Faecal Sludge Management (FSM)

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2 authors:

Martin Strauss
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Faecal Sludge Management (FSM)

Martin Strauss, martin.strauss@eawag.ch
Doulaye Koné, doulaye.kone@eawag.ch

FSM – A Must to Avoid Pitfalls in Sanitation!

[see end of article for list of acronyms and abbreviations]

Though a vast majority of urban dwellers in developing countries will continue to depend on on-site sanitation installations and on pit emptying services, many stakeholders in urban sanitation still regard sewered sanitation as the standard and exclusive solution to the urban "shit drama". Others promote and implement on-site sanitation programmes, yet forget to cater to an improved and sustainable collection, use or disposal of pit or vault contents. This leads to pitfalls or own-goals in urban sanitation upgrading. SANDEC has recently intensified its support and field research on the institutional and financial aspects of FSM. Technical research on treatment options of the contents (so-called faecal sludges, FS) of on-site sanitation installations also continued. SANDEC plans to increase its focus on building the capacity of selected institutions and professionals, and disseminating FSM knowledge in the years to come.

Field Research Update and Outlook

Treatment options

Collaborative field research on low-cost FS treatment options comprised:

- co-treatment of septage and wastewater in waste stabilisation ponds (including pretreating FS in settling/anaerobic ponds); collaborating partner: CIS/UNR;
- septage treatment in constructed wetlands (Photo 1; sludge humification; partner: AIT);
- FS dewatering on unplanted sludge drying beds (Photo 2; partners: IWMI/ KNUST/ KMA);
- combined composting (co-composting) of dewatered FS and organic solid waste (partners: IWMI/KNUST/KMA).

Tentative guidance on design and expected performance is now available (Table 1; selected processes and options only). The options are free of process-related, permanent mechanical equipment except for solids removal accumulated in primary settling-thickening units or for pumping FS liquids, if gravity flow is not possible.

Photo 1: Cattail-planted constructed wetlands

Photo 2: Sludge drying beds (Kumasi)

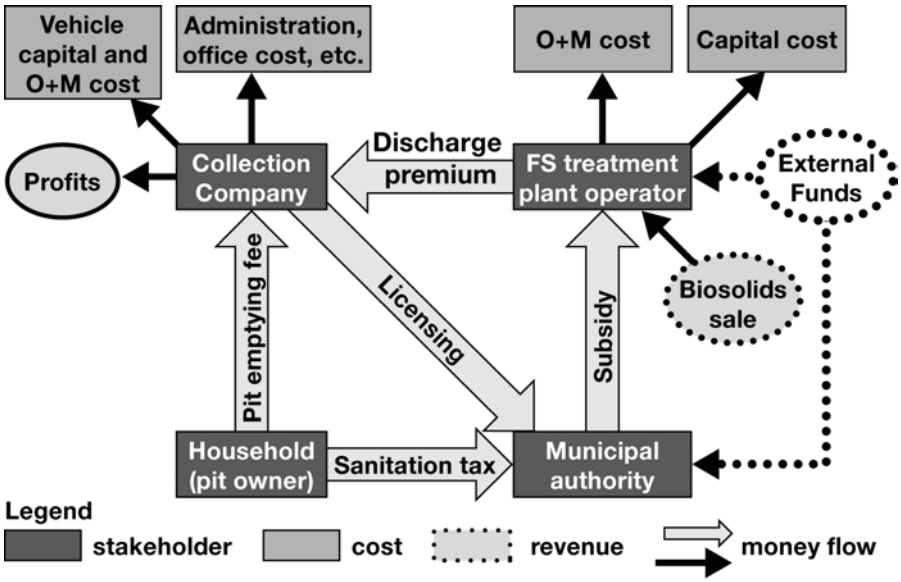

Figure 1: Money flux and stakeholder relationship tool for iFSM (Discharge premium arrow: paying the FS haulers rather than charging them – an incentive-based regulatory tool)

Future collaborative treatment research will focus on expanding the use of constructed wetlands to treat FS other than septage, and use of macrophytes other than *Typha*, and on evaluating different filter bed characteristics and configurations in sludge drying beds.

Financial/Institutional Aspects

The two major challenges associated with improving FSM consist in ensuring that FS is transported to the appropriate (treatment) site, and that the biosolids produced from treated FS are marketable to local, urban and peri-urban farmers or other potential buyers. Identifying, analysing roles, seeking advice of and concerting with key stakeholders - households, FS collection entrepreneurs, municipal and national sanitation authorities, farmers - are essential factors to meeting these challenges. Establishing sound financial structures and flows is a further important prerequisite. The "money flux" model illustrated in Figure 1 can be used as an FS management planning tool.

