Waste incineration bottom ash in bound construction materials

Ash 2012

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Background

- Incineration of household and industrial waste
  - Increasing every year
  - Fly ash is hazardous waste
  - Bottom ash is non hazardous waste
  - Most of the mass is bottom ash

- Waste incineration bottom ash today:
  - Quenching water bath
  - Scrap metal separation
  - Separation of size fractions
  - Ageing ~6 months
  - Utilization as construction material inside landfills

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Background

- Problem
  - Utilization today is limited to construction material inside landfills
  - Many Swedish landfills will be closing in the near future
  - Concerns for negative effects on the environment limits utilization outside landfills
  - Scientific results are needed to enable wider utilization

- Goal
  - Evaluate waste incineration bottom ash in laboratory as a bound construction material regarding both environmental and technical properties
  - Evaluate laboratory methods for testing of bound ash materials in laboratory

→ Increase the possibilities for utilization of waste incineration bottom ash

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Conclusions

- Diffusion tests are preferable to percolation tests for bound materials
- Diffusion coefficients are low for bound materials with bottom ash
- Low hydraulic conductivity
- Bottom ash in bound materials reduce risk of crack formation compared to stabilized fly ash materials
- Bottom ash in bound materials improve technical properties compared to stabilized fly ash materials
- Manufacture of test samples at optimal water content for maximum dry density is not optimal for hardening materials
- Waste incineration bottom ash works well in bound construction materials

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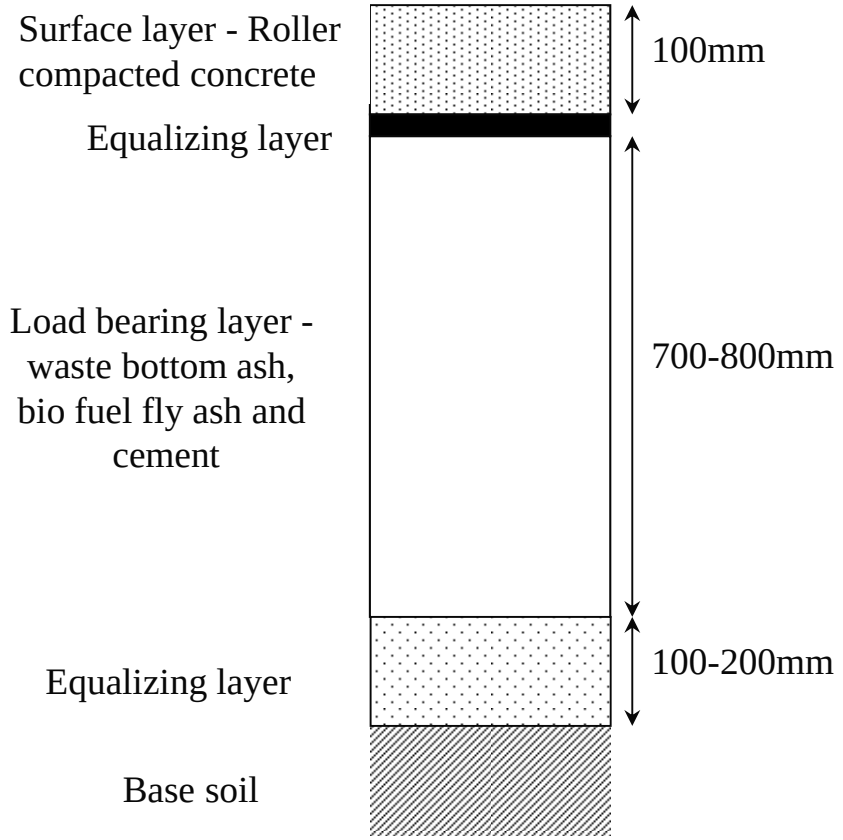
Waste bottom ash in bound materials

- Reducing environmental risk through either:
  - Removal of contaminants
  - Stabilization of contaminants
- Stabilization of bottom ash with cement and fly ashes
  - Bio/peat fly ash is already used
  - Bound material
  - Low hydraulic conductivity
  - Reduced mobility of contaminants



