Highlights on Swedish research activities in EcoSan
- Sanitation by All

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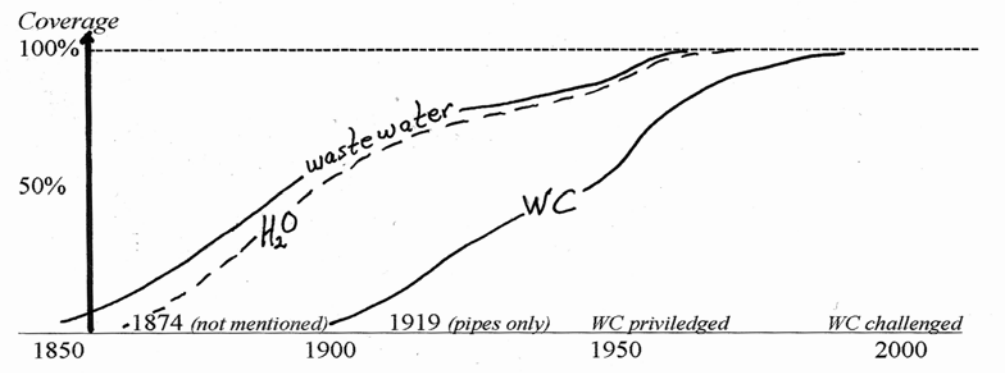
Let me start by saying that Swedish research has proved that EcoSan is a viable option. The next step will be to carry out system analysis and comparisons with other sanitation systems. The Swedish research includes studies of hygienisation of urine and faeces, risk assessment, reuse of urine as fertiliser, management issues, and user behaviours and attitudes.

Man has always tried to find sanitary solutions, and EcoSan technology that is available today has a long ***history***. For example, the toilet on the picture was introduced in Sweden in the 1860s when several-storey buildings became popular. This urine-diverting toilet solved the problem residents had when descending 4-5 floors to visit a dry toilet in the yard, and then return 5 floors – with no elevator. This no-flush toilet with a vent pipe was odourless and installed in the flat. It was introduced in a period when the sewers from the flats were of too small dimension to accommodate faecal material. The faecal matter was collected, say, every three month, and brought back to farm land. However, the nutrient-rich urine in the porcelain bowl was emptied in the kitchen sink and discharged in rivers and lakes – and not recycled (Drangert and Hallström 2001).

The WC evolved into a privileged solution in Sweden in the early 20th century. The first National Health Act of 1874 dealt only with dry sanitation systems, while the second Act of 1919 only discussed piped toilet systems (Drangert, Nelson, and Nilsson 2002). The household coverage of piped water and sewer developed as seen in the diagram below. Two major conclusions from the diagram are that (i) it took a long period to attain full coverage and (ii) it was a slow, stepwise improvement.

Diagram 1. The evolution of piped water and wastewater in Swedish towns

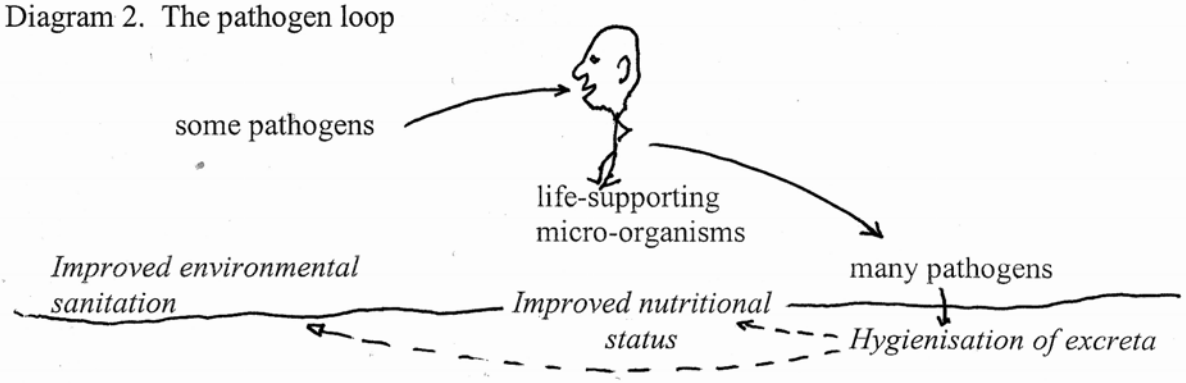


The water and sanitation management in small towns developed from infiltration of used water to the groundwater and universal reuse of excreta to an outspoken ***supply and discharge management.*** The water supply management remained unquestioned up to the 1980s. At that time, it became evident that it is cheaper to hold back consumption by ***demand management*** than to construct new water schemes. We now discern a return to an era of ***reuse management*** using tariffs and saving devices This time the goal is sustainability, and it includes stewardship by all, especially concerning the prevention of serious pollution of used water.

