Thallium extraction from hydrochloric acid media into a deep eutectic solvent using bis(2-ethylhexyl) phosphate

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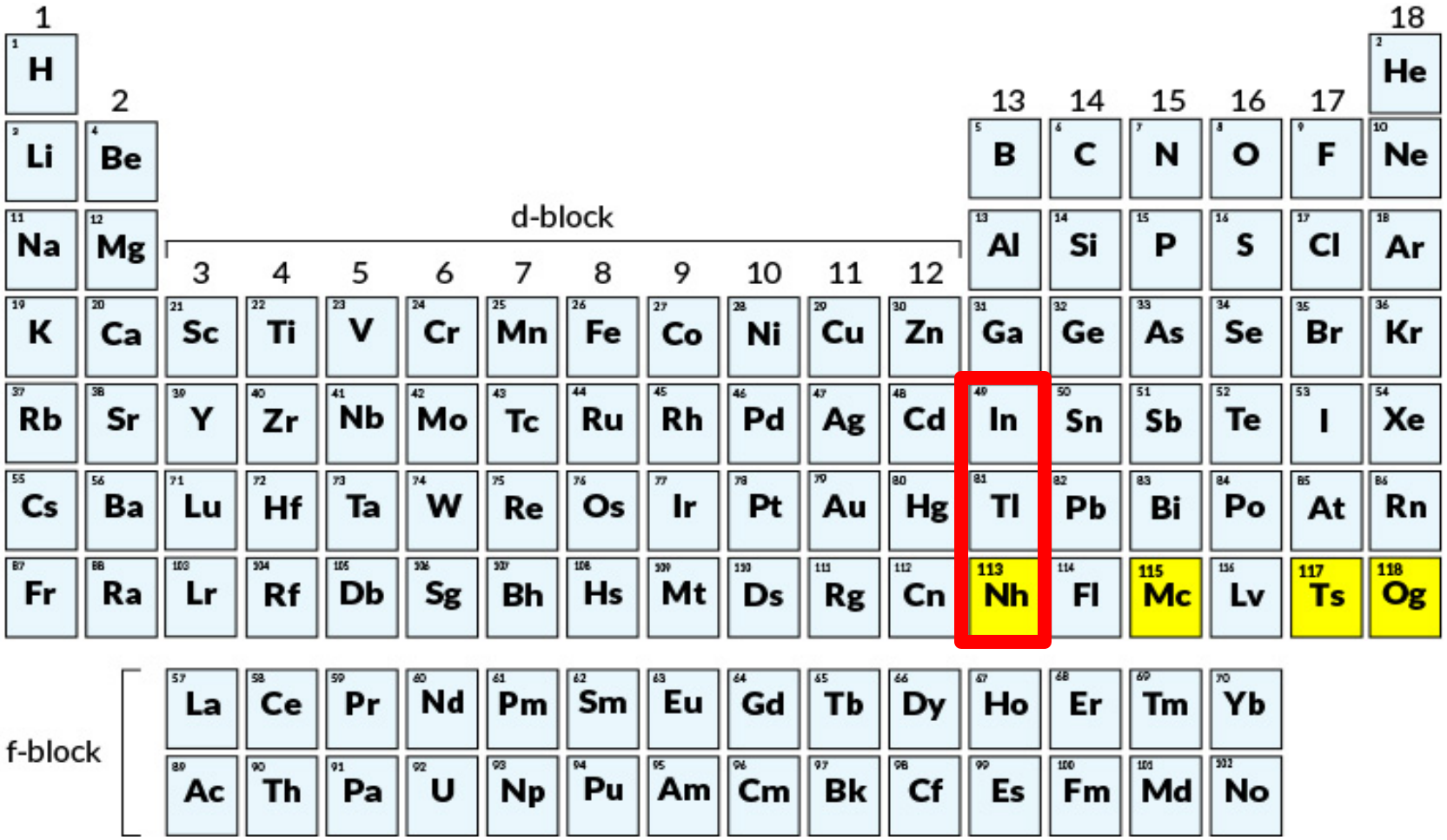
Introduction