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Laboratory testing

- Reference material - Mixture R
  - Waste bottom ash 1%
  - Bio fuel fly ash 94%
  - Cement 5%

- Bound bottom ash material - Mixture S
  - Waste bottom ash 64%
  - Bio fuel fly ash 31%
  - Cement 5%

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Laboratory testing

- Sample preparation
  - Optimum water content for maximum dry density
  - Proctor packing
  - Hardening in sealed tubes at 7°C
- Environmental properties
  - Percolation leaching tests
  - Diffusion leaching tests
- Technical properties
  - Hydraulic conductivity
  - Unconfined compression tests
  - Non-destructive testing of E-modulus

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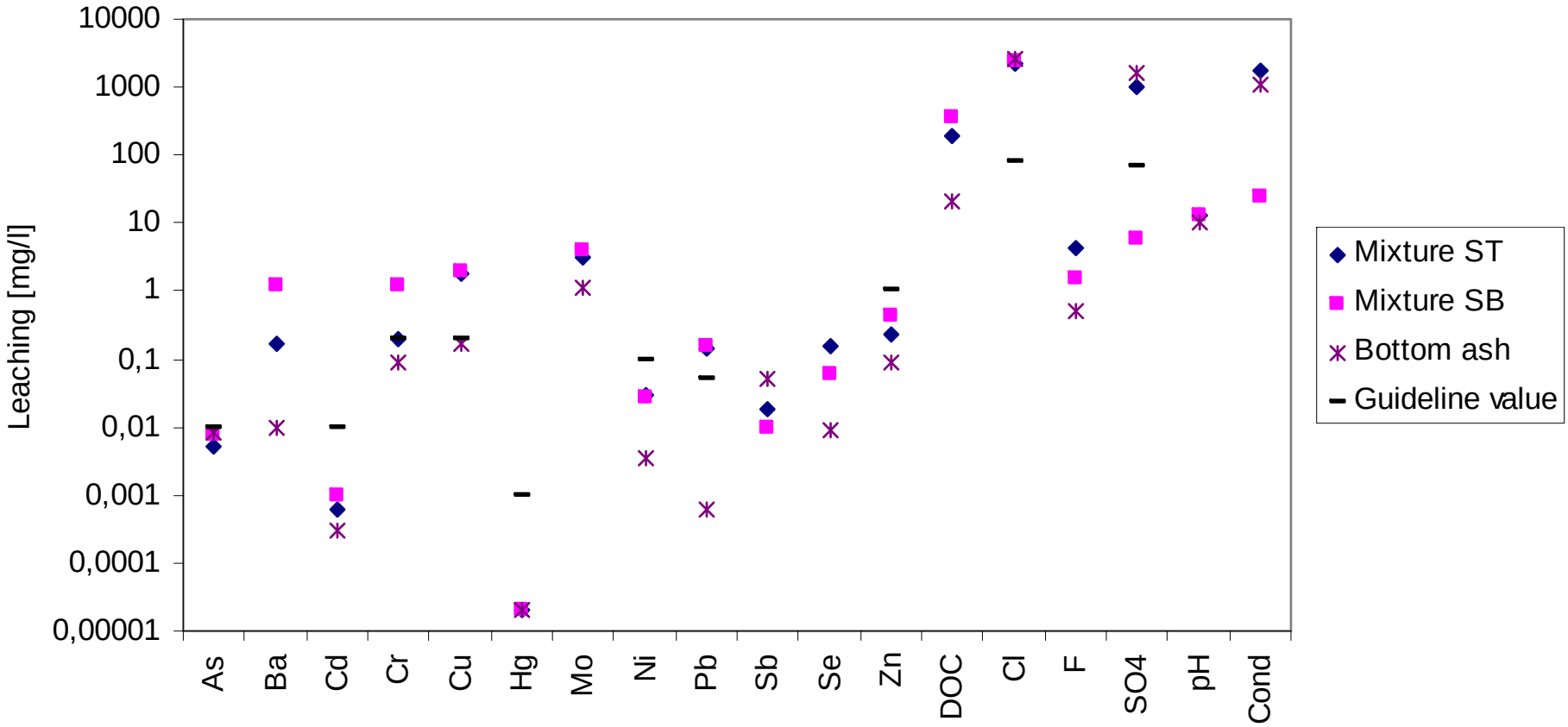
Results - Percolation leaching L/S 0,1



