

Seminarium Miljöriktig användning av askor 31 januari - 1 februari 2006

Nedbrytning av aska och slam i tätskikt

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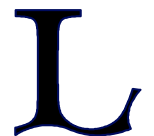
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Objectives

Determine the chemical and biological durability of landfill liners built with ash and sludge



Conclusions

- Biological degradation negligible
- Alkaline degradation of organics possible but only initially
- Optimal mixture ratio is material dependent
- Change in TOC did not affect the hydraulic conductivity
- Compaction dominating factor for hydraulic conductivity
- Drying increased the hydraulic conductivity
- Freezing/thawing did not affect the hydraulic conductivity
- Appropriate design of ash-sludge liners ensures
 - long-term stability
 - hydraulic conductivity $\leq 10^{-9}$ m s⁻¹
 - total loss of TOC $\leq 3\%$ w/w



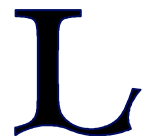
Recommendations

- determine optimal mixture ratio
- ensure high compaction
- prepare a homogeneous mixture
- avoid drying using a well working drainage layer and a vegetation layer

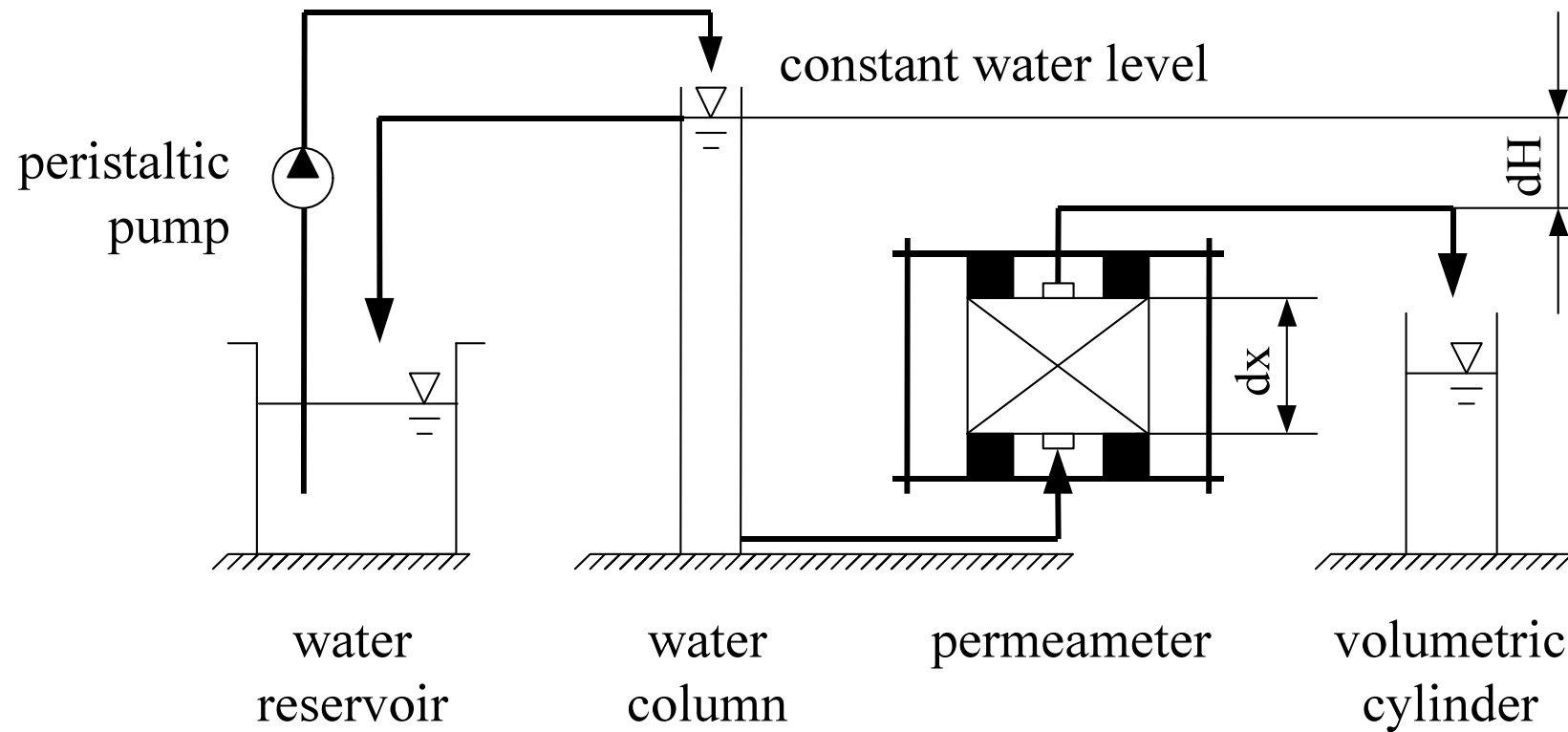


Project approach

- Feasibility study
- Permeameter experiments



Permeameter set-up



Equipment



Experimental layout for 5 cycles

Factor	Level		
	High	0	Low
Material	N-Ö	–	M-B
A/S ratio, g g ⁻¹	4	1	0.25
Water content, wt-%	40	30	20
Compaction, t m ⁻³	1.50	1.34	0.92
Biological inhibition	Yes	–	No
Freezing/thawing	Yes	–	No
Drying	Yes	–	No



