



Development of a Novel GANEX Process

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Summary

- GANEX, a separation process for the next generation of nuclear systems
- The Chalmers GANEX process (BTBP + TBP)
 - Successful An group separation from Ln
 - Possible to extract An under metal loading
 - Some problems with FP and CP
 - These problems have possible solutions
 - System stable towards hydrolysis and radiolysis





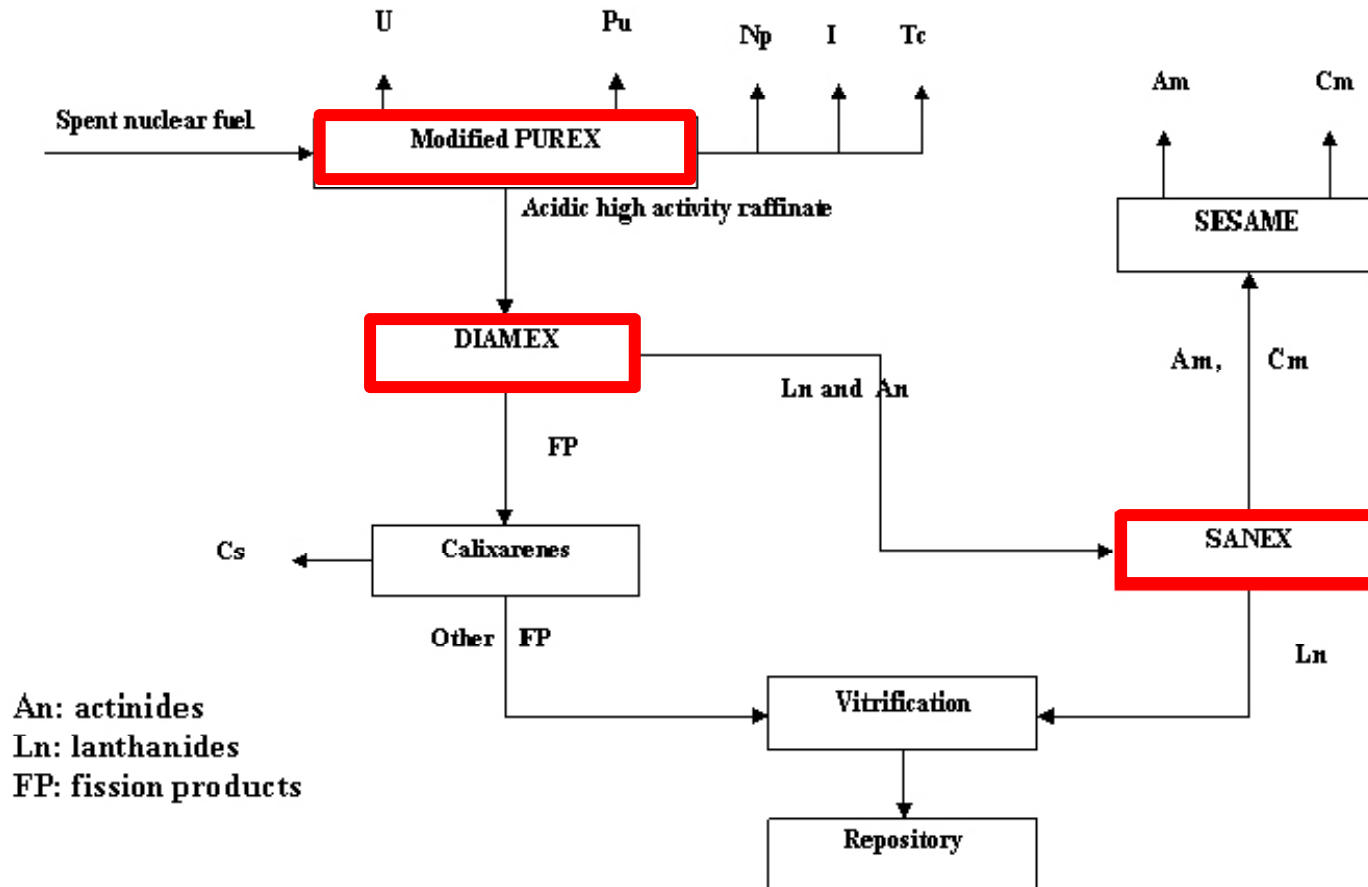
Background - P&T History at Chalmers

- The first P&T research started almost 30 years ago as means to reduce the radiotoxicity of waste flows from processing plants.
- The research started again about 14 years ago as part of an EU project, NEWPART, followed by PARTNEW and then EUROPART.
- The EU framework project in the area of P&T, ACSEPT, has been running since March 2008 and the Chalmers group is participating



