

The Peepoo bag

End-user aspects and Sanitation performance

NetsSaf Final Conference, Ouagadougou 2008

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UN millennium development goal no.7, target 10:



To halve, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation.

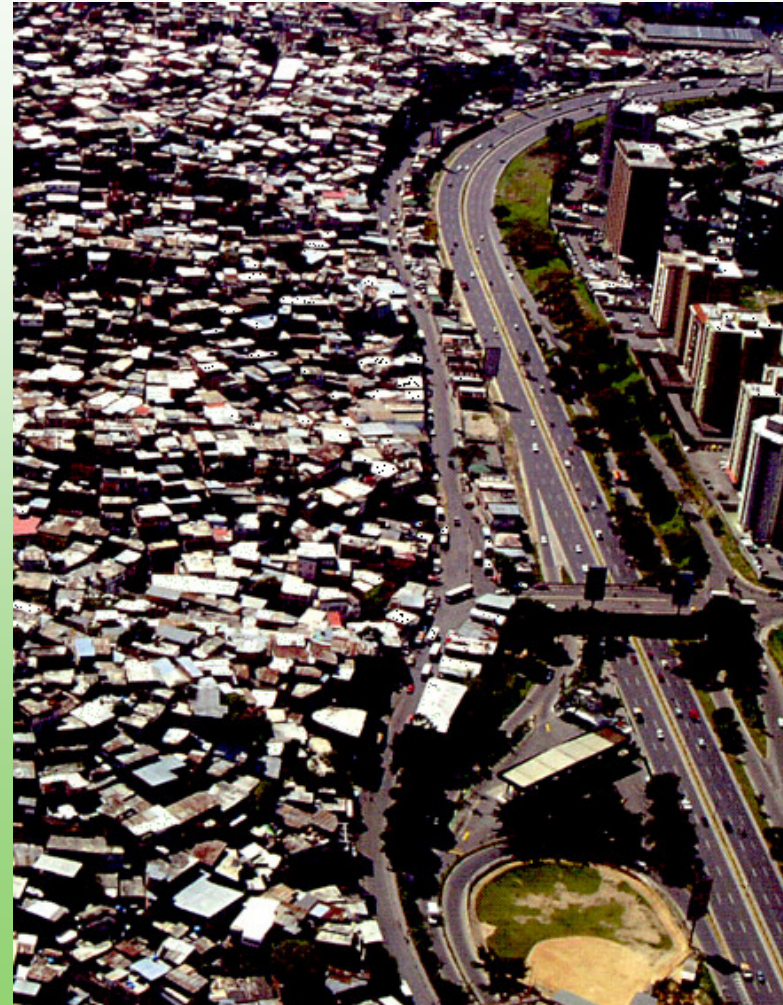


Photos: Camilla Wirseen

Sanitation challenges

- Poor societies
- Weak infrastructures
- High population densities
- Complex investments
- Institutional rigidity