For all FS to be delivered to the treatment sites, we propose the special strategic element of reimbursing rather than charging FS haulers (Steiner *et al.* 2002; Jeuland 2002; Blunier 2004; Koanda 2004). This regulatory market tool is likely to curb indiscriminate FS dumping and, thus, reduce public health risks and water pollution. The costs of the treatment plant operations must be covered by licensing fees, sanitation taxes, proceeds from the sale of treated biosolids, and/or from subsidies.

Table 1: Selected Options for (Pre)treating Faecal Sludges: Design Criteria and Expected Removal Efficiencies

Treatment process or option	Design and operational criteria	Treatment goals and achievable performance		
		Solids-liquid separation	Removal of organic pollutants in liquid fraction	Removal of parasites (helminth eggs)
Settling/ anaerobic ponds	300-600g $BOD_5/m^3/d$ HRT[1]: ≥ 15 days SAR[2]: 0.02 m^3/m^3 (Rosario) and 0.13 m^3/m^3 (Accra)	BOD_5 > 60-70%	Filtered BOD_5 > 50%	Eggs concentrated in the settled and floating solids
Constructed wetlands (planted drying beds)	≤ 250 kg TS/m^2/year SAR: 20 cm/year (Bangkok; *Typha augustifolia* - cattail); bed permeability unimpaired for 7 years; vent piping required	SS > 80 %	To be treated in ponds or constructed wetlands for enhanced BOD, nutrients or pathogen removal	100% retained on top of the filter media
Co-composting	Dewatered FS (TS = 20-25 %): organic solid waste = 3:1 – 2:1 (vol. ratio) Windrow turning @ 10 days' interval for 8 weeks	- Compost maturity reached after 10-12 weeks - Heavy metal concentrations in compost meet the standards of industrialised countries		No. of viable eggs < reuse guideline

[1] *HRT: Hydraulic retention time*

[2] *SAR: Solids Accumulation Rate*

The entire scheme is sustainable only if:

- households can afford pit emptying
- enterprises can make a profit while adhering to the rules and regulations
- treatment operations meet the established treatment objectives and are profitable or operated at least cost
- the responsible authority can achieve sustainable iFSM at minimal costs.

Photo 3: Private entrepreneurs – stewards for clean cities

SANDEC has conducted financial assessment studies on FS collection enterprises in Bamako (Mali), Ouahigouya (Burkina Faso) and Kumasi (Ghana). The studies reveal that FS collection is a profitable business if haulage distances remain short and if licensing fees and sanitation taxes levied by public entities are channelled back to subsidise the system. In West Africa for example, private entrepreneurs (Photo 3) have taken the lead in managing the stewardship for safeguarding the urban environment through well-managed FS collection (Jeuland 2004). In Ouahigouya (Burkina Faso), a PhD study is in progress to devise stakeholder involvement methods and a methodology to evaluate strategic scenarios for iFSM as an integral component of urban sanitation upgrading (Koanda *et al*. 2004). Furthermore, SANDEC is investigating the impact of stakeholder involvement on iFSM sustainability.

Dissemination, Training and Competence Building

An increasing number of national and municipal authorities, including external support agencies feel the need to improve FSM. We are responding to this need by strengthening our efforts to assist selected institutions in building expertise on technical and managerial aspects as well as on monitoring and applied research in FSM.

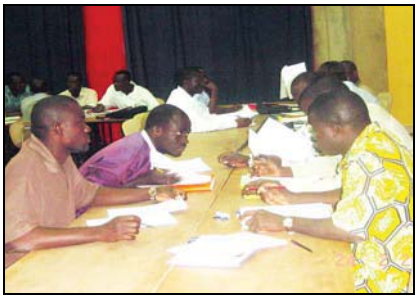

Photo 4: Training of trainers – key elements in building professional competence

The specific ongoing activities comprise:

- Producing guidance documents and briefs on technical and non-technical aspects of FSM.
- Developing training modules and training professionals and trainers in FSM (Photo 4).
- Identifying institutions in the South interested in developing FSM expertise and assisting them in their efforts.
- Liaising with multilateral and bilateral support agencies, often key players, in formulating urban sanitation strategies.

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Acronyms and Abbreviations

AIT	Asian Inst. of Technology (Bangkok, Thailand)
CIS/UNR	Centro de Ingeniería Sanitaria, Univ. Nacional de Rosario (Argentina)
FS	Faecal sludges
FSM	Faecal sludge management
iFSM	Improved FS management
IWMI	Inter. Water Management Institute (Africa Office)
KMA	Kumasi Metropolitan Assembly (Ghana)
KNUST	Kwame Nkrumah Univ. of Science & Tech. (Kumasi, Ghana)

Photo 5: Ghanaian sanitation experts and treatment plant operator at an FS treatment plant in Ghana (left: FS settling-thickening tank; right: stabilization pond for settling tank supernatant)