Background - The old European P&T route

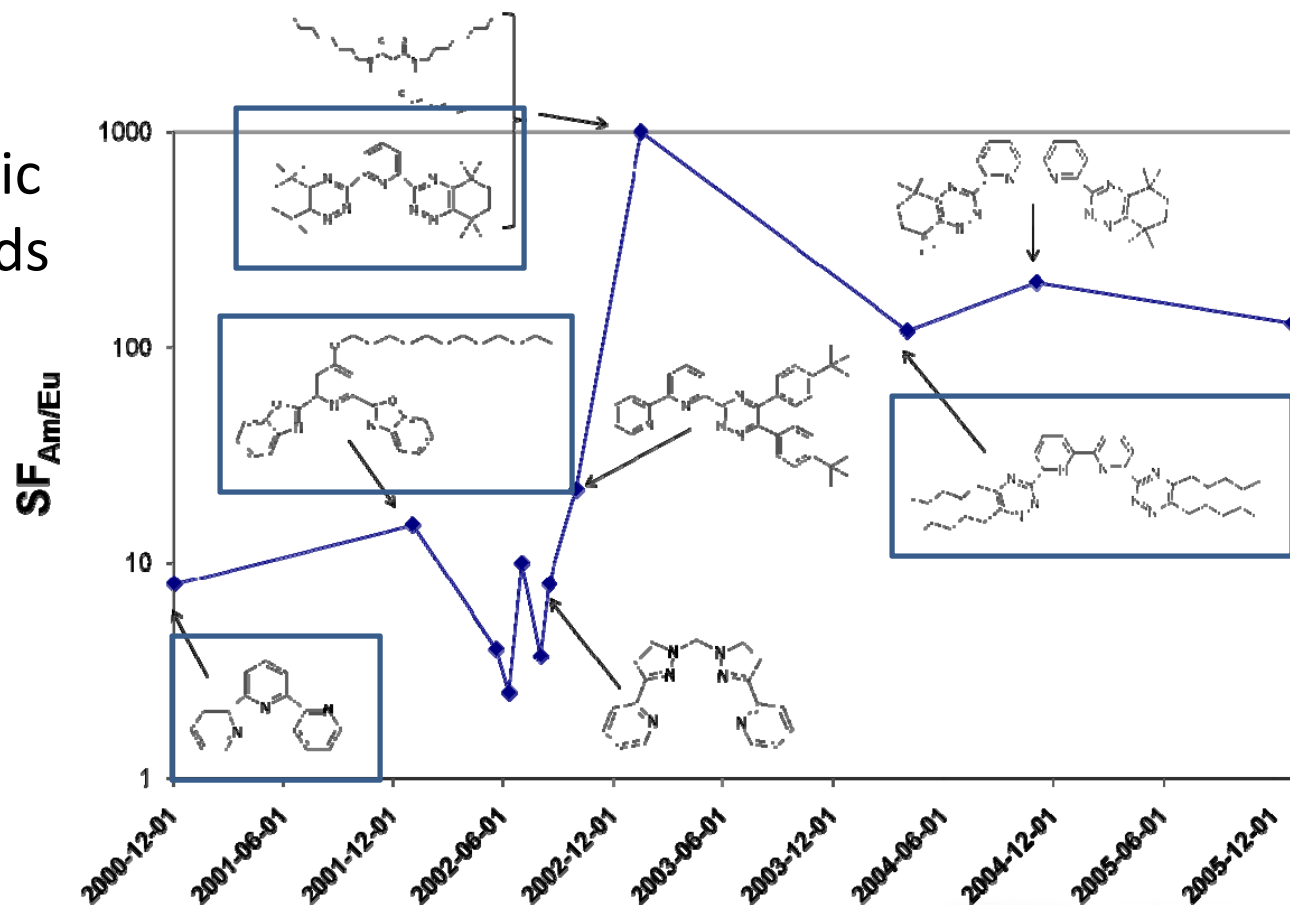
(proven in hot tests on genuine spent fuel)



