An overview of options for humanitarian emergency sanitation

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Holiday Inn, Burlington, ON - February 18, 2015

Plan

- **Introduction**
- **Options for sanitation**
- **Improvements needed for emergency sanitation**
- **Conclusion**

Introduction: some figures

- **40% of the world population live surrounded by human feces.**
- **13 million of deaths each year.**
- **$1 invested in sanitation = $9 saved in medical care !**

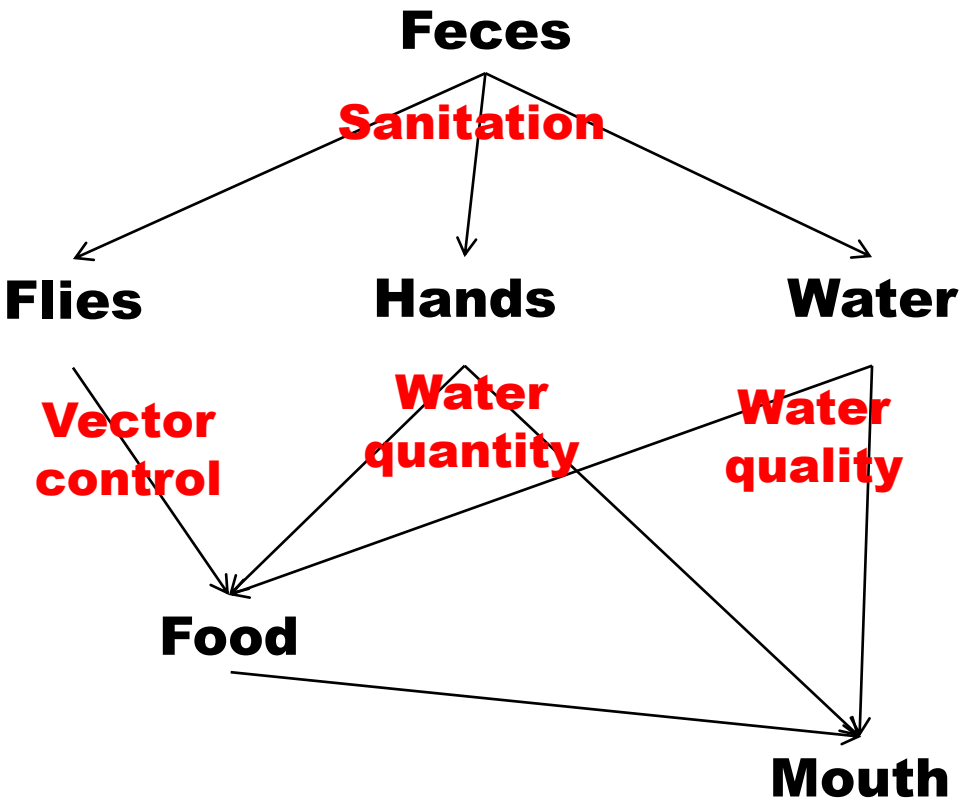
Humanitarian emergency ?

- **Resources are limited**
- **Crowded people**
- **Lack of basic needs**
- **Fast onset**

Camp for displaced people in Democratic Republic of Congo (Photo: © Christian Als, 2008)

