Waste Water Management: Recycle and Reuse

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Management of water resources is the biggest challenge

* How do we face it ???
* Obviously conservation of resources, judicious use of water resources
* Rain water harvesting
* Controlling pollution of water bodies caused by indiscriminate disposal of municipal waste water and industrial pollutants
* Recycling of waste water to the extent possible

This last point is our topic today

Waste water management: essential for controlling pollution

* Waste water can be categorized into municipal / domestic and commercial / trade / industrial
* All of these need to be disposed in scientific manner
* Waste water, from whatever source, can be a source of severe environmental pollution and a health hazard
* Appropriate disposal is very important

Recycling and reuse of waste water

* The world of waste water management has moved a full cycle in about 100 years
* The journey started with the ubiquitous septic tank in 1860, moved up to increasingly centralized and large sewerage system and then it was realised that more water and more energy was being consumed in the process
* The kind of planning and executing capability required to construct hundreds of kilometres of sewer lines and maintain them for 3-4 decades is not happening in developing countries

Municipal waste water

* In our high aspiration of having a sewerage system everywhere, we tend to forget the basic premises on which this system is based
* Minimum 100 lpcd water availability, proper plumbing, laying of the sewer drains for long stretches with proper leak proof fitting and gradient and finally constructing an appropriate sewage treatment plant (STP) – these are very real challenges
* Laying sewer drains as a ‘post script’ is another formidable challenge
* Then comes the issue of operation and maintenance for the sewer line as well as the STP

Municipal waste water

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* So, how do we deal with the situation?
* Fortunately it has been realized that reversing the trend from centralized to de-centralized may have the answers
* At the same time there has been a shift towards reducing energy requirement by depending more on the biological processes
* Countries with predominantly tropical climate have an edge over the temperate ones

Municipal waste water

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* The famous book ‘Sewage Treatment in Hot Climates’ by Duncan Mara from the University of Dundee (1976) opened a new chapter
* Very fortunately, Duncan Mara had visited our facilities at Patna
* In this book Duncan Mara broached the subject of waste stabilization ponds, aerated lagoons, oxidation ditches, high rate biofiltration and effluent reuse
* And the band wagon moved on to ‘small bore sewer’ for decentralized application, especially for high density areas

Development of decentralized systems

* The latest **'Manual on Sewerage and Sewage Treatment Systems'** published by the Ministry of Urban Development, Government of India, 2013 has included a chapter on **'Decentralized Sewerage System'**, Chapter 8 and **'On-site Sanitation'**, Chapter 9

* This is of great significance although it takes a long time to get percolated into Government programs in departmental tenders
* Small bore sewer has been included
* Interestingly, public toilets have been described as 'a further decentralization within decentralized sewerage'

Development of decentralized systems

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Some of the options for disposal of waste water are:

* Septic tank (the classic solution but with lots of limitations)
* Biogas plant (different scale application possible)
* DEWATS (decentralized waste water treatment system) baffled septic tank and anaerobic filter stand out as more plausible solutions of DEWATS; small bore sewer can be used for linkage with the toilets)
* Soil Biotechnology (SBT) developed by IIT, Bombay
* Stabilization ponds etc.

Land requirement for the various systems

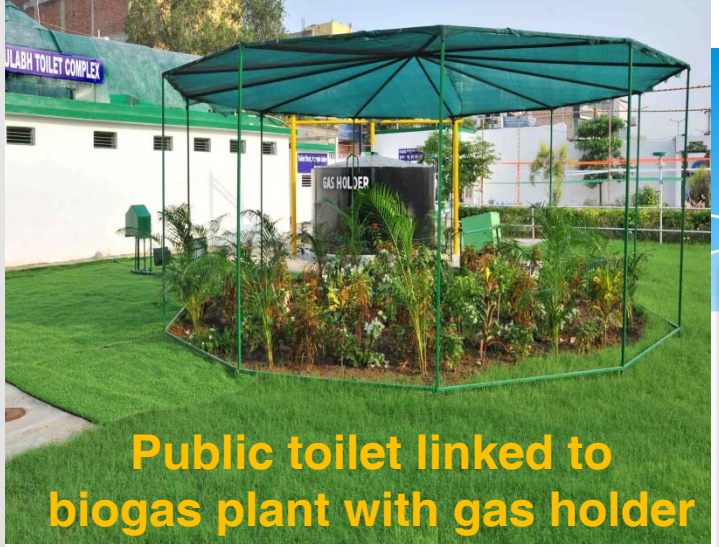
Land requirement:

* Septic tank – 0.5 m^2 / m^3 daily flow
* Baffled Septic tank / Anaerobic filter – 1 m^2 / m^3 daily flow
* Constructed wetland - 30 m^2 / m^3 daily flow
* Anaerobic ponds – 4 m^2 / m^3 daily flow
* Facultative aerobic ponds – 25 m^2 / m^3 daily flow

Decentralized systems

* Land and water availability are important determinants for choice of a system
* Our organization has worked on biogas technology, duckweed (aqua-culture) and DEWATS

- Human excreta recycled resulting in the production of biogas.
- Used for cooking, lighting, electricity generation & warming oneself in winter.
- 200 biogas plants of 35-60 cubic meter capacity constructed in different parts of India and 5 places in Afghanistan.



Public toilet linked to biogas plant with gas holder

HUMAN EXCRETA BASED BIOGAS PLANT


His Excellency Timothy J. Roemer former, Ambassador of USA to India trying his hand in frying a papadam.

USES OF BIOGAS

Her Royal Highness Princess Mathilde of Belgium, lighting the mantle lamp which uses biogas from the Sulabh Toilet Complex as the source of energy.

His Excellency Mr. Richard R. Verma, US Ambassador to India, watching an engine which ignites on battery to convert biogas into electricity

His Excellency Mr. Richard R. Verma, US Ambassador to India watching a demonstration of the Sulabh biogas being used as heating agent and warmer.