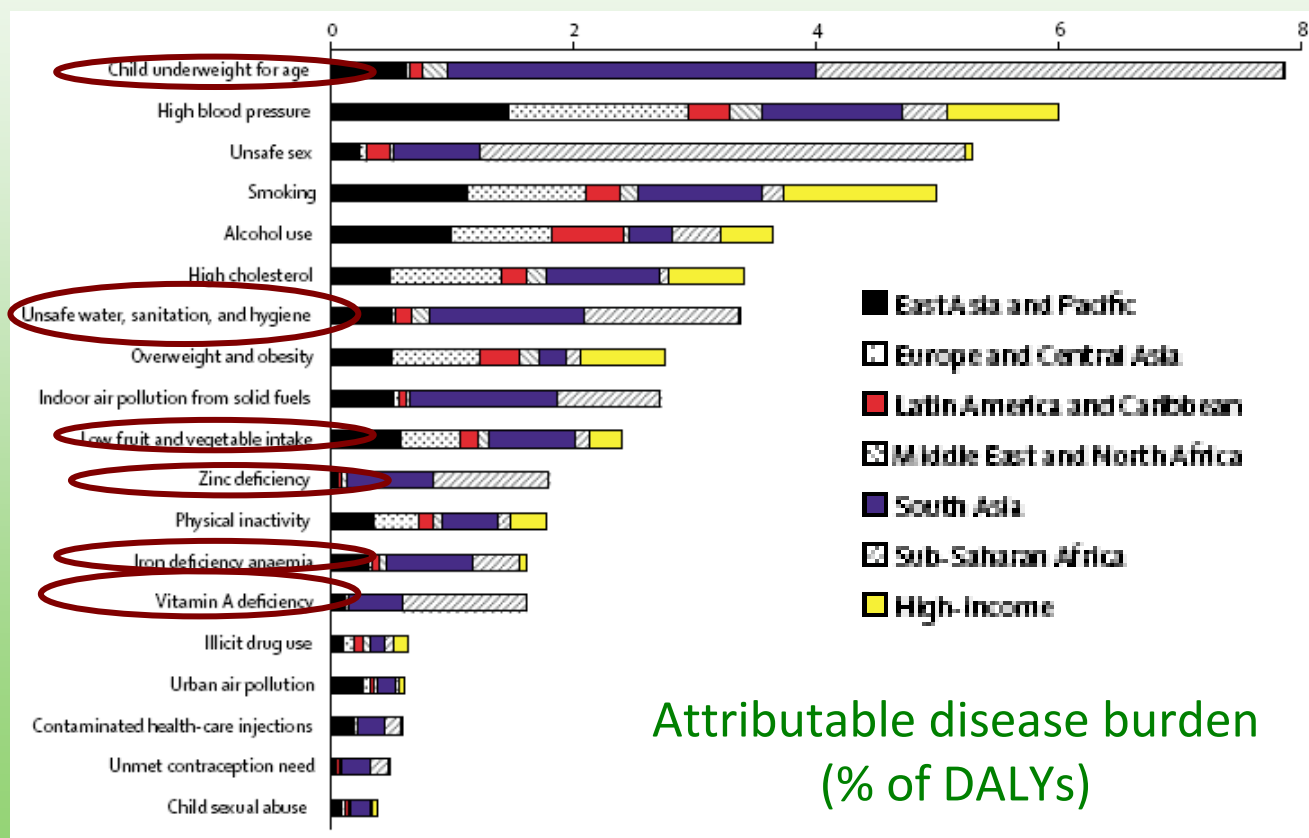
*1 billion of urban
habitants live in slums*



Sanitation and health

Misuse of nutrients, a neglected health aspect

*Contributors to 2001 global health burden**



* Lopez et al. 2006 Global and regional burden of disease and risk factors, 2001

The Peepoo bag



(14x38 cm)

Single-use,
self-sanitizing,
bio-degradable
toilet,
producing enriched
fertilizer from
human excreta



