

Seminarium Miljöriktig användning av askor
31 januari - 1 februari 2006

Styrd utlakning från avfallsaskor

Malin Svensson, Luleå tekniska universitet

Inga Herrmann, Luleå tekniska universitet

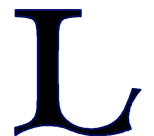
Rolf Sjöblom, Tekedo AB

Holger Ecke, Luleå tekniska universitet



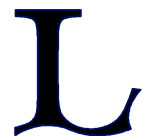
Objective

Selective mobilization and separation of critical elements in representative ashes from waste incineration



Conclusions

- Lack of regulation and/or legislation
- Waste Decree (*Avfallsförordningen*): treated BA and FA non-hazardous
- Swedish EPA Guidance Values Contaminated Soil: BA and FA did not meet limit values for less sensitive land use
- EU Landfill Directive: FA hazardous, BA non-hazardous
- Landfill-critical elements in BA: **Sb**, **Mo**, Cu, **Cr**, Cl^-
- Landfill-critical elements in FA: **Cr**, Se, Pb, Cl^-
- Leaching factors for BA: CO_2 in excess, L/S, pH, temperature and time
- Leaching factors for FA: CO_2 in excess, L/S, pH, temperature
- Selective mobilization recommended for Cl^-
- R&D needs for treatment of Cl^- -bearing leachate

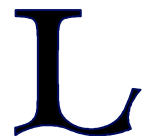


Problem

Single critical elements may ...

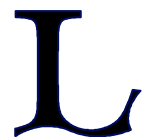
... jeopardize the reuse of ashes

... entail the crucial
discrimination between
hazardous waste and non-
hazardous waste



Project approach

- Review of literature including regulation and legislation
- Total content analysis
- Two-step compliance leaching test
- Factor-controlled leaching
- Chemical equilibrium calculation

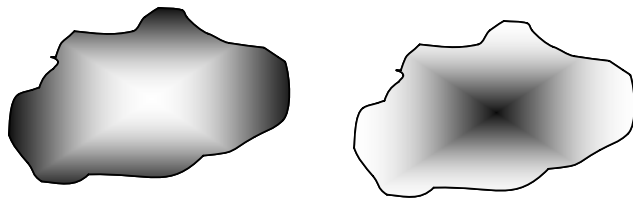


– Challenge –

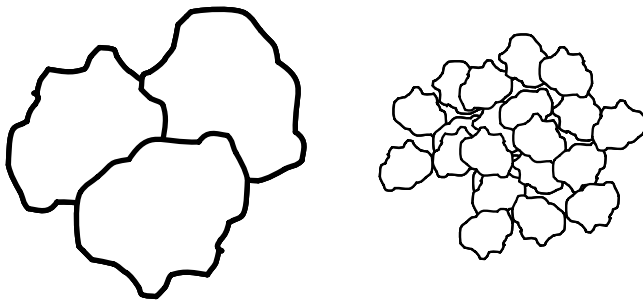
Quantification of factor impact on leaching

