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Ammonia sanitisation for a safe use of sewage fractions – from theory to practice

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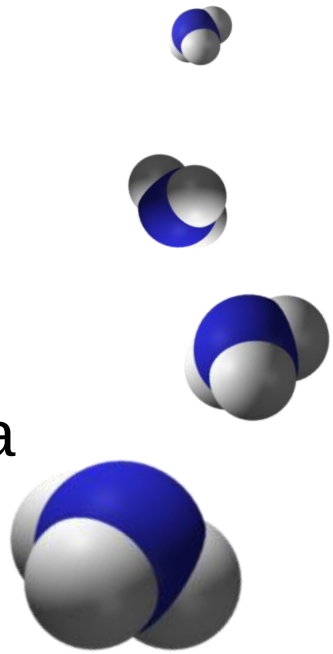
Ammonia sanitisation



- $NH_3 + H^+ < > NH_4^+$
- Intrinsic (e.g. urine) or added as urea or ammonia
- Robust treatment
  - closed
  - ambient temperature
- Prevents:
  - Green house gases[a]
  - Regrowth / contamination

Full scale application

urine

faeces

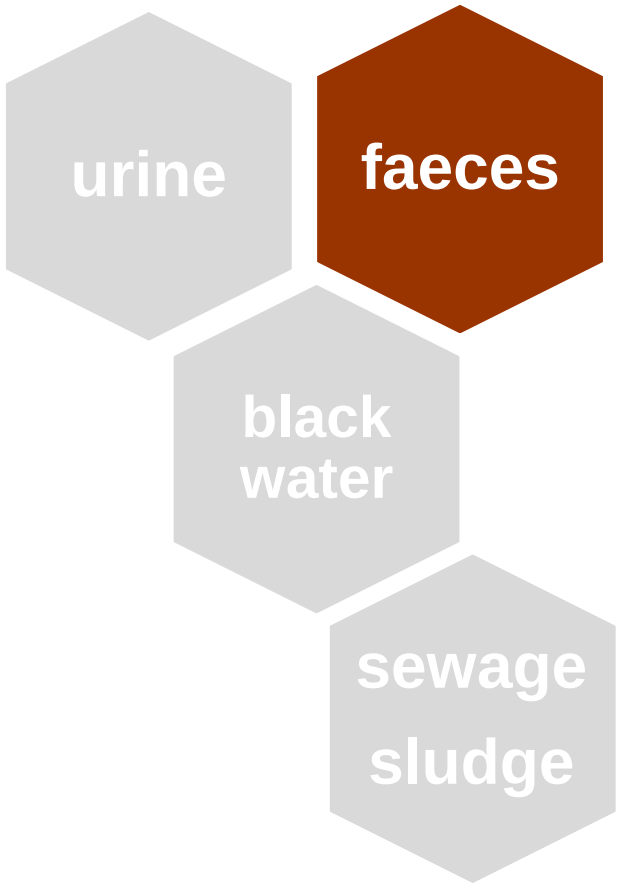
black water

sewage sludge

Treatment implications

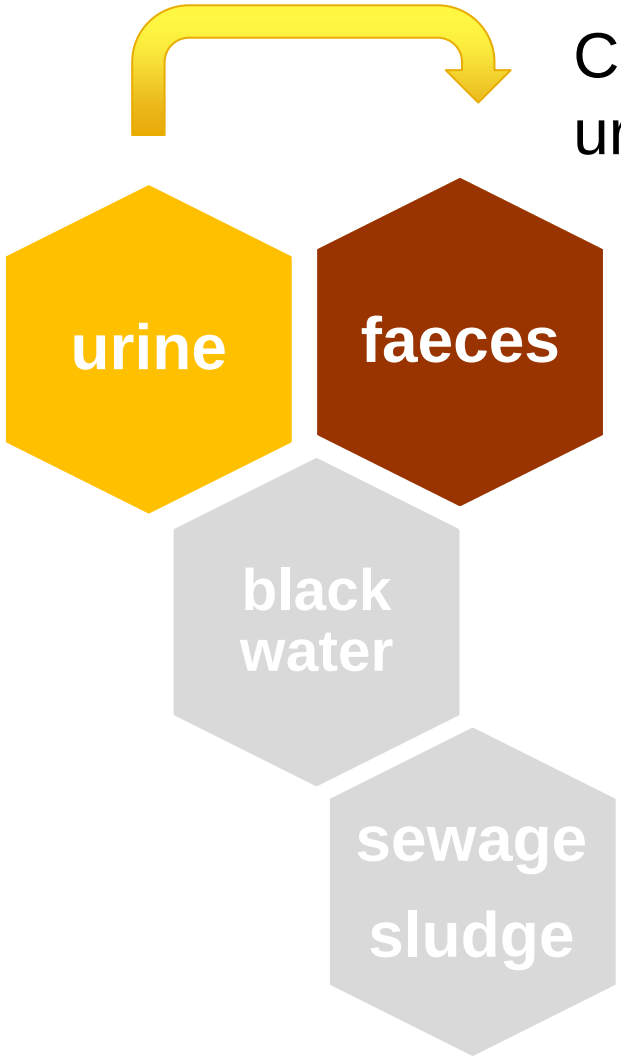
NH-N variable
low risk

Treatment implications



1% urea
consider ash mixing

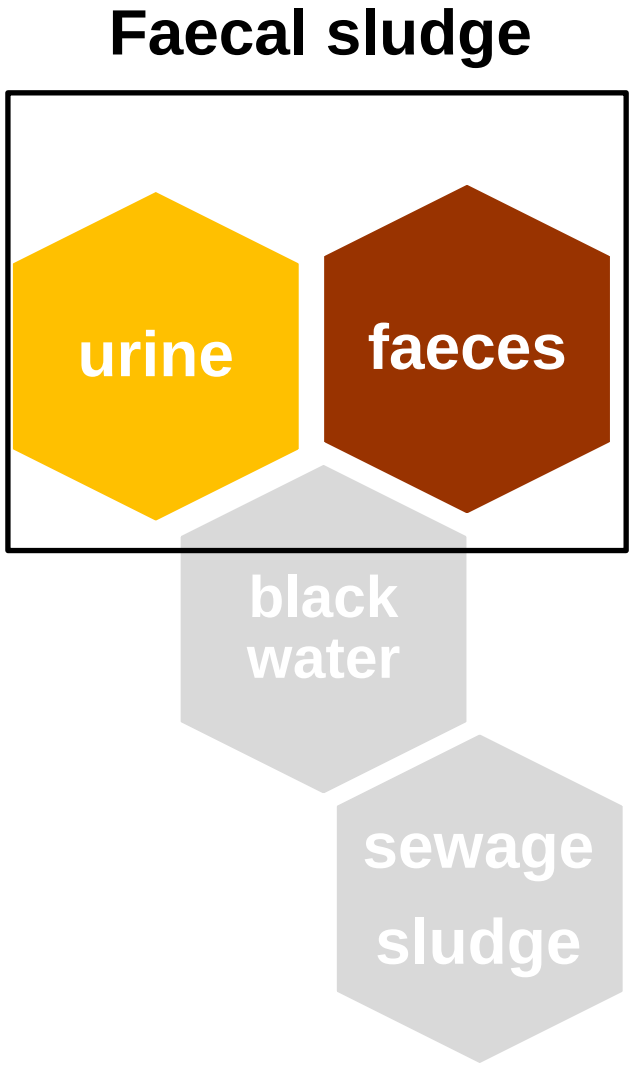
Treatment implications



Collected separately – urine to sanitise faeces

Treatment implications

Self sanitizing:
if closed collection
if flush < 2L /p*day



Treatment implications

diluted
urea 0.25%