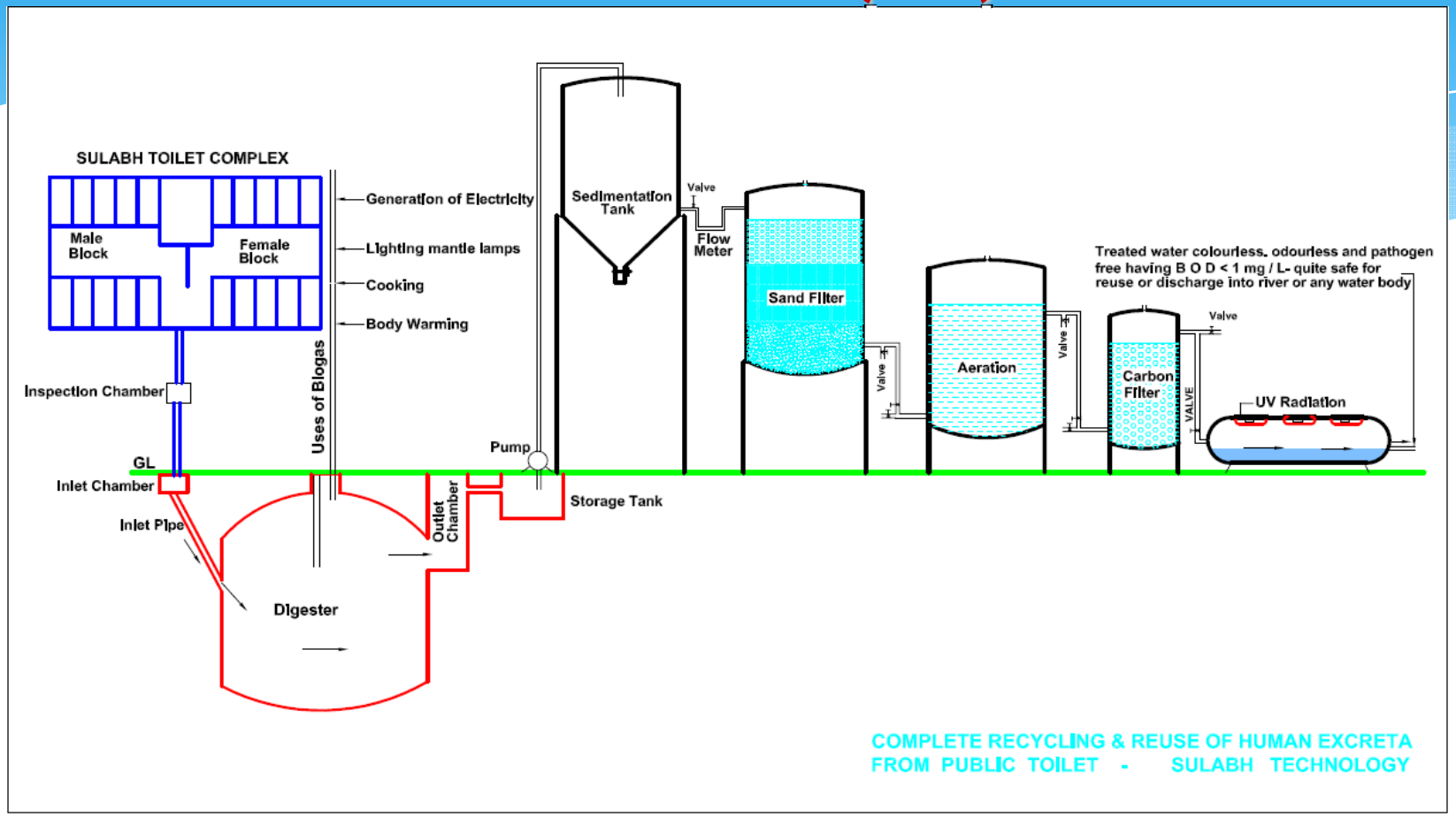
Sulabh Effluent Treatment Plant

- Biogas effluent treated through sedimentation tank, aeration tank, sand filter, activated charcoal followed by Ultra Violet (UV) rays.
- After the treatment the Biochemical Oxygen Demand (BOD) reduced to less than 10 milligram per litre.
- Treated effluent turns colourless, odourless and pathogen-free.

Can be used as liquid manure.

- Safe for aquaculture, agriculture, gardening & discharging into water body.

Public Toilet Linked To Biogas Digester And Sulabh Effluent Treatment (SET) Device



The water discharged is treated by passing it through sedimentation chamber, sand filter, aeration tank, charcoal and through ultra violet rays.

Our experience with DEWATS

* We were the first organisation to get DEWATS in India (Sulabh International Institute of Technical Research and Training or SIITRAT) in association with the Bremen Overseas Research & Development Association (BORDA)
* The project is funded by the European Union (EU) and the participating organisations were:
  – BORDA, Germany
  – SIITRAT, New Delhi, India
  – GERES (Groupe Engineers Renouvelables et Environment), Marseilles France

Our experience with DEWATS

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* – CEEIC (Chengdu Energy Environment International Corporation), China
* – HRIEE (Hangzhou Research Institute of Energy and Environment), Hangzhou, China
* – CSR (Centre for Scientific Research), Auroville, India
* – MDS (Malandu Development Society), Parathodu, Kerala, India
* Initially the product design was called ‘Low Maintenance Waste Water Treatment Systems’ or LOMWATS

Our experience with DEWATS

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* Eight numbers of DEWATS facilities were designed and constructed by SIITRAT in Delhi and NCR
* The designs were simplified designs, consisting of pre-settlers, anaerobic filters and ponds
* Each design was especially tailored for the ground situation
* The results were quite encouraging
* BOD reduction was to the tune of 80-97.6 % in comparison to 43.2 % for a standard septic tank

Drainage

* Like waste water, drainage is a big issue
* Most of the surface drains are in pitiable condition
* Both are extremely important
* Drainage master plans are essential including their revision once in 5 years
* Multiple drainage authorities should be replaced by a single drainage nodal authority
* Rainy season is the crucial test period for the adequacy of drainage in a city or in a village

Way forward

* Planning capability is the most important factor

* Planning capability for developing a sustainable plan for disposal of waste water followed by capability for preparing tenders and execution and ultimately, operation and maintenance on a long term basis are required
* All the stakeholders must be involved during the planning exercise as well as the execution period for long term success

Thank You