- Chemical properties of superheavy elements (Z > 108) are relatively unknown, with exception of element 112
- Preliminary research to investigate the chemical properties of Element 113
  - Chemical behavior of its homologs, In and Tl are studied
  - In this work, specifically Tl extraction
- Overall goal: investigate whether the periodic trends are maintained for superheavy elements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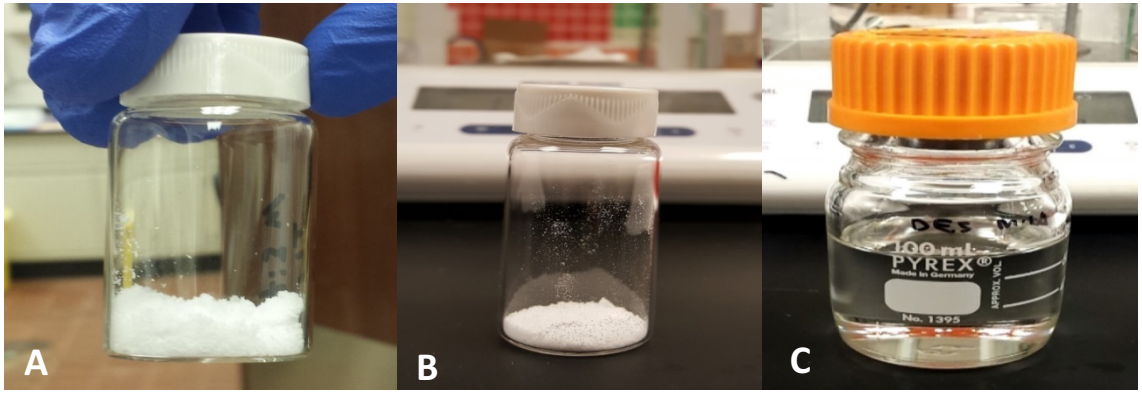
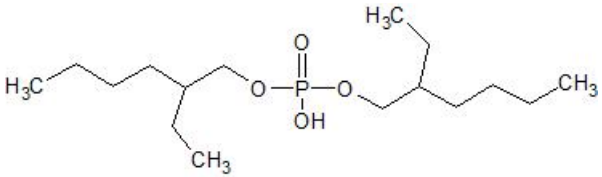
Deep Eutectic Solvents (DESs)

- DESs are a mixture of a Lewis acid and base with a melting point lower than its substituent parts
- This work uses a DES composed of a 2:1 molar ratio of DL-menthol and lauric acid (DES M:LA)