Background – Ligand Development

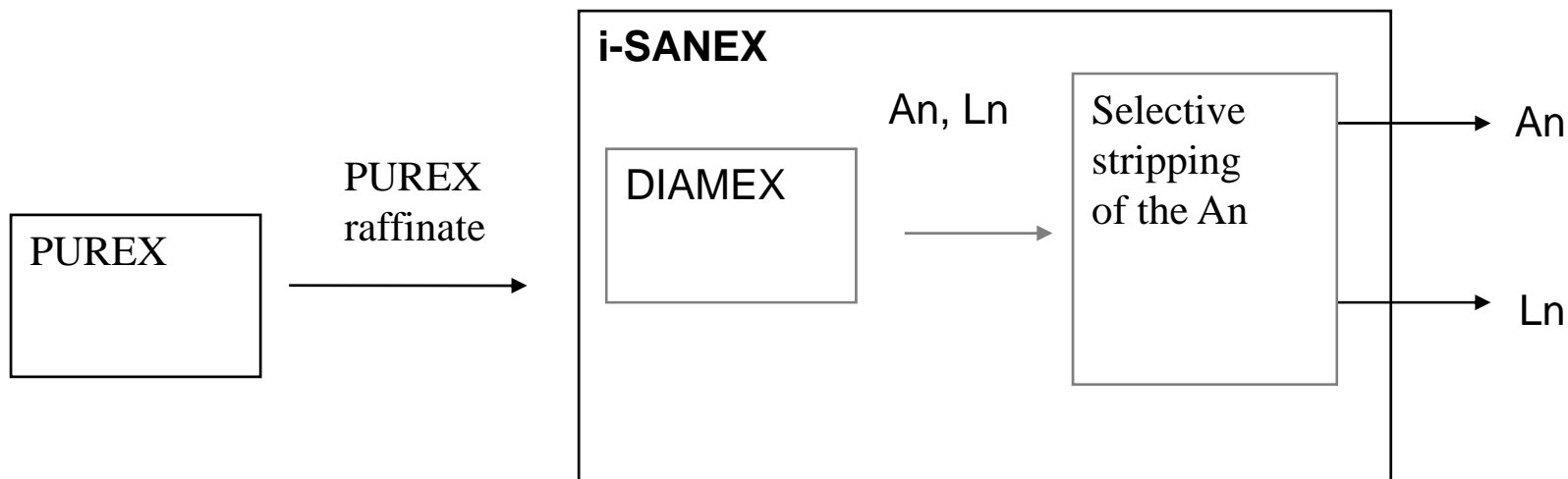
Heterocyclic, aromatic nitrogen donor ligands
e.g.

- TERPY
- BODO
- BTP
- BTBP



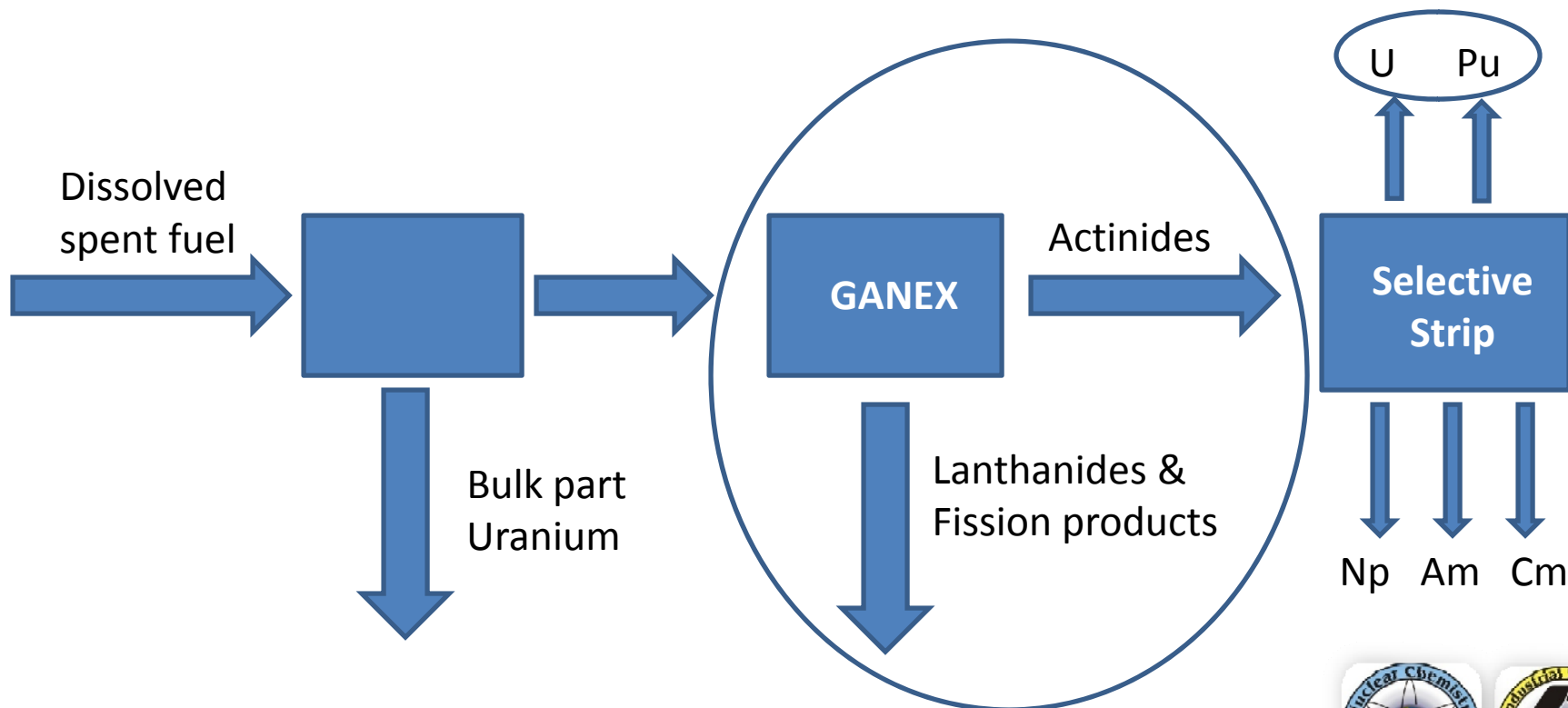
Background - The new European P&T routes

- i-SANEX



- GANEX

Background - GANEX Group ActiNide EXtraction





The Chalmers GANEX process

- Combine two well known extractants with different properties:

Extract trivalent actinides and separate them from the trivalent lanthanides. Extract pentavalent actinides.