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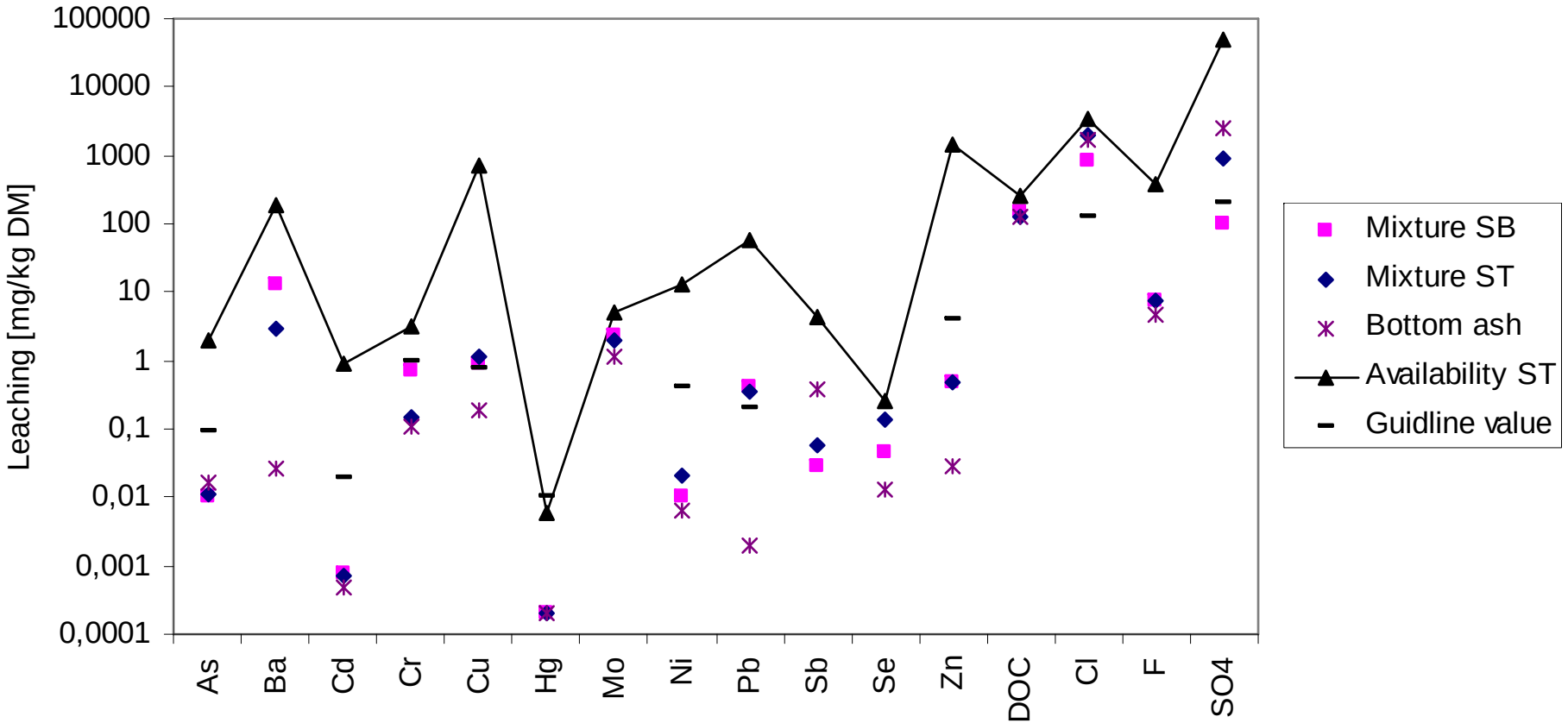
Results - Percolation leaching L/S 10