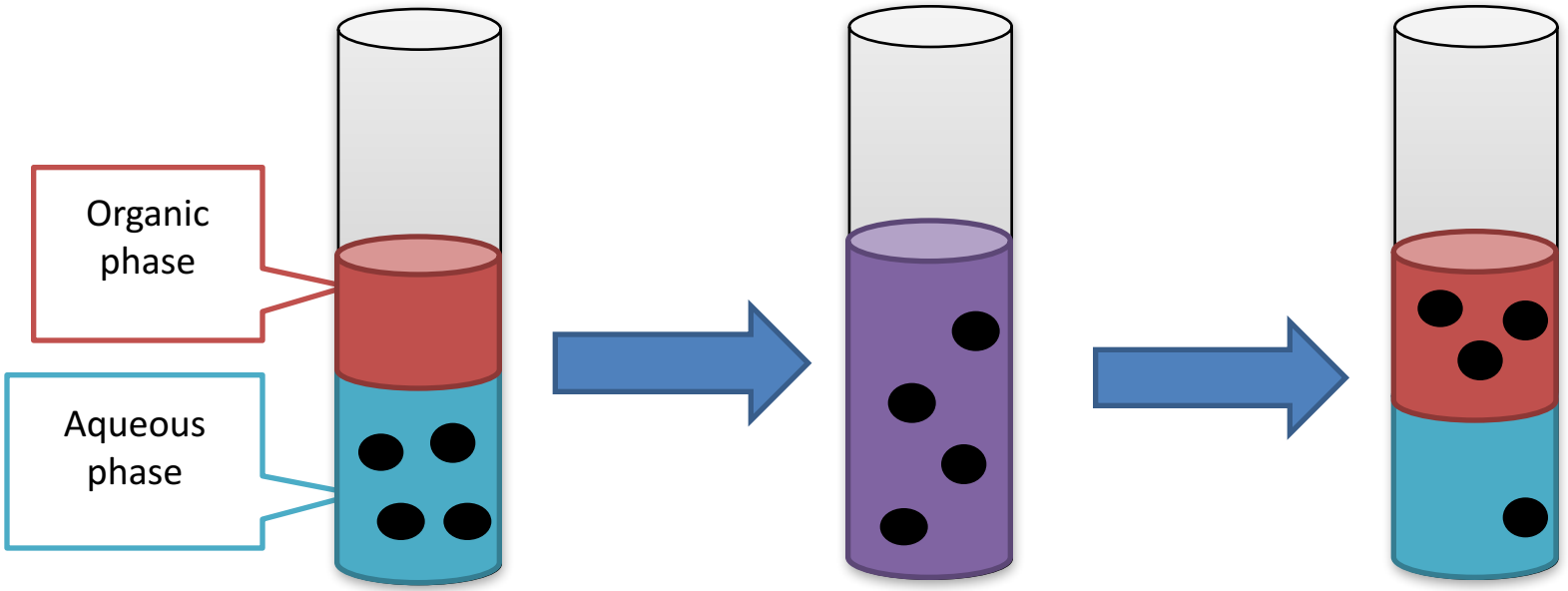
bis(2-ethylhexyl) phosphate

DL-menthol
T_m = 36.82˚C [3]

Lauric Acid
T_m = 43.29˚C

DES M:LA
T_m = 13.84˚C

Liquid-liquid Extractions



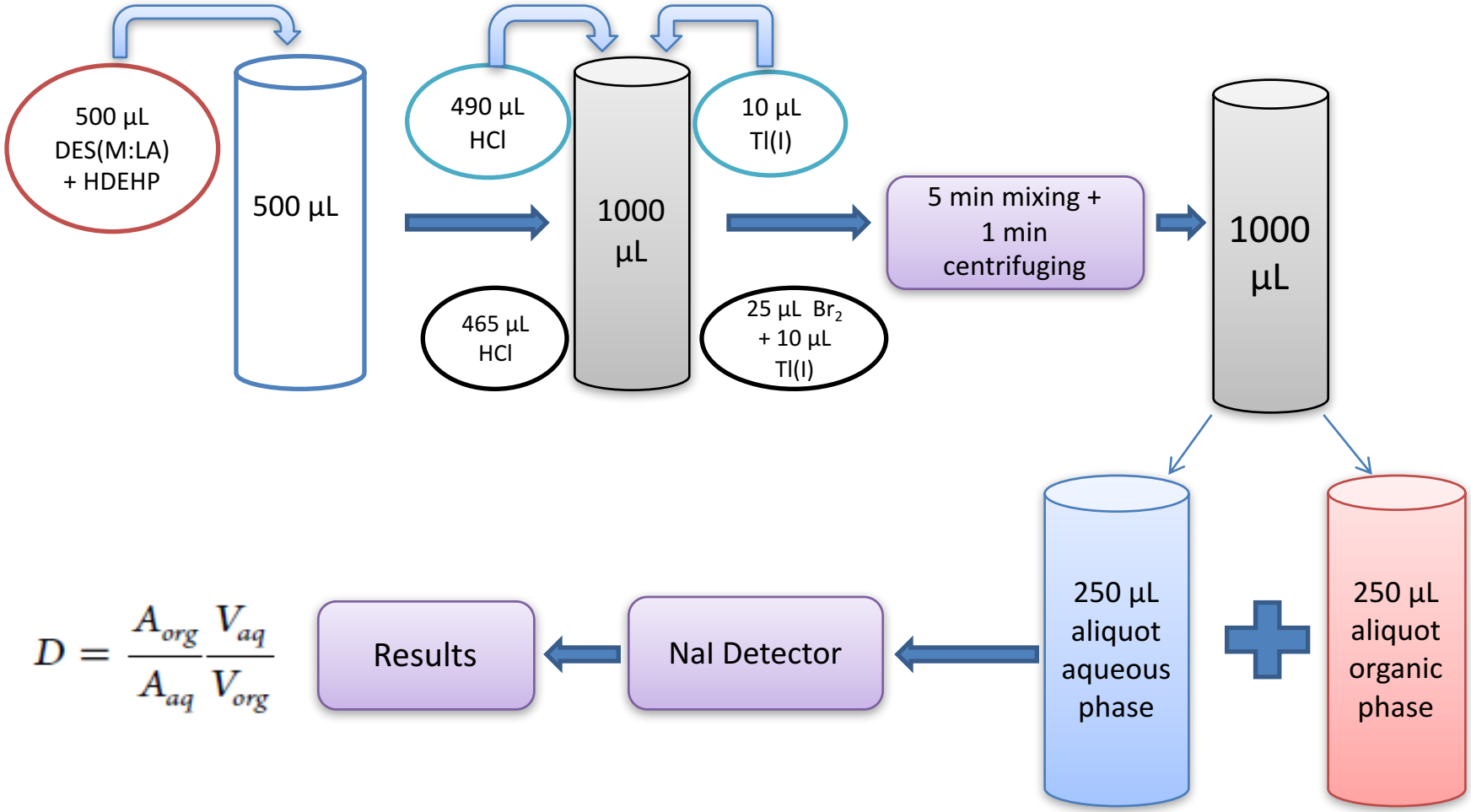
Solvent system with analyte in the aqueous phase