BTBP (heterocyclic N-donor ligand)

Extract tetra- and hexavalent actinides

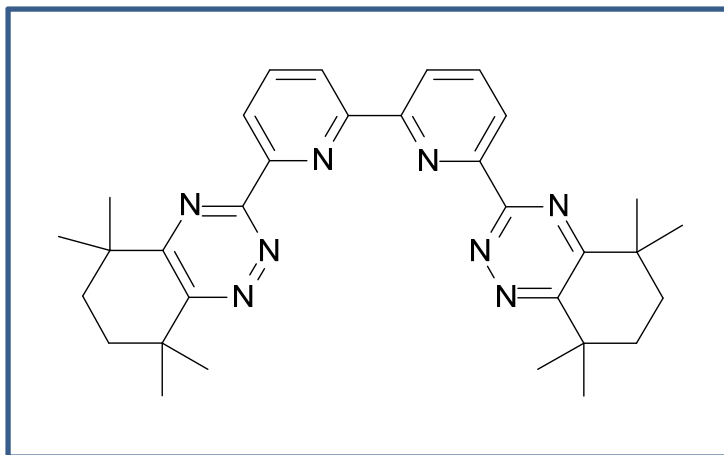
TBP (organophosphorous O-donor ligand)

=> No need for redox control

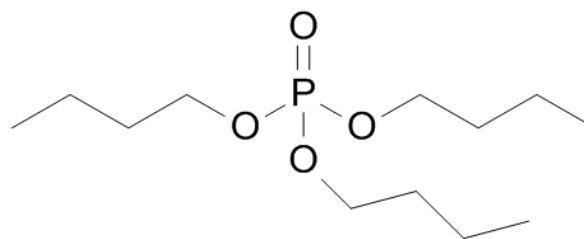


The Chalmers GANEX process

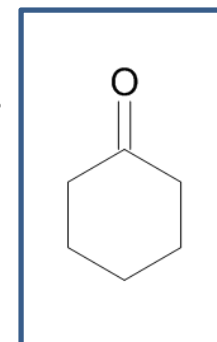
- The extractants are combined into one solvent and used for actinide extraction from 4M HNO₃
- Due to strong acid and irradiation, a stable BTBP is needed
- Due to poor solubility of the BTBP and the poor extraction kinetics of the solvent the diluent used is cyclohexanone



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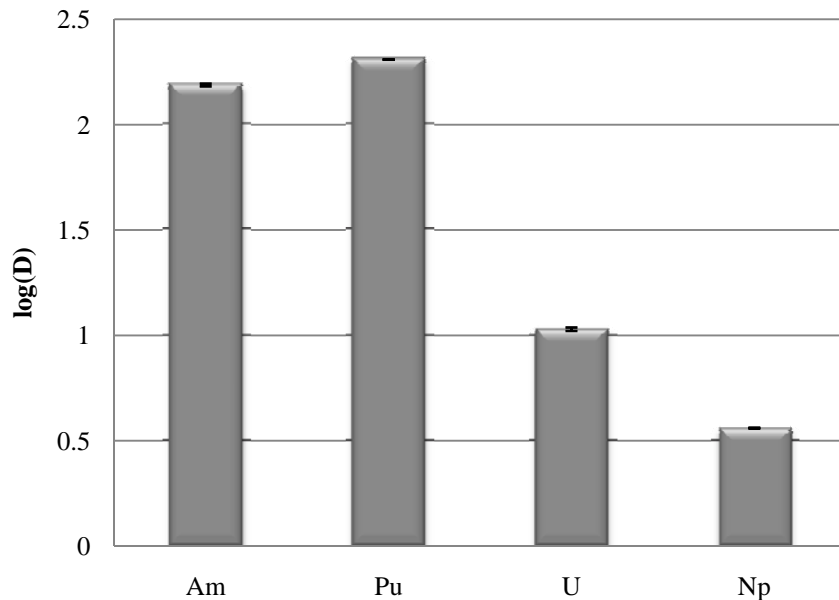