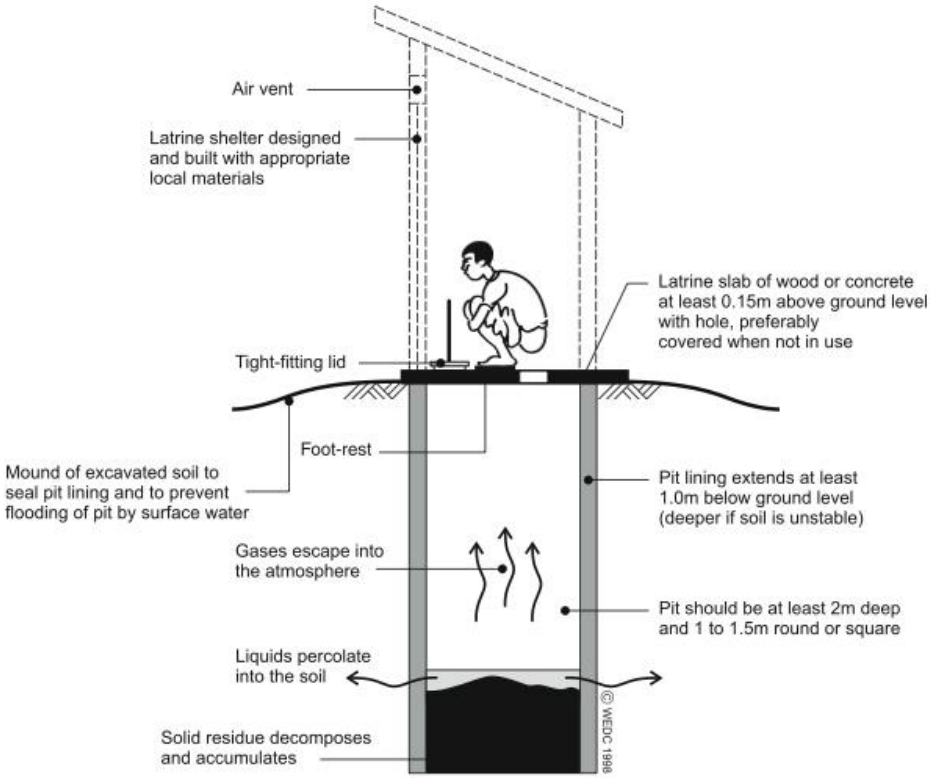
Fecal-oral transmission route

Diarrhoeal Diseases



Basic needs

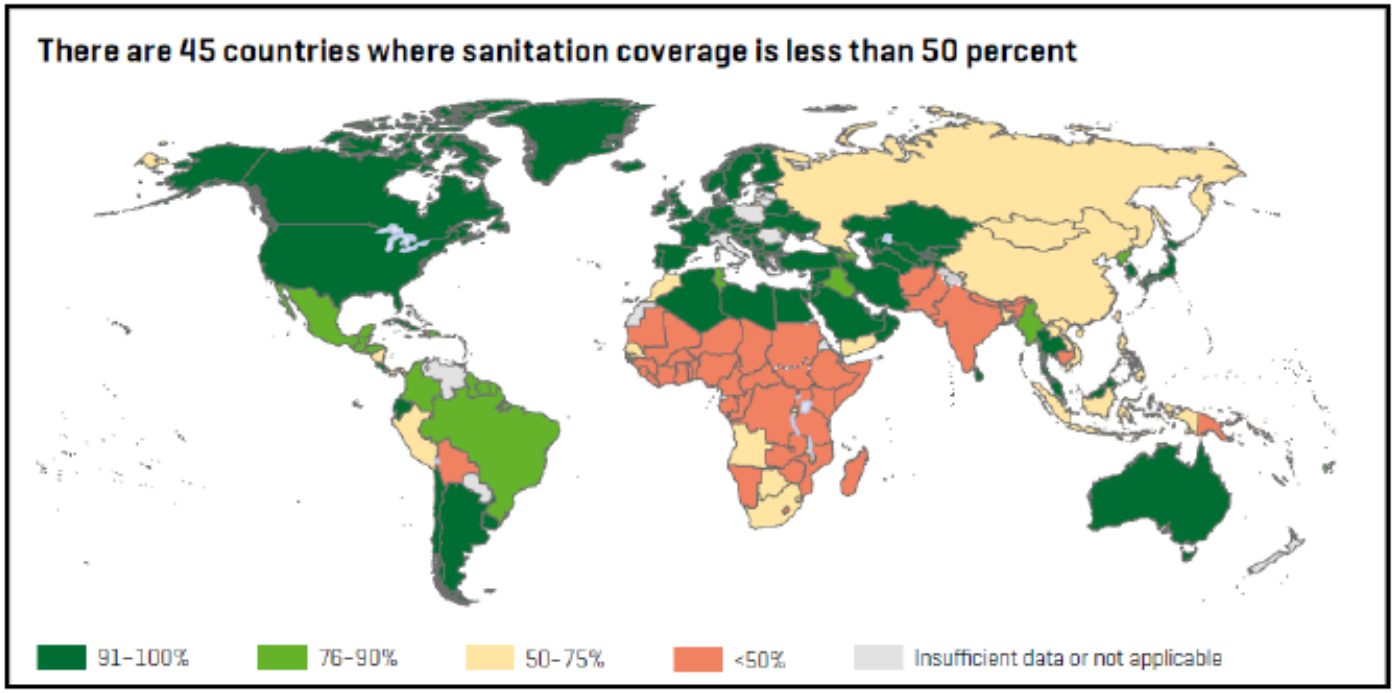
- **Drinking water access (quality & quantity)**
- **Hygiene promotion**
- **Sanitation …**



Problems !