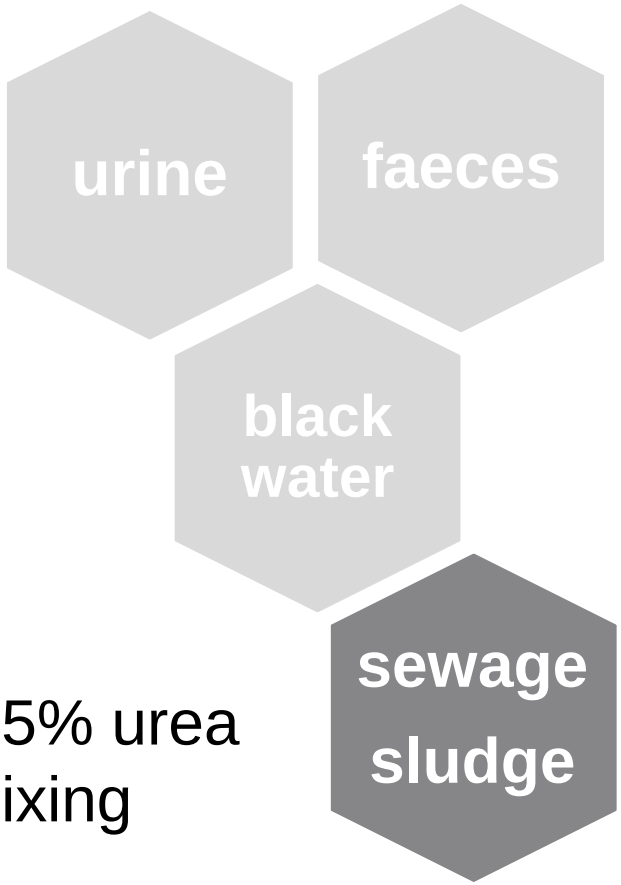
urine

faeces

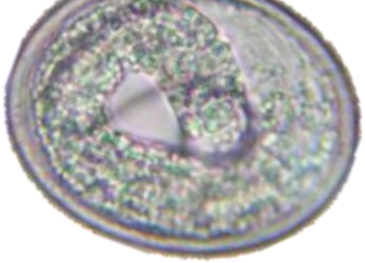
black water

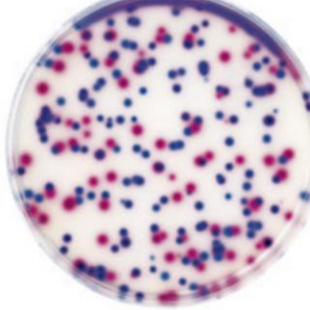
sewage sludge

Treatment implications



1.5% urea mixing





Pathogen inactivation

Group	Studied organisms	Reference /indicator organism	Gap of knowledge
Bacteria	*Salmonella, E.coli, Campylobacter, Mycobacterium tuberculosis, Aeromonas hydrophila, Pseudomonas aeruginosa*	*E. coli*	*Vibrio cholera*
Viruses	rota-, adeno-, reo-, polio-, enteroviruses, bacteriophages	f-RNA phages	
Protozoa	Cryptosporidium spp, Entamoeba spp.		*Giardia*
Helminths	*Ascaris, Trichuris*, whip worm	*Ascaris*	

4.5 $\log_{10}$ reduction ascaris eggs faeces 25% TS, pH 9

NH-N		Temperature (°C)					
g/L	mM	10	15	20	25	30	35
1	71	2059	796	313	126	52	22
2	143	1296	501	197	79	32	13
3	214	1003	387	152	61	25	10
4	286	839	324	127	51	21	9
Urea 1%		736	284	111	44	18	7
6	429	663	255	100	40	16	7
7	500	609	235	92	36	15	6
8	571	568	219	85	34	14	6
9	643	535	206	80	32	13	5