EcoSan is an important part of the present change in water and waste management, and it deals with ***three loops***.

The ***pathogen loop*** affects people´s health and should be broken. Micro-organisms are present everywhere. The human body contains a few kilograms of micro-organisms that are helpful for the metabolism of food. We ingest and inhale pathogens from the environment, sometimes making us sick. But, most of all we excrete large quantities of pathogens. The crucial step in EcoSan is to break the loop of harmful micro-organisms, mainly by hygienising our excreta.

Diagram 2. The pathogen loop

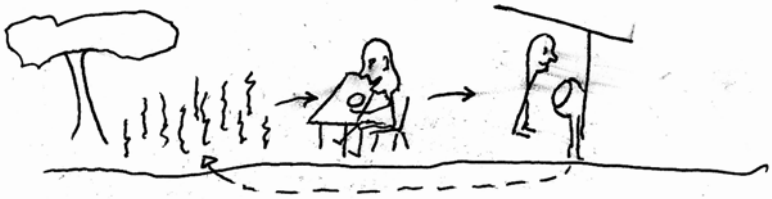


The long ***water loop*** brings water from rivers, lakes and from beneath the ground for use in towns. In order to safeguard nature and facilitate reuse of water, we should make loops short and return only fair-quality water after use! The EcoSan method suggests that we *keep various water and "waste" streams separate and use little or no water for toilets.*

Diagram 3. The water loops make us all to "live downstream"

The ***nutrient loop*** is the new focus. The present linear flow of nutrients extends from mines via fertiliser factories, farms, food industry to town-dwellers´ bellies, and after excreting via sewers back to the water bodies. In order to prevent eutrophication of lakes and instead make use of the nutrients in food production, we need to close the nutrient loop.

Diagram 4. "Closing the nutrient loop"



The basic ingredient in re-use discussions is the nutrient content. The chemical composition of what we eat and excrete has been known for more than a century from Liebig and others. Research has also shown that human beings, especially children, get diarrhoea from ingestion of contaminated food and from dirty fingers. The amount of disease related to water itself is comparatively low, as long as the general environment is foul.

What is needed today is a management strategy that integrates all knowledge available, and that also co-ordinates the three loops. This should be the aim of research and policy work in the near future.
Some highlights of EcoSan-research related to urine-diverting toilets that has been carried out in Sweden in the last few years is summarised in the table (see reference list).

Socio-cultural	***Technical***	***Hygiene & environment***	***Food production***	***Economic***
General conclusions				
Some solutions are acceptable	Several options; dry-wet, cheap-expensive, single – group housing	Reasonable standards	Local reuse	Affordable options for all
- no smell - indoors - full control	vent pipe collection outside the flat/house	improvement over - dug latrines and - most sewers	- flowers, trees - vegetables - golf course	- personal taste guide choice - movable
Encountered problems				
men pie standing, not all eat food fertilised with urine, regulations	blockage in urine pipe,	possible cross-contamination	loss of nitrogen	transport costs
Partial solutions				
urinals, promotion, and de-regulation respectively	wider pipes, caustic soda, steel wisker	hygienisation by 6 months storage of urine and faeces	no N losses, if i.a. urine is worked into the soil	energy benefit if distance to farm < 200 km
More findings				
women often in favour of ecosan toilets	urine tank beside field to reduce compaction of soil	high temperature & pH, low moisture favourable to dieoff	urine as effective as chemical fertilisers	low O&M costs for decentralised systems
men sceptical due to change in their technical role	only little research on greywater handling in ecosan	select sturdy indicators (spores, sterols, etc) for worst case	no need to mix urine with water before application	
Swedes favour ecosan toilets in summer houses	few vacuum toilet or biogas research in Sweden yet	select what to fertilise depending on assoc. safety risks	faecal compost is soil-like after a few months	
Swedes prefer saving devices		air emissions negligible except for ammonia	ash and lime are good drying mtrl with high pH	
NGOs reluctant to produce toilets for sale		no groundwater contamination by urine-diverting loo	very low levels of heavy metals in excreta	

Given the various technical and management options, it is evident that almost any family is in a position to install a urine-diverting toilet in the house or pay for the installation. This gives the policy option to advocate household responsibility. We should avoid the policy error in the 1980s stating that water is a human right and advocating the slogan “Water for All”.

I would like to conclude with a policy suggestion: "**SANITATION BY ALL"**

References

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