- **Lack of adequate sanitation facilities**

- **Pit latrine contents**



Global sanitation trends in 2011 (WHO/UNICEF JMP for Water Supply and Sanitation 2013)

Haïti case on 12 January 2010

- **316 000 people killed**
- **1.5 million internally displaced persons in 1300 camps**
  - **29% without toilets**
  - **42% without water**

➢ **Cholera had killed more than 8000 people by January 2013**

Objectives

To implement a sanitation system of the pit latrine content (fecal sludge management)

- **Overview of existing options**
- **Preliminary tests**
- **Field tests**
- **Improvement of the « best » solution**
- **Standardized procedure for emergency situations**

Fecal sludge characterization

Table 3-2 Characteristics of faecal sludge and its comparison with sewage

	Public Toilet Sludge	Septic Tank Sludge	Sewage
Characterisation	Highly concentrated, mostly fresh FS, stored for few days or weeks	Low concentration, usually stored for several years; more stable than public toilet sludge	Tropical sewage
COD (mg/L)	20,000 - 50,000	x20 to x40	500 - 2,500
COD/BOD	2:1 - 5:1	5:1 - 10:1	2:1
NH_4-N (mg/L)	2,000 - 5,000	<1,000	30 - 70
TS	≥3.5%	<2%	<1%
SS (mg/L)	≥30,000	x400 to x500	200 - 700
Helminth eggs (n°/L)	20,000 - 60,000	x30 to x70	300 - 2,000

[Adapted from Heinss et al., 1998, cited in (Eawag/Sandec 2008)].

(Maria Eliette Gonzalez Perez, 2014)

Different treatment for fecal sludge

Criteria for sanitation

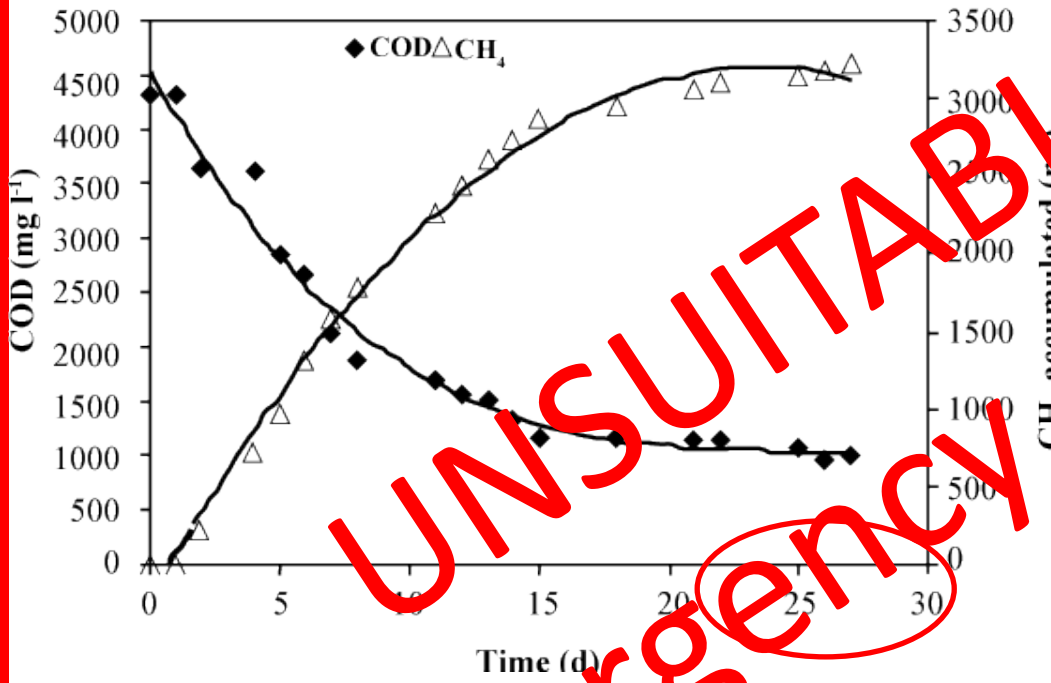
- **Low-cost**
- **Simple**
- **Fast setup**
- **An operationally easy process**

Treatment « kit »