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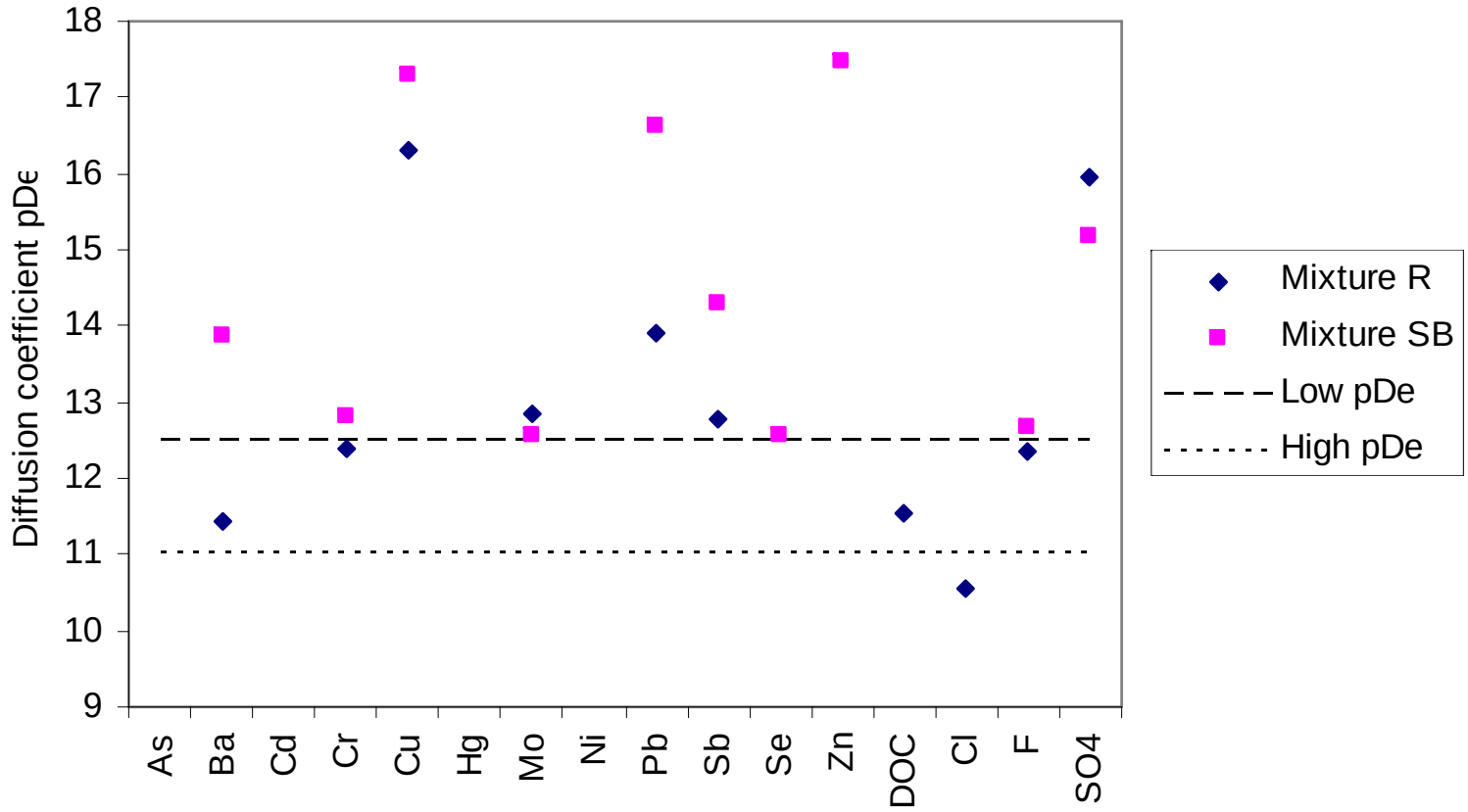
Results - Diffusion coeficients