Surface accessibility

1. Surface enrichment

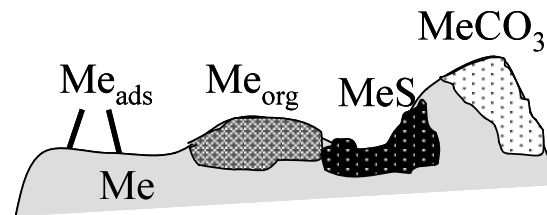


2. Particle size

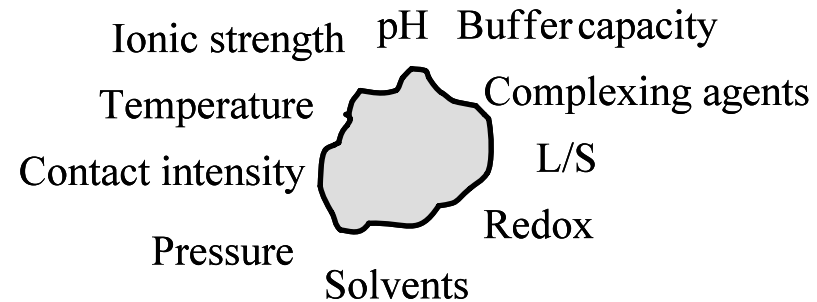


Surface solubility

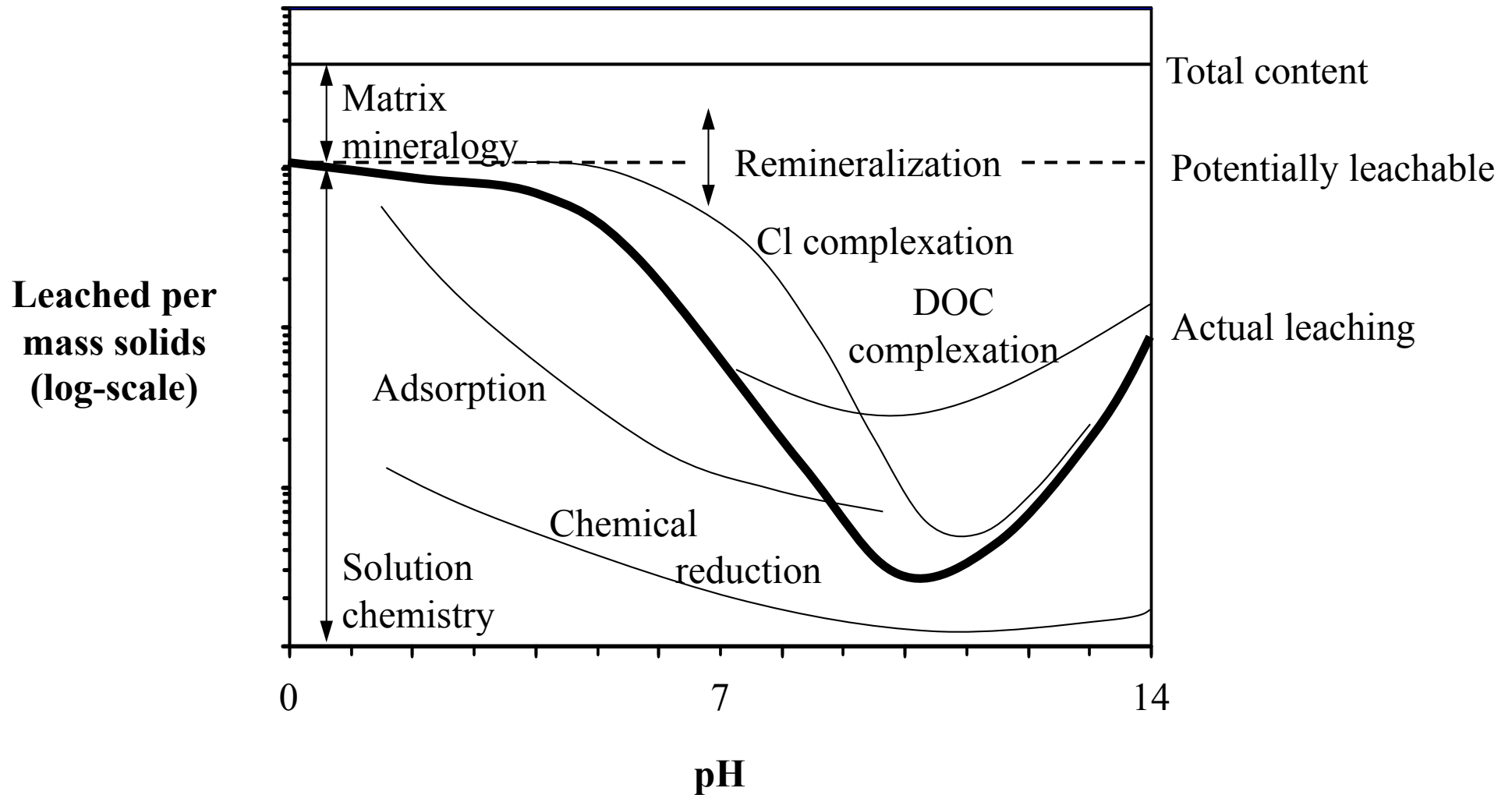
1. Surface speciation



2. Leaching conditions



Major mechanisms controlling metal leachability

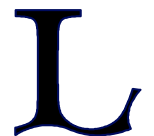


Critical element criteria

Waste Decree (*Avfallsförordningen*)