Urea 2%		508	195	76	30	12	5

Ascaris inactivation model

Fidjeland, J., Nordin, A., Pecson, B.M., Nelson, K.L., Vinnerås, B. 2015. Modeling the inactivation of ascaris eggs as a function of ammonia concentration and temperature. Water Research, 83, 153-160.

Now as web application demo version:

https://fidjeland.shinyapps.io/Ascarisinactivation/

Acknowledgments to Loic Decrey creating the app!

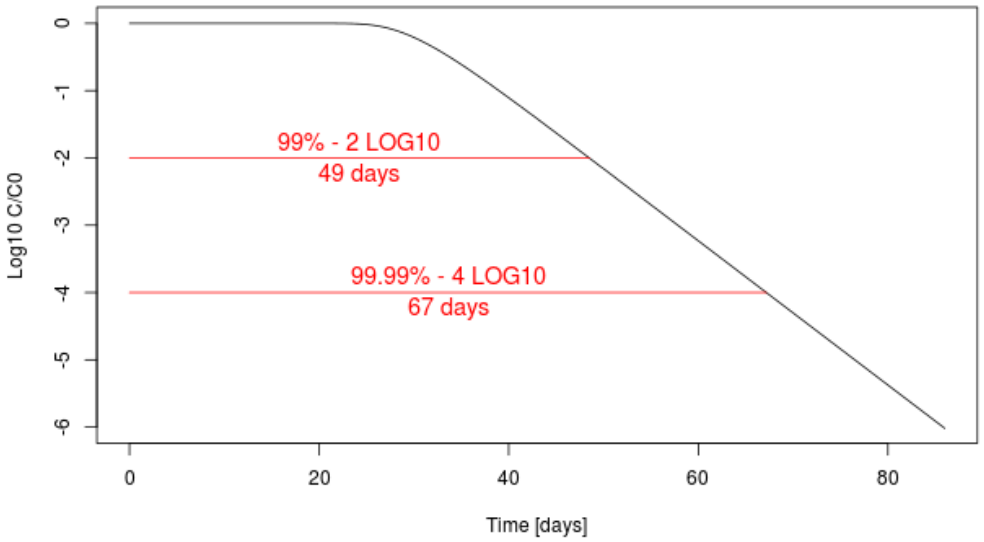
Ascaris inactivation model

Type of matrice:

- (•) Feces/urine mixture
- ( ) Urine

Calculate

Input data | Output data | Kinetics | Plot



Temperature [Â°C]:

20

Measured pH:

9

Total ammonium nitrogen [mM] (of the raw material, i.e. without urea addition):

100

Urea [mM of urea] (as an additive):

334

Total solid [g/L]:

200

Contact j_fidjeland@yahoo.no for questions and feedback and for frequent users a non limited copy.

Thank you for your attention!

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