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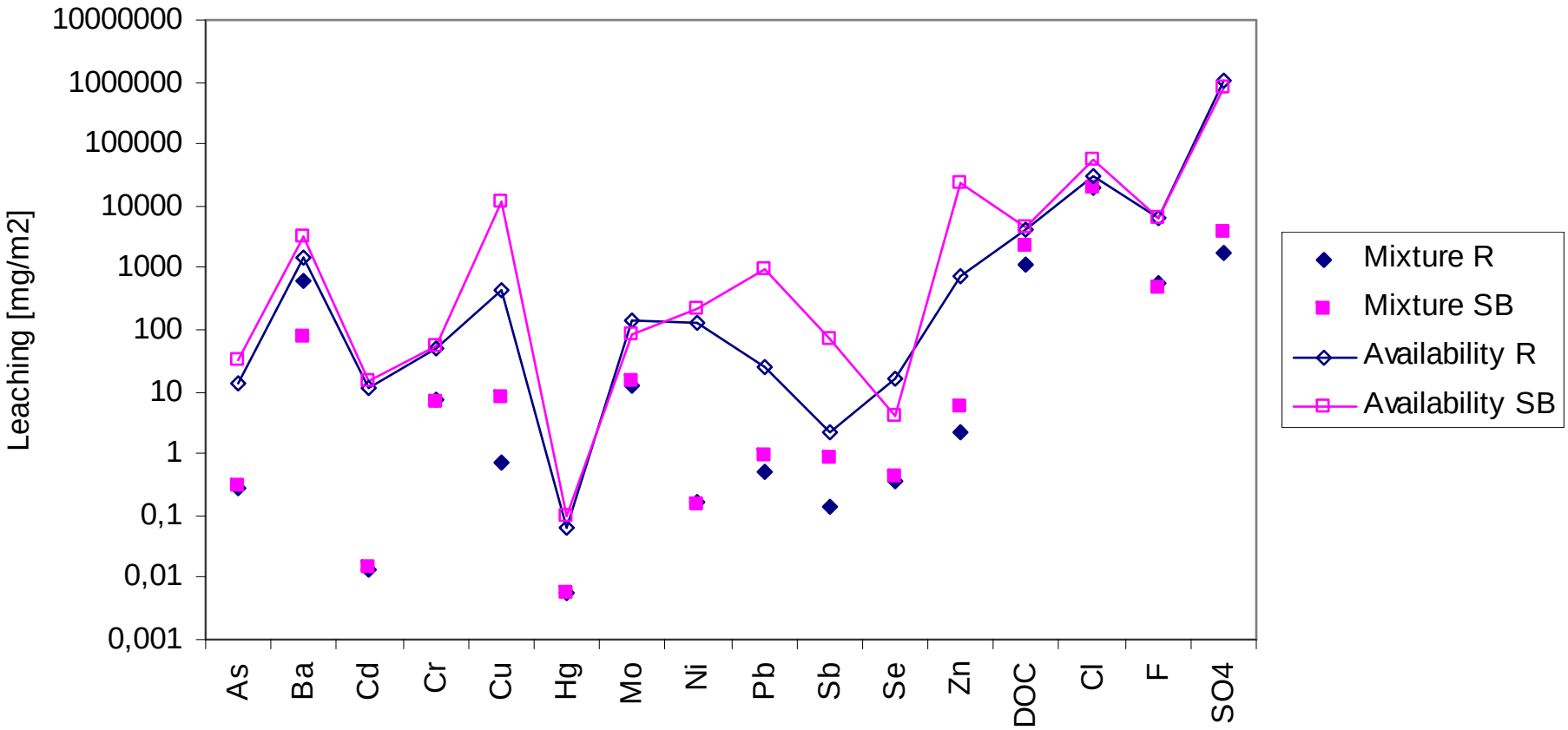
Results - Diffusion leaching



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Results - Hydraulic conductivity

Hydraulic conductivity:

- 6.35 10^{-6} m/s, hardening in 7°C during 28 days manufactured at 15% water content
- 7.05 10^{-10} m/s, hardening in 20°C during 167 days manufactured at higher water content

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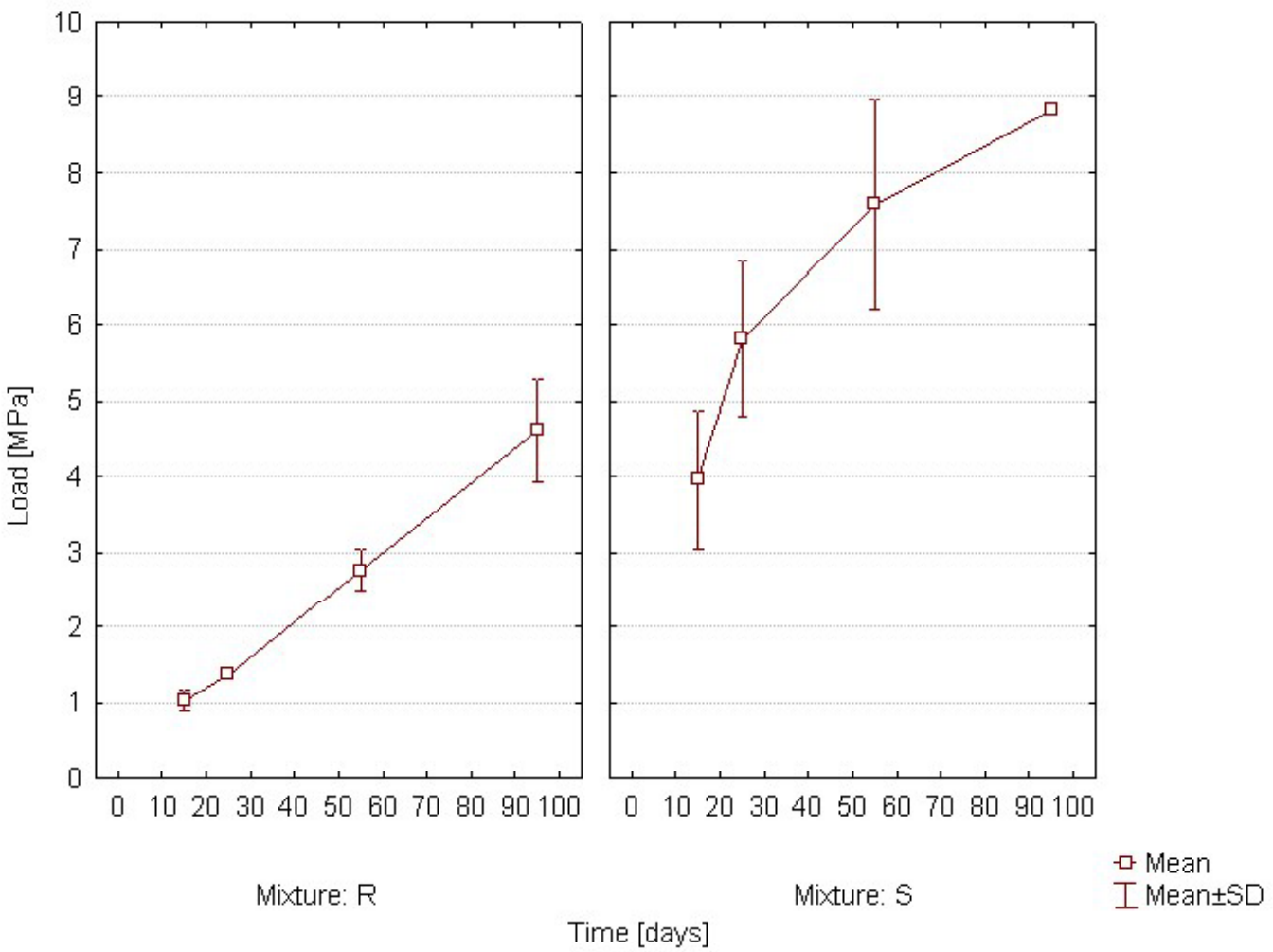
Results - Unconfined compression strength



