Microwave-Assisted Homogeneous Liquid-Liquid Extraction of Platinum Group Elements from Nitric Acid Aqueous Solution to Thermomorphic [Hbet][Tf₂N] Ionic Liquid

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Introduction

Nuclear Fuel Cycle and vitrification

Microwave irradiation

Thermomorphic ionic liquid ; [Hbet][Tf₂N]

Microwave assisted extraction

Results & Discussion - I : Liquid-liquid extraction

Single system

Mixe system: solution system containing Ru(III), Rh(III), or Pd(II).

Extractability (%) of Ru(III), Rh(III), and Pd(II) vs. [HNO₃] in the [Hbet][Tf₂N]-HNO₃(aq) system. Shaking time: 1 h.

<table>
<thead>
<tr>
<th>[HNO₃] (M)</th>
<th>Pd(II)</th>
<th>Rh(III)</th>
<th>Ru(III)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.3</td>
<td>60%</td>
<td>50%</td>
<td>40%</td>
</tr>
<tr>
<td>0.5</td>
<td>70%</td>
<td>60%</td>
<td>50%</td>
</tr>
<tr>
<td>1.0</td>
<td>80%</td>
<td>70%</td>
<td>60%</td>
</tr>
</tbody>
</table>

Extractability (%) of each metal species decreases with increasing [HNO₃]. Pd(II) at 0.3M [HNO₃] shows high extractability.

Results & Discussion - II : Microwave assisted extraction

Single system

<table>
<thead>
<tr>
<th>[Hbet][Tf₂N]</th>
<th>[Hbet][Tf₂N]</th>
<th>[Hbet][Tf₂N]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1M HNO₃</td>
<td>200 W(2.45 GHz)</td>
<td>ICP-MS measurement : Agilent ICP-MS 7700</td>
</tr>
</tbody>
</table>

Mixed system: solution system containing Ru(III), Rh(III), and Pd(II).

Extractability (%) of Ru(III), Rh(III), and Pd(II) in microwave assisted extraction of the [Hbet][Tf₂N]-0.3 M HNO₃(aq) system. Left: single system, Right: mixed system.

Conclusions

Microwave irradiation largely accelerates the homogeneous liquid-liquid extraction reactions of Rh(III) and Ru(III) in the HNO₃(aq)-[Hbet][Tf₂N] system.

Future Works

Detail studies on extraction mechanism.
Mutual separation of Ru(III), Rh(III), and Pd(II).
Investigation of new ionic liquids.