Mix to allow analyte to partition

Phases are centrifuged to settle and mechanically separated

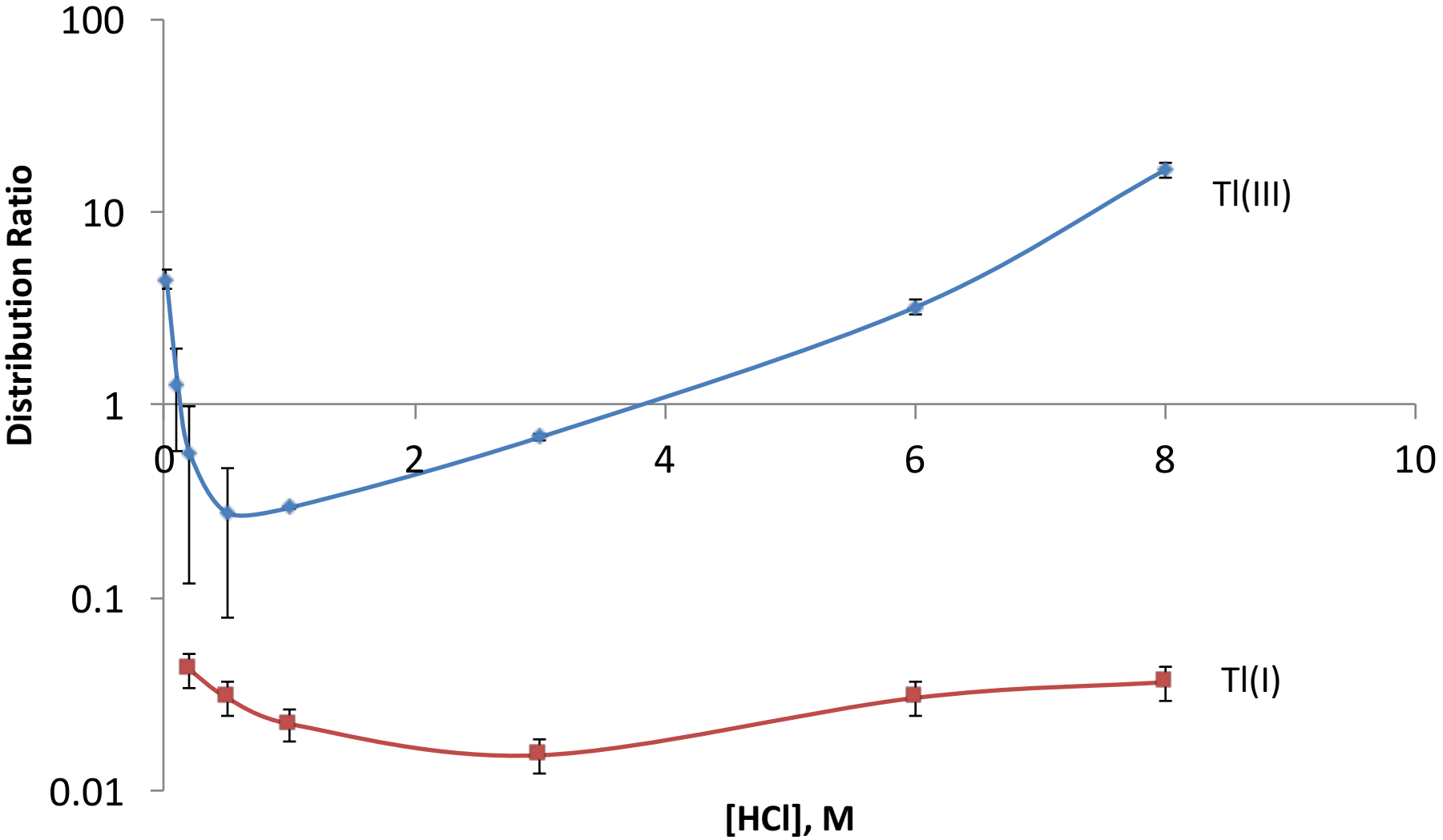
Analyte used: ^