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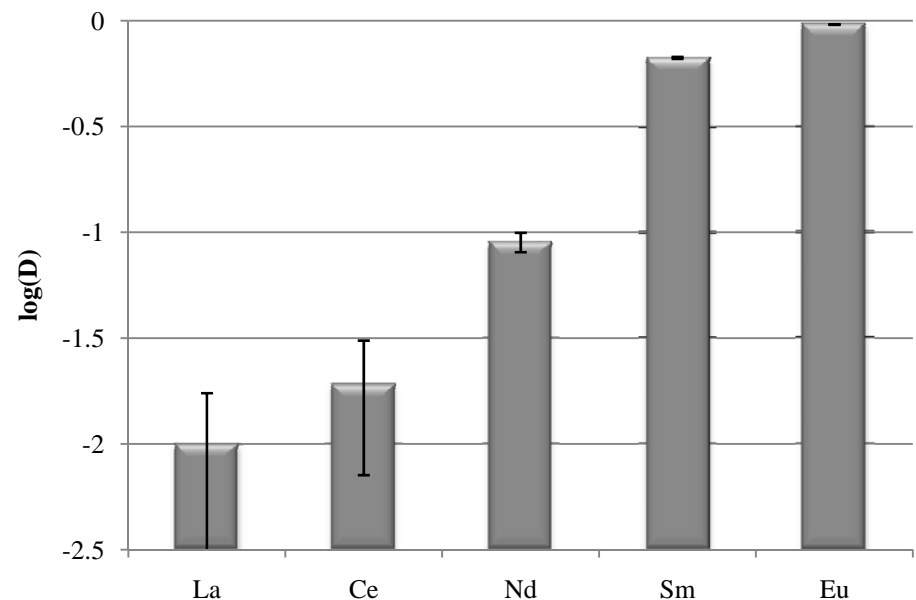


The Chalmers Process – Results

Actinides



Lanthanides



The Chalmers Process – Results

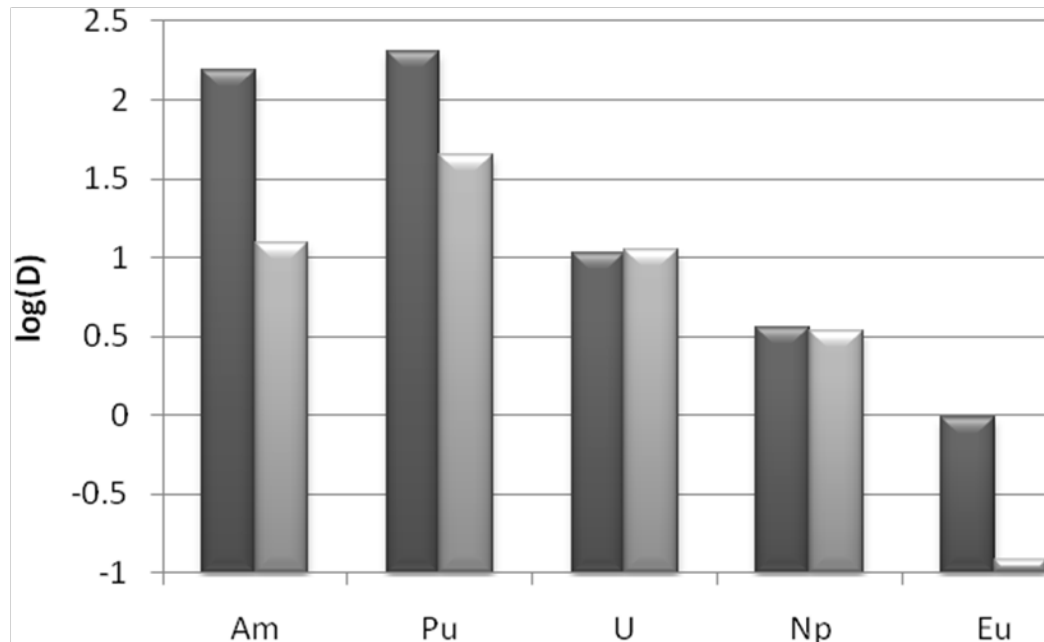
Separation Factors

Elements	Separation factor
Am / Eu	160
Pu / Eu	210
U / Eu	11
Np / Eu	3.5
Am / Nd	1700
Pu / Nd	2300
U / Nd	120
Np / Nd	38

The Chalmers Process – Results

Metal loading

(Rb, Sr, Y, Zr, Mo, Rh, Pd, Ag, Cd, Sb, Cs, Ba, La, Ce, Nd, Sm, Te)