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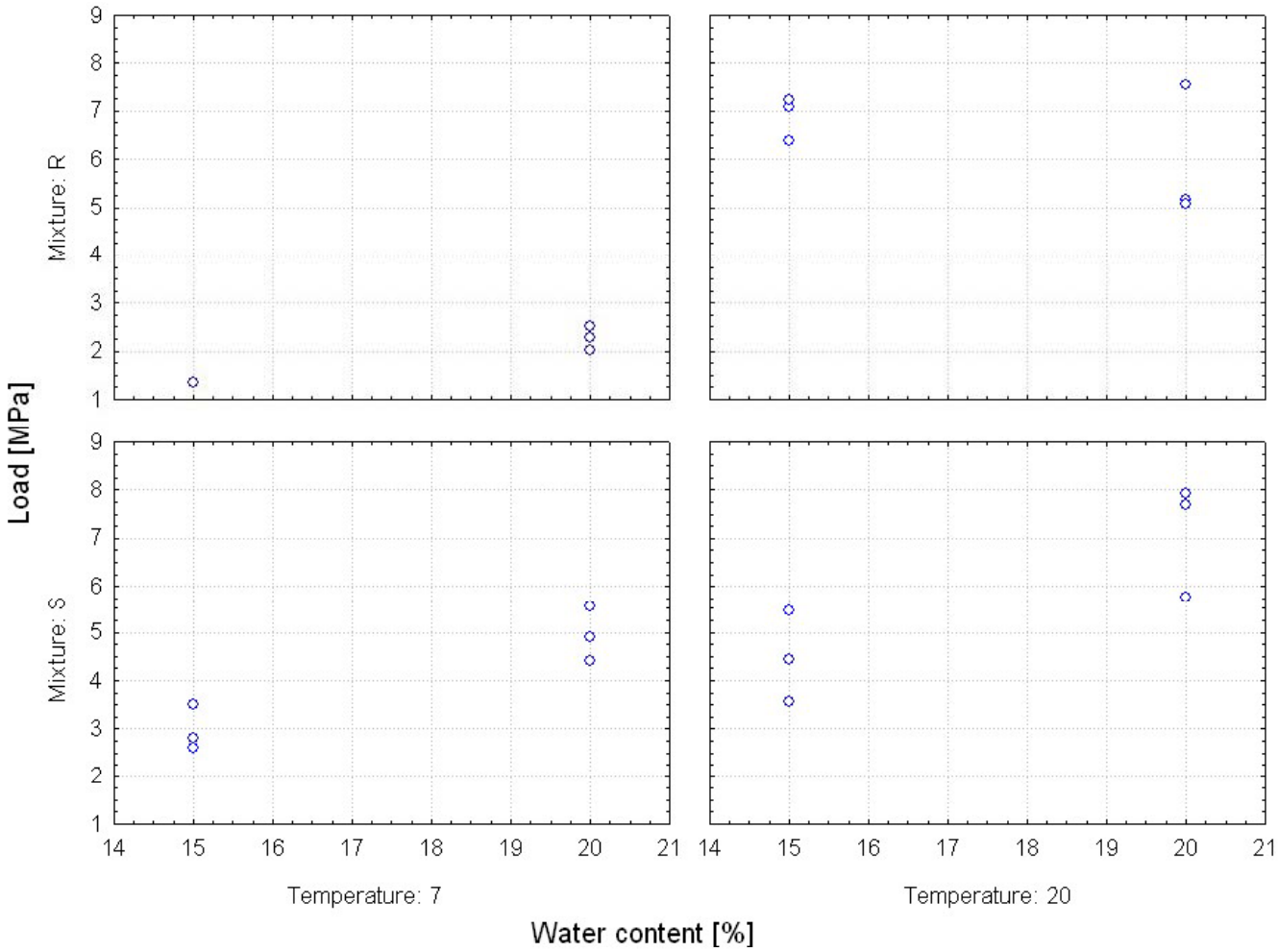
Results - Unconfined compression strength