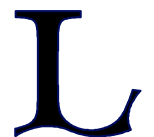
EU Landfill Directive

Swedish EPA Guidance Values Contaminated Soil
(*Naturvårdsverkets riktvärden för förorenad mark*)



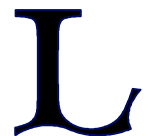
Two research objects

- Bottom ash (BA) from municipal solid waste incineration at Dåva, Umeå
- Fly ash (FA) from wood, paper and plastic incineration at Högdalenverket P6, Stockholm

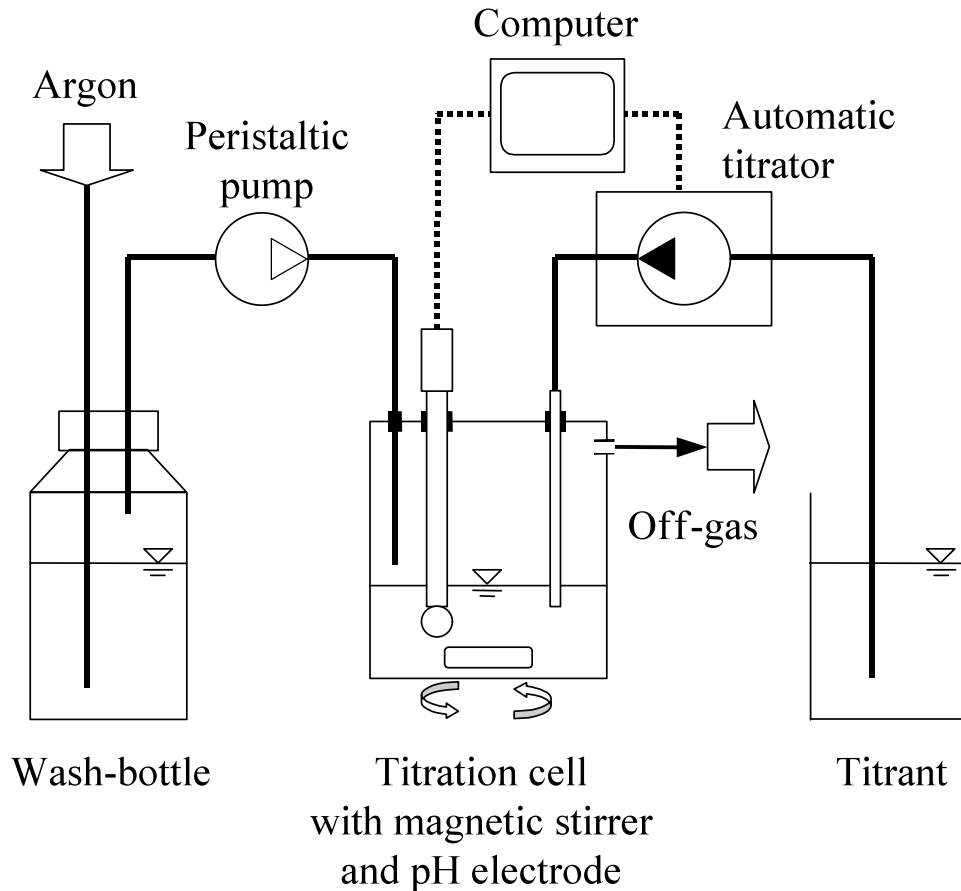


Critical elements

- Bottom ash as inert waste:
Cr, Cu, Mo, Sb, Cl⁻
- Fly ash as non-hazardous waste:
Cr, Se, Cl⁻



Experimental leaching set-up



Factors	Levels
L/S	5 / 12 / 20 kg^{-1}
Time	2 / 15 / 24 h
pH	7 / 10 / 12
Ultrasonic	0 / 10 / 40 min
Temperature	20 / 40 / 60 $^{\circ}\text{C}$
CO ₂	no / yes



– Example –

Mobilization of Sb [mg (kg BA) ⁻¹] from BA

$$\begin{aligned}\log_{10} \text{Sb} = & - 0.002 \\ & + 0.022 \times \text{L/S} \\ & - 0.075 \times \text{Time} \\ & + 0.018 \times \text{pH} \\ & + 0.007 \times \text{Temperature} \\ & + 0.007 \times \text{Time} \times \text{pH}\end{aligned}$$

Degree of explanation, $R^2 = 0.90$

