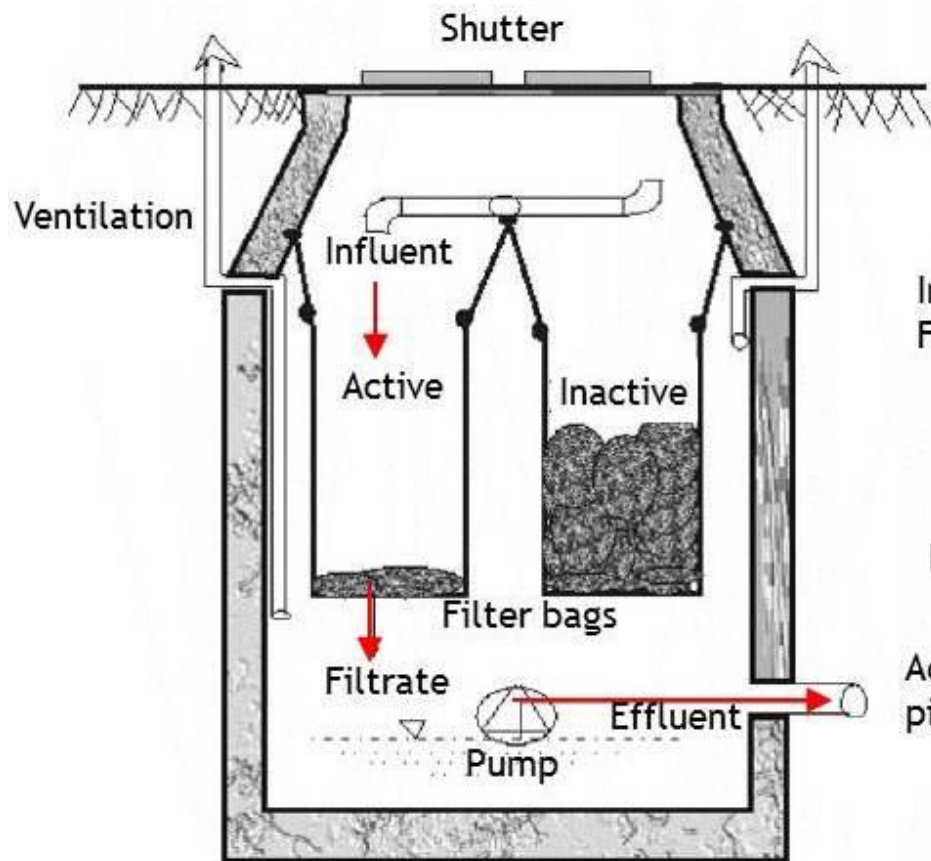
3. Design Principals

Compost Filter Bags Source: HOFMANN et al. (2010)

- Filter bags made out of plastic (reusable after emptying)
- Filter bags are hanging in a ventilated chamber
- Solid components (e.g. faeces, toilet paper) stay in the straw bed of the filter
- Liquid effluent is collected below the bags and pumped to the second treatment stage
- Well working pre-treatment solution up to 40 p.e. (so far the experience)

3. Design Principals

Compost Filter Bags



Source: GAJUREL (2003)

4. Treatment Efficiency

Pollution Removal

- Solid sludge (e.g. faeces, organic household waste) and bulking material (e.g. straw, wood chips) decompose to a humus like material (humanure).
- But the solid material still contains pathogen. (HOFFMANN et al. 2010)
→ Secondary (co-)composting is necessary.
- Liquid effluent is still highly infectious (avoid contact).
→ Further treatment, usually in a constructed wetland.



Left: composting human faeces in Al Alto, Bolivia. Source: SUSANA on Flickr (2012)

Right: composting chamber for excreta, toilet paper and organic household waste in Hamburg-Allermöhe, Germany. Source: SUSANA on Flickr (2012)



4. Treatment Efficiency

Health Aspect

- A compost filter is a pre-treatment facility, i.e. effluents need further treatment
- The active chamber contains hazardous organic material (excreta)
- If there is any operation or maintenance, the operator should wear gloves
- The compost filter and man holes should be covered all the time to protect it from precipitation and avoid accidents.



Liquid Effluent of the compost filter before it is pumped into the CW. It still contains pathogens and is high infectious. Source: STAUFFER (2009)

5. Operation and Maintenance

Two Chamber Compost Filter

- Dry material such as straw or wood chips must be added weekly to monthly (arranged all over the filter surface)
- Clogging (overflow) should be avoided (this leads to anaerobe conditions)

Compost Filter Bags

- Once a week dry straw has to be added
- Two to four filter bags are used in alternating modes in two separate chambers
- Retained solids are composted during the resting phase of 6 months, during which the second bag is used.

6. Applicability

- Suitable for domestic waste- or greywater with high organic load (e.g. blackwater, brownwater from vacuum or low-flush toilets)
- Usually designed as a first stage of waste water treatment in combination with constructed wetlands
- So far constructed up to 70 p.e.
- Also works for areas with colder climates (e.g. Switzerland, Germany)
- Community/household can produce its own compost and fertiliser



On-site treatment system in Switzerland for 36 p.e. Covered compost filter (left), covered pump shaft and vertical flow constructed wetland as a last treatment step (right). Source: STAUFFER (2009)

7. Pros' and Cons'

Advantages:

- The effluent (filtrate) from a compost filter has no unpleasant odour and no biogas production compared to anaerobic pre-treatment systems (e.g. septic tanks)
- Produces compost that can be used for gardening or farming
- No expensive sewer connection to a centralised treatment plant
- Can be operated and maintained by everyone after a short training

Advantages:

- Needs more “hands-on” maintenance than other on-site pre-treatment methods (e.g. septic tank)
- Use is limited to small units
- Clogging may occur, usually due to having selected the wrong filter bags or substrate or due to bad maintenance
- The leachate (liquid effluent) requires further treatment

8. References

BALLY, A.; BITTNER, K. (2009): Pflanzenkläranlagen - Die ökologische Alternative zur technischen Kleinkläranlage. In: Fachzeitschrift "Verein für Ingenieurbioogie" 4/09, 80-85. URL: <http://www.bicon-ag.com/pflanzenklaeranlagen/BiCon-Klaeranlagen4.pdf> [Accessed: 14.11.2011]

GAJUREL, D.R.; LI, Z.; OTTERPOHL, R. (2010): Investigation of the Effectiveness of Source Control Sanitation Concepts Including Pre-Treatment with Rottebehaelter. In: Water Science and Technology 48, 111-118. URL: http://www.netssaf.net/typo3conf/ext/naw_securedl/secure.php?u=0&file=uploads/media/Investigation_of_the_effectiveness_of_source_control.pdf&t=1321351738&hash=f76f66f36afcf87580218a6eebb2f4bc [Accessed: 09.11.2011]

HOFFMANN, H.; PLATZER, C.; WINKER, M.; MUENCH, E., v.; GTZ (Editor) (2011): Technology Review of Constructed Wetlands. Subsurface Flow Constructed Wetlands for Greywater and Domestic Wastewater Treatment. Eschborn: Deutsche Gesellschaft für Technische Zusammenarbeit GmbH (GTZ) Sustainable sanitation - ecosan program. URL: <http://www.gtz.de/en/dokumente/giz2011-en-technology-review-constructed-wetlands.pdf> [Accessed: 14.11.2011].

LACK, W. (2006): Abwasserreinigung mit Pflanzen - Bau für 4 bis 400 Einwohner. Stauffen bei Freiburg: Ökobuch Verlag.



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