* Abstract
  + PUREX experiment
  + Determined Decontamination factors for U, Mo, Ru, Ce, Sm, Sr, Pm, Eu, Nd, Pd, Cd, Ba, Sn
  + Single contact, and 4 contact
  + Overall 94 % Pu recovery with overall DF of 20 and 5
* Introduction
  + Literature sources on overall process or cycle decontamination factors (106 – 108)
  + Details about elemental DF for PUREX have been largely limited to major activity contributors (Ru, Zr)
  + Investigation of PUREX processed plutonium for trace contaminates give indication of material origins
* Background
  + Defined DC, and DF
    - DF characteristic of different process cycles
  + Defined overall DF and show how individual DFs are important (because a single number doesn’t tell me a lot of information about individual elements)
    - DF overall is a strong function of the pool of contaminants used for calculation
      * DF driven by contaminants with largest initial concentration followed by contaminants with large DC
        + 30 contaminants, DC = 0.001, DF = 1000. Single contaminant to 0.01, DF = 772. (worse with less contaminants)
        + Change the one to 0.1, DF = 250 (75% error) (worse with bigger delta)
      * DF limited to worst contaminant
    - DFs driven by volume
    - Each contact of TBP drives DFs down.
* Literature review
  + DFs and PUREX process described
  + DC for uranium
  + Differential uranium decontamination
  + Over cycle DF for PUREX for Ru, Zr, and Nb, can’t find alkali earth metals
* Experiment
  + Mostly the same as before – probably good for a nuclear engineer, not good for a chemist
* Results

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Element | 1 Contact TBP/ 1 Contact Fe | ± | 4 Contact TBP/ 3 Contact Fe | ± |
| Heavy Metal | | | | |
| U | 6.85 | 0.46 | 15.08 | 0.60 |
| Alkali Metals | | | | |
| Rb | 32 | 1.55 | 1.84 | 0.26 |
| Cs | 146 | 7.58 | 11.92 | 0.96 |
| Alkaline Earth | | | | |
| Sr | 233.5 | 12.74 | 38.26 | 2.23 |
| Ba | 344.4 | 200 | 0.39 | 50 |
| Transition Metals/Post Transition Metals | | | | |
| Mo | 20.67 | 2.03 | 1.19 | 0.25 |
| Ru | 49 | 1.9 | 2.84 | 0.111 |
| Pd | 65 | 14.3 | 3.62 | 0.94 |
| Cd | 61 | 6.6 | 3.5 | 0.98 |
| Sn | 7.45 | 0.43 | 13.85 | 1.29 |
| Lanthanides | | | | |
| Ce | 35.24 | 1.68 | 3.2 | 0.67 |
| Nd | 15.2 | 1.429 | 8.6 | 3.4 |
| Pm | 10.7 | 0.66 | 3.3 | 0.5 |
| Sm | 9.94 | 0.25 | 2.5 | 0.19 |
| Eu | 8.4 | 0.49 | 2.6 | 0.23 |

Over process

76% Pu recovery for 1 contact, 94 % for four

Low because of volume holdup

Talk about not letting elements reach equilibrium (don’t know how I would go about doing that)

94%, then 90%, then terribly, decay of iron(II), nitrite (exists in low quantities)

Talk about different trends among elements for DF

Cesium and rubidium have a large difference in DF (Still working on figuring that out).

Is this due to lanthanide contraction? Where as the atoms get smaller, with a higher charge density, they are more easily extracted? – Does this explain why Cs is better than Rb, and why Ba is better than Sr?)