Single Use

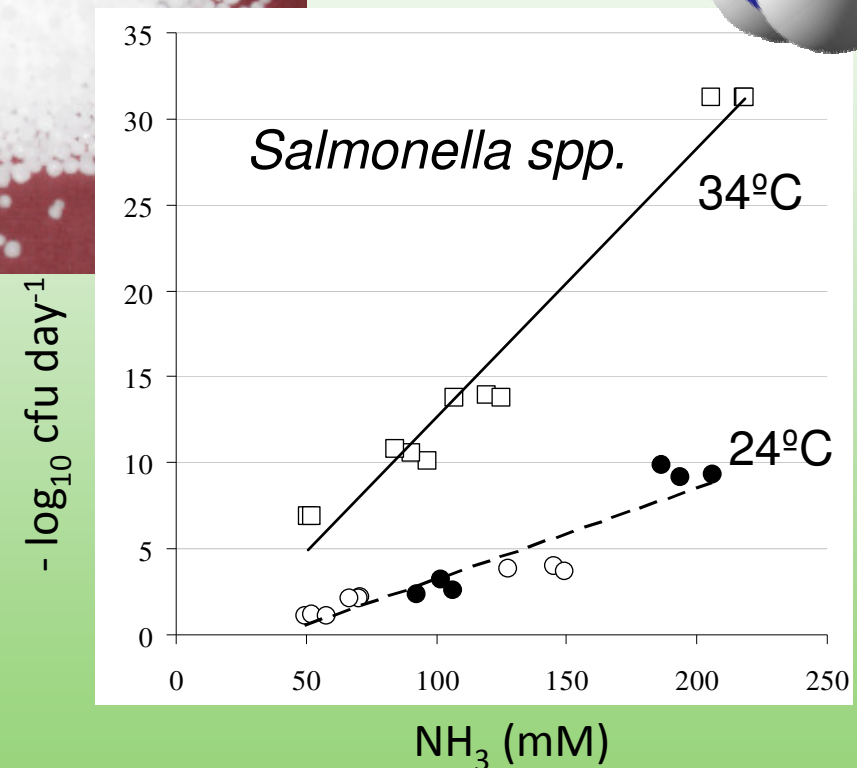
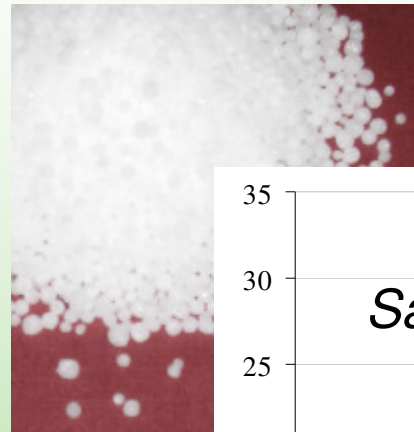
- Affordable - 0.025 USD
- Used once by one person
- Weight 10 grams
- Flexible in time and location
- Odor-free 24 hours



Photo: Camilla Wirseen

Self Sanitizing

- Urea 4 g bag
- Forms ammonia and carbonates
- User-friendly disinfectant
- Active at pH ~ 9
- Increased fertilizer value
- Sanitised in 2-4 weeks



Inactivation of *Salmonella* spp. in faeces (●) and urine (○/□) plotted against concentration of NH_3 (aq) at 24 and 34°C

Bio Degradable

- Minimise physical contamination
- Durable 4 weeks
- Aromatic co-polyesters and poly-lactic acid (PLA) wax and lime
- EU standard EN13432
- Complete degradation
- Today 45% renewable - 100% future goal



Photo: Camilla Wirseen

Fertiliser Production

- Faeces rich in carbon, potassium and phosphorus
- Urea enriches with nitrogen
- Mineral fertilizers expensive and scarce
- Resource instead of a contaminant.
- Fertilizer value can drive collection?



Photo: Peter Morgan

End-user Test

- Ergonomic function and suitability
- Soweto East, Kibera, Nairobi, Kenya
- Poor sanitation conditions
- 30 persons - 1 Peepoo bag per person and day 2 weeks
- Questionnaire and Focus group interviews

Photos: Camilla Wirseen



End-user Evaluation

- Favorable at the sanitary context
- Positive answers on cleanliness
 - 4% excreta did not enter easily
- Flexibility and lack of smell important
 - 4% thought bag smelled after use
- Women positive
 - worked well for children
- 86% positive to every day use