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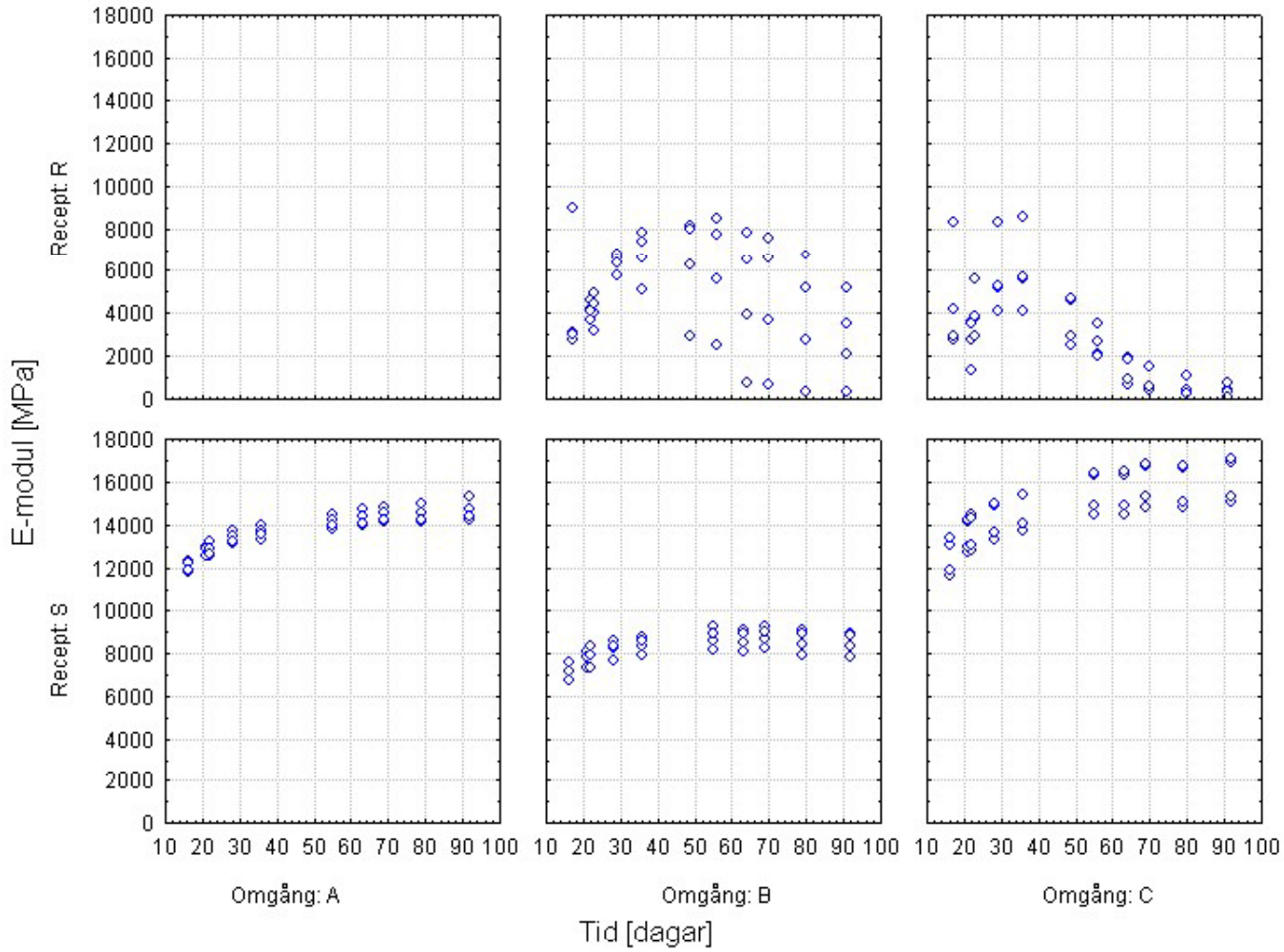
Results - Non-destructive testing



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Questions?

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