The Chalmers Process – Results

Separation Factors

Without Metal Loading

Elements	Separation factor
Am / Eu	160
Pu / Eu	210
U / Eu	11
Np / Eu	3.5

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Metal Loading

Elements	Separation factor
Am / Eu	101
Pu / Eu	363
U / Eu	91
Np / Eu	28



The Chalmers Process – Results

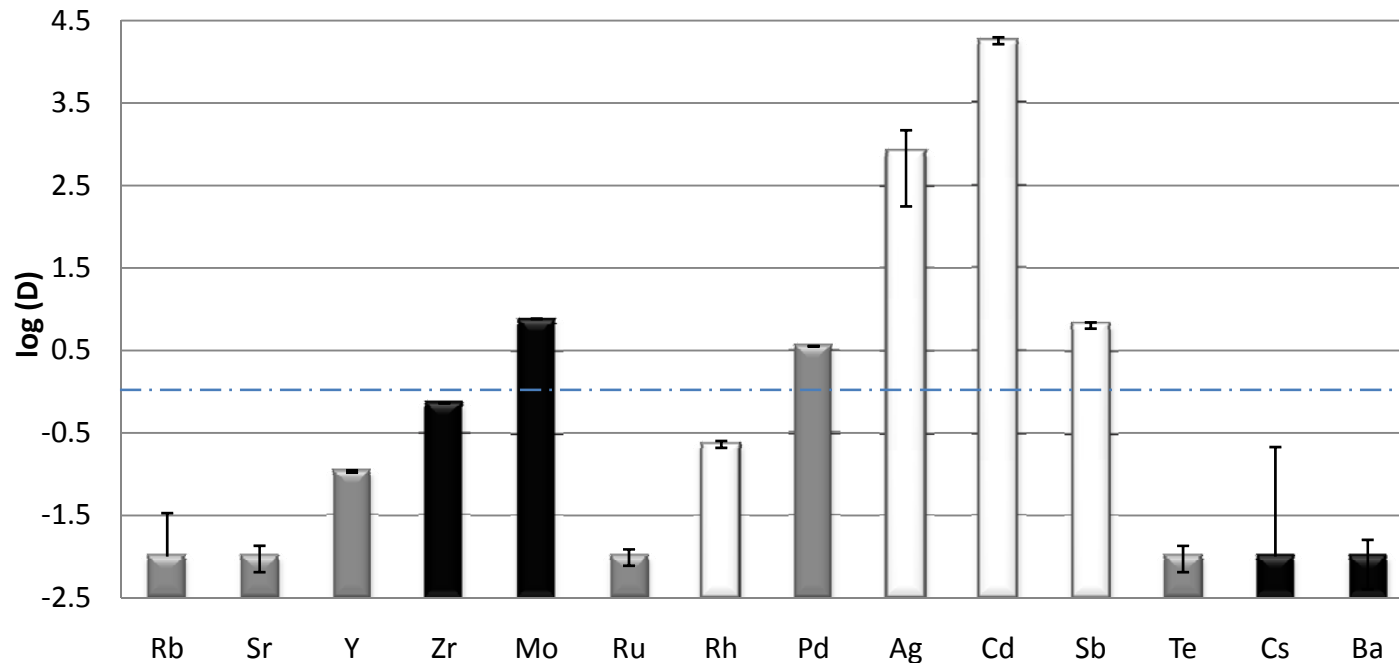
Fission/Corrosion product extraction

- Extraction of Fission and/or Corrosion Products in the GANEX process is unwanted
- Extraction under process like conditions
=> Metal concentrations close to those in dissolved spent fuel