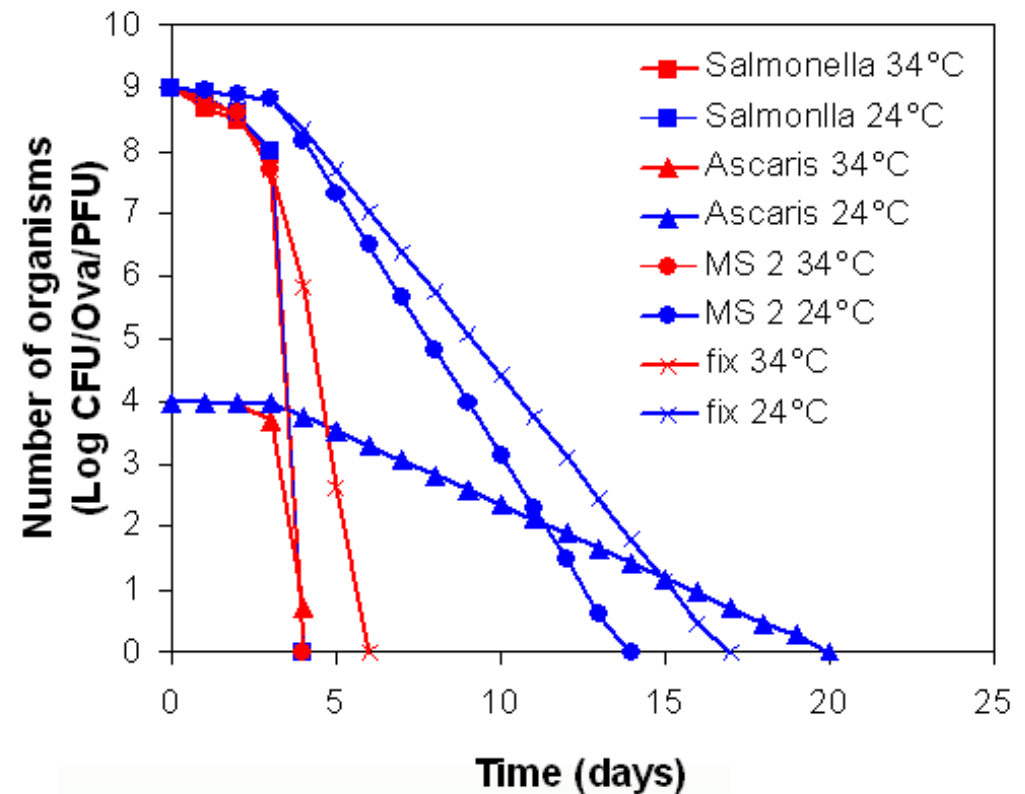


Photo: Camilla Wirseen

Sanitation

- High pathogen load*
 - Bacteria $9 \log_{10} \text{g}^{-1}$
 - Virus $9 \log_{10} \text{g}^{-1}$
 - Parasites $4 \log_{10} \text{g}^{-1}$
- Reduction related to
 - NH_3
 - Temperature
- Larger defecation lower NH_3 concentration

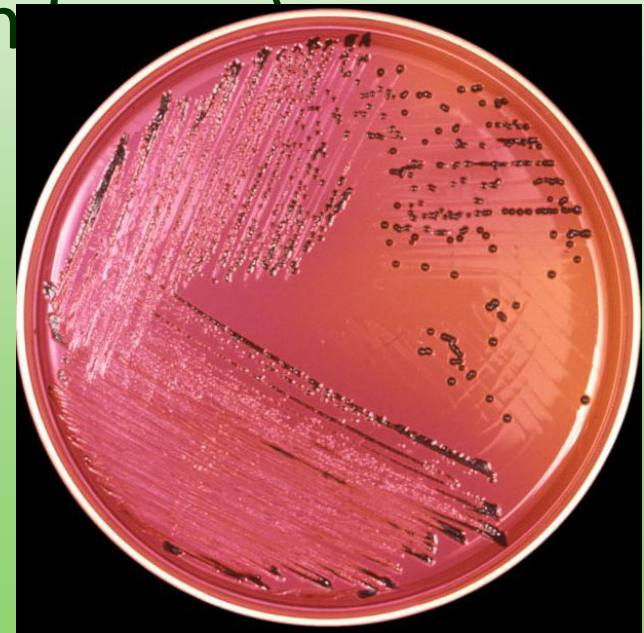
* Westrell, 2006 MRA and its implication for risk management in urban water systems



Assessment of sanitation at 24°C and 34°C with reduction rates based on an 100 g defecation with 80% moisture content.