Treatment for drinking water

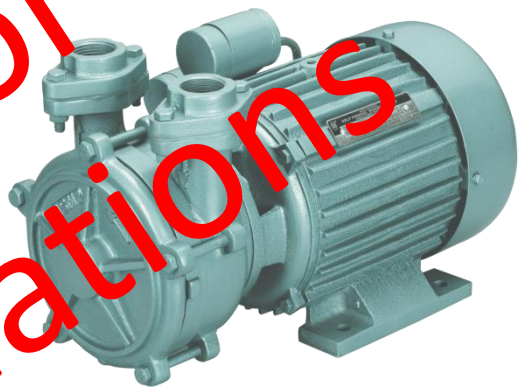
Biological treatment

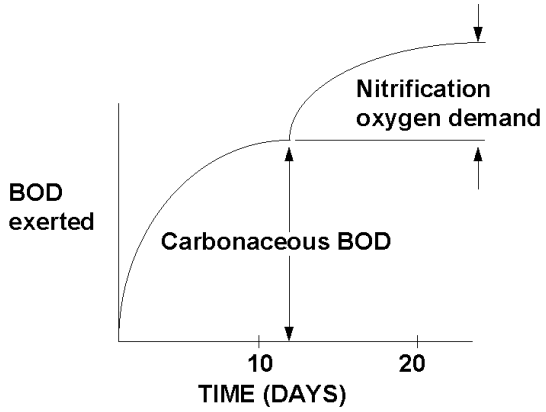
- **Needs time to be developed**



UNSUITABLE for emergency situations

OR





Physicochemical treatment

- **Chlorine**
- **Lime**

Already tested, but lacking a standardised protocol

- **Potassium ferrate**
- **Organic compounds**
  - **Ammonia**
  - **Lactic acid**

Not already tested in emergency situations

Chlorine

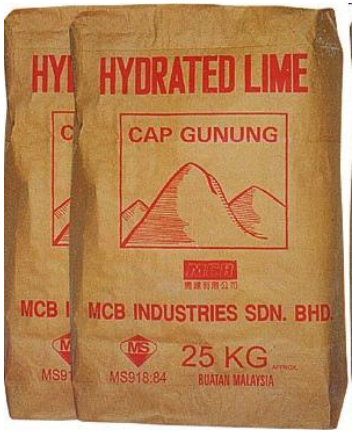
<u>Limitation:</u> inefficient against protozoan cysts.

Already used in humanitarian emergency

(Nelson & Murray, 2008)

Lime

Effect: rising the pH.



Already used in humanitarian emergency

(Bauerfield, 2014)

Potassium ferrate

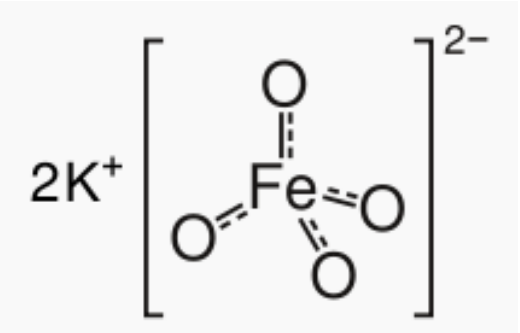
- **Solids reduction**

Sludge mass reduction (suspended solids)

- **Oxidation/disinfection**

Better than chlorine, hypochlorite, chlorine dioxide, ozone, hydrogen peroxide, dissolved oxygen & permanganate.

Never used in emergencies



(Jiang and Lloyd, 2002) & (Deluca et al., 1992)

Organic compounds

- **Ammonia**

Effect: rising the pH

- **Formation of NH_3 (sanitising agent)**
- **efficiency against pathogenic**

Urea is available in the urine

Not used in emergencies

(Maria Eliette Gonzalez Perez, 2014)

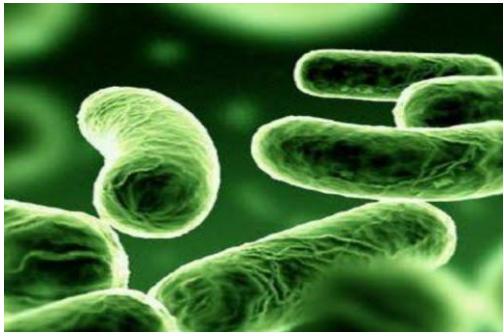
Organic compounds

- **Lactic Acid**

Effect: penetrate the cytoplasmic membrane of microorganisms

Transport is not dangerous

Not used during emergencies



Lactobacillus bacteria

(Dennis Hanjalika Malambo, 2014)

Conclusion

	Chlorine	Lime	Ferrate	Ammonia	Lactic Acid
Transport	**+++**	**+++**	**?**	**+++**	**+++**
Local availability	**+++**	**+++**	**--**	**+++**	**+++**
Treatment time	**< 2 hours**	**< 2 hours**	**?**	**4-50 days ??**	**7-15 days ??**
Cost	**$**	**$**	**$$$**	**$**	**$$**
Ease of use	**+++**	**+++**	**?**	**+++**	**+++**
Experience in emergencies	**Yes**	**Yes**	**None**	**None**	**None**

Benchmark

Future work …

Thank you!!! Any questions?

Water, Sanitation & Hygiene Research Group is hiring (MSc & PhD)… are you interested?

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