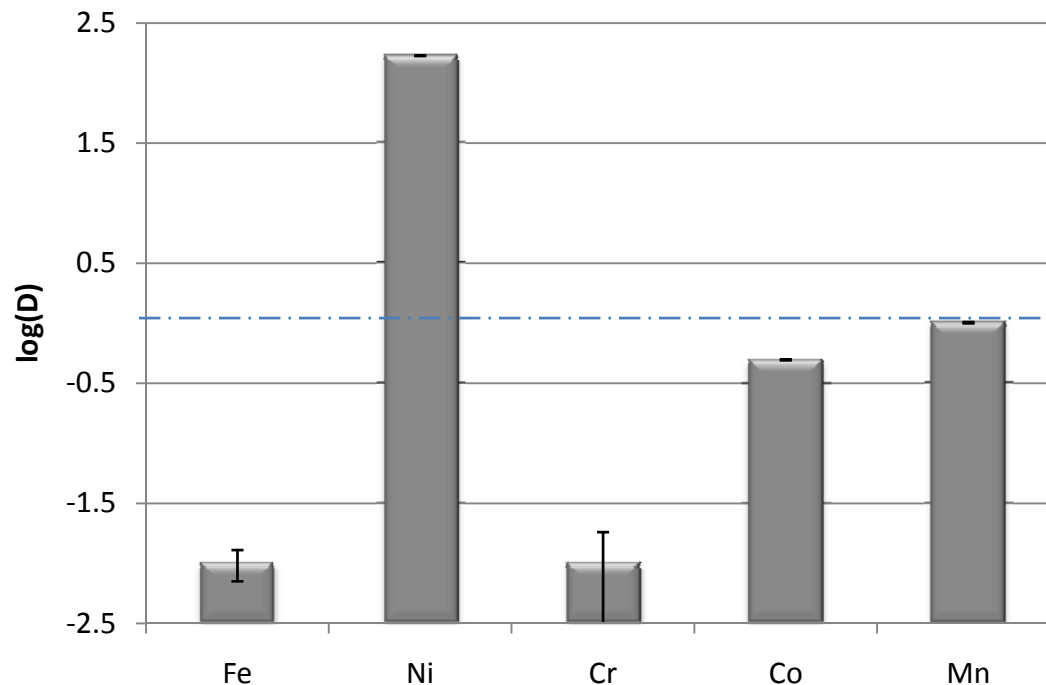
The Chalmers Process – Results

Fission product extraction



The Chalmers Process – Results

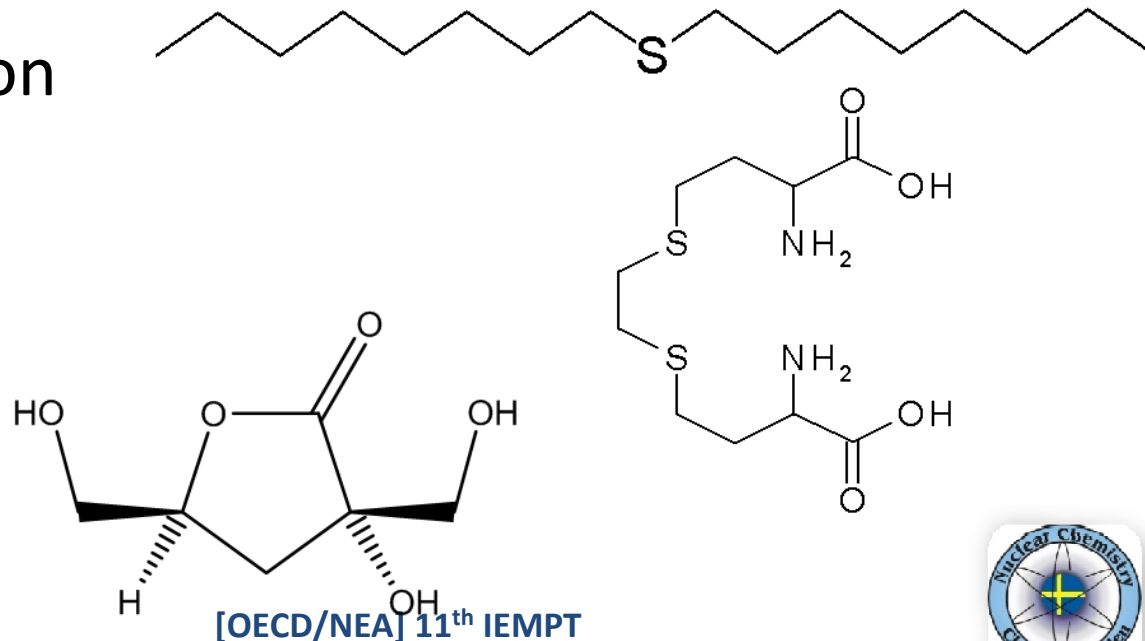
Corrosion product extraction



The Chalmers Process – Results

Fission- and Corrosion Product problem
Can be dealt with in different ways e.g.