Analyses

Solid material

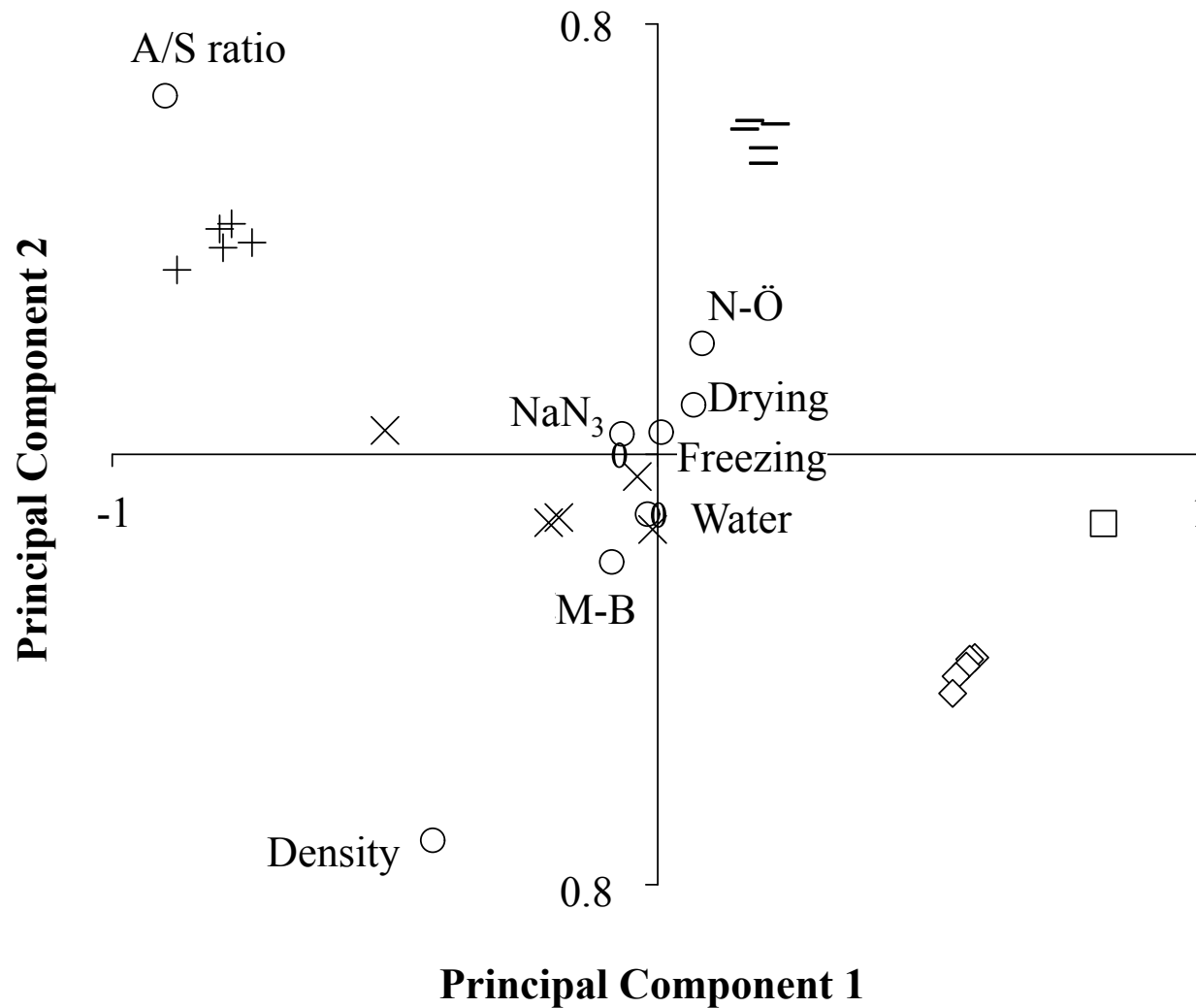
- TOC
- LOI (550°C)
- Hydraulic conductivity
- TS content

Permeameter water

- TOC
- Electrical conductivity
- pH



Qualitative evaluation



Responses:

- hydraulic conductivity
- + pH
- × electrical conductivity
- TOC_{start}
- ◇ TOC_{residual}



– Example –

Quantitative evaluation

Conditions:

- Liner mixture: NSR sludge – Öresundskraft ash
- No of permeation cycles: 5

$$\begin{aligned} \text{Hydraulic conductivity } (\log_{10} \text{ m s}^{-1}) = & 2.4 \\ & - 0.4 \times \text{Ash/Sludge ratio} \\ & - 8.5 \times \text{Compaction} \\ & + 0.4 \times \text{Drying} \\ & + 0.6 \times \text{Ash/Sludge ratio} \times \text{Compaction} \end{aligned}$$

Degree of explanation, $R^2 = 0.84$

No impact: Initial water content, biological inhibition, freezing/thawing



Decrease of TOC content over time