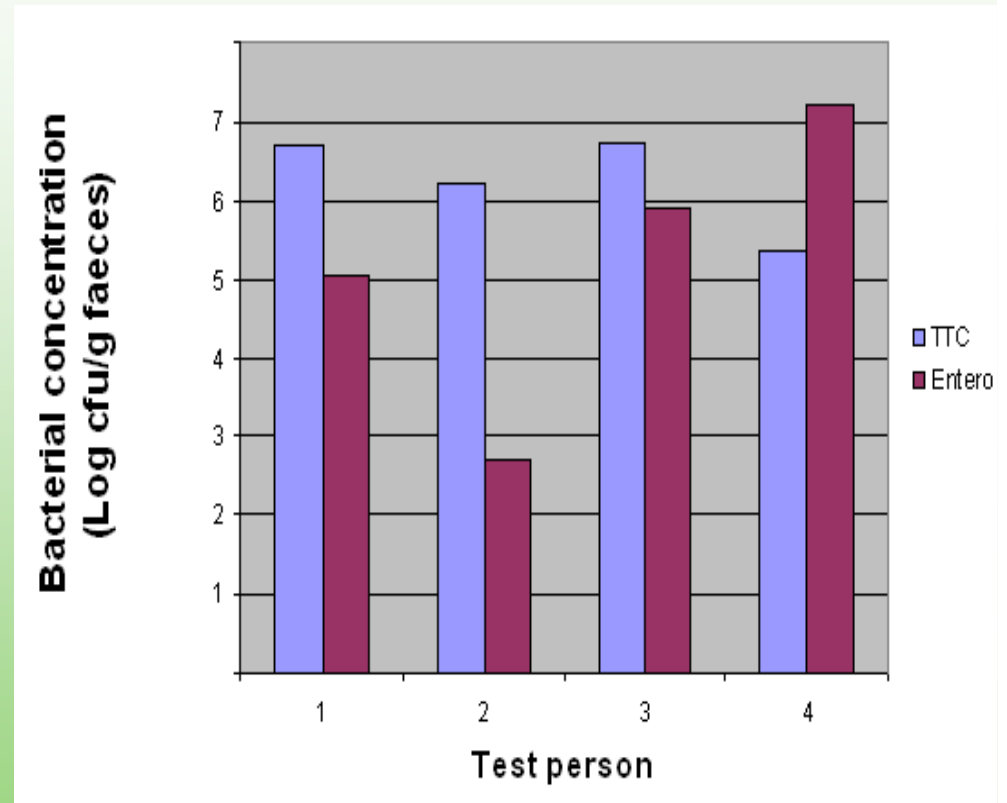
Sanitation test

- Peepoo bags were used for defecation
- Left on ground in outdoor Swedish summer climate
- Indicator organisms (present in feces) monitored
 - Total thermotolerant coliforms
 - *Enterococcus* spp.



Sanitation performance

- 38 - 128 g/defecation
- 8°C - 41°C
- No organisms detected after 4 weeks
- *Salmonella* spp. and *Escherichia coli* O157:H7 inactivated 14 times faster than *Enterococcus* spp. at 34°C*
- Water losses
 - did not affect sanitization
 - Lead to improvements of material composition



Organism start concentrations (Log cfu/ g faeces)

* Nordin et al. 2008; Vinnerås et al. 2008

Conclusions

- High user acceptance
- Sanitizes human excreta independently of waste management services
- Pathogens and viral indicators inactivated with margins
- Safe fertilizer production enables sustainable food production and local entrepreneurship
- Requires little local infrastructure
 - Emergency situations
 - Supplement to public toilets