- Pre extraction
- Suppression
- Stripping

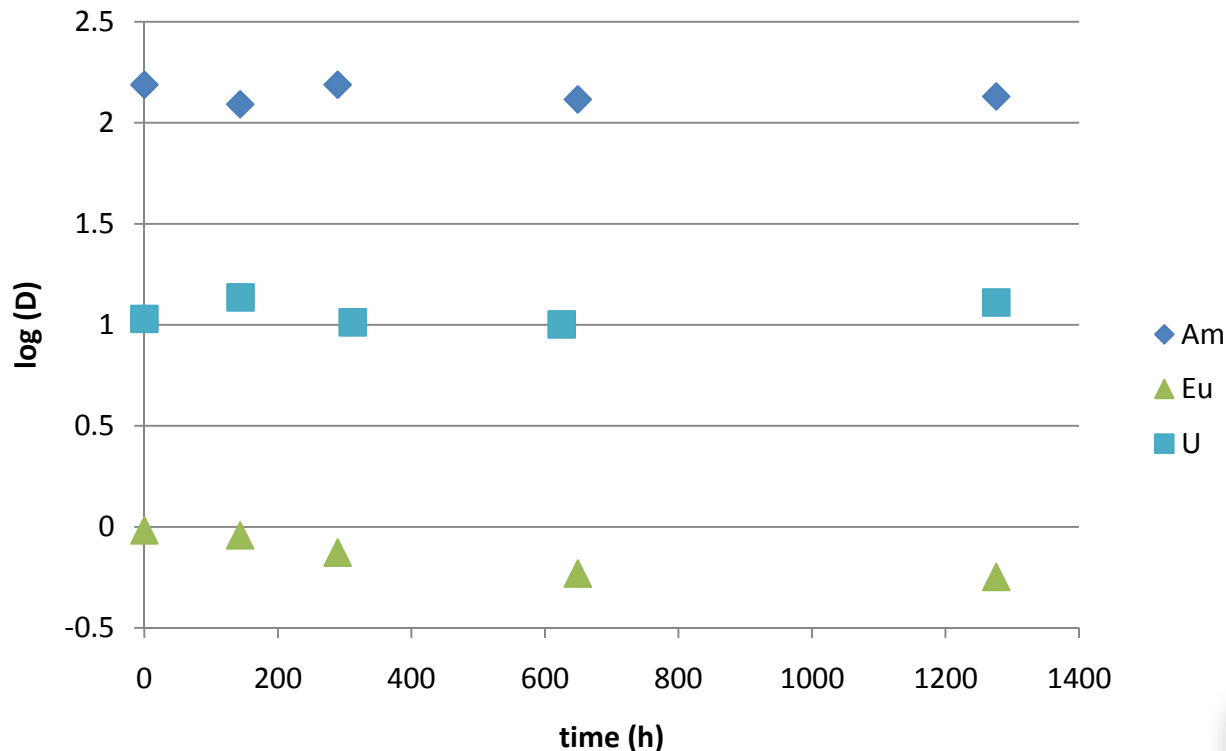


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San Francisco, November 2010

The Chalmers Process – Results Stability

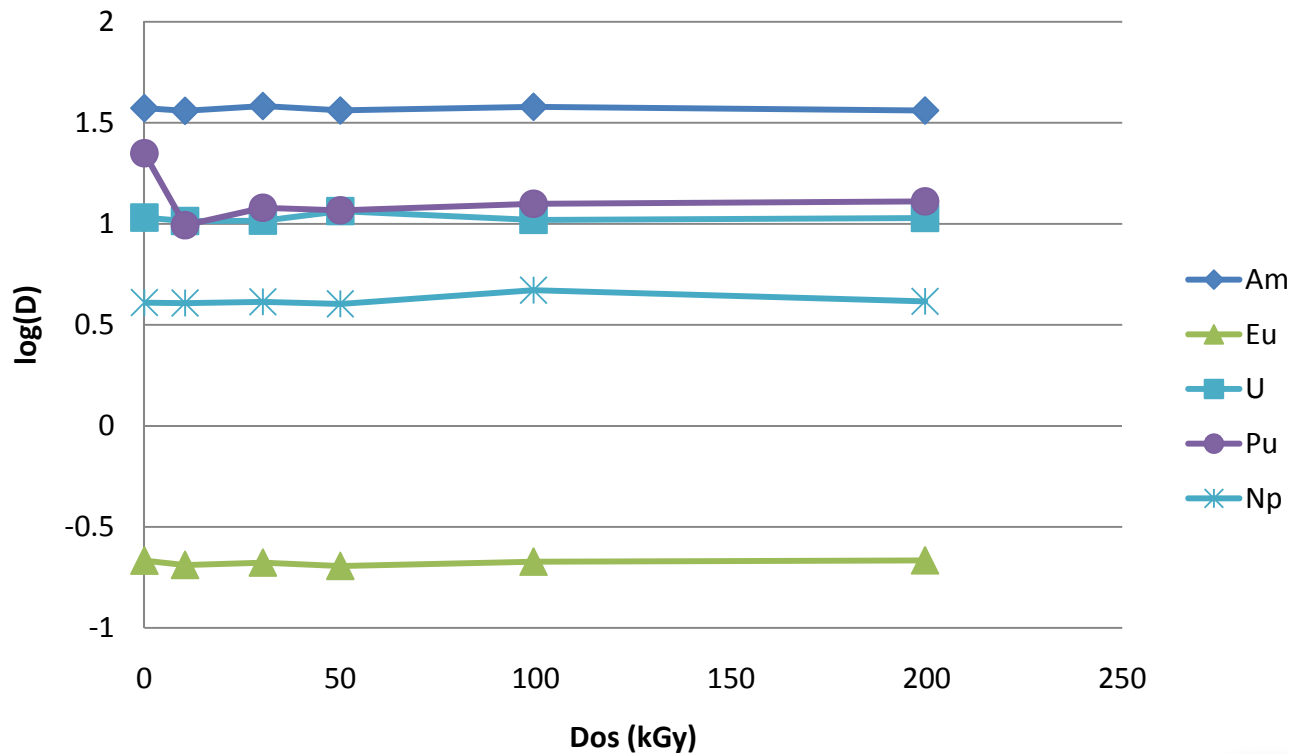
Hydrolytic stability



[OECD/NEA] 11th IEMPT
San Francisco, November 2010

The Chalmers Process – Results

Radiolytic stability





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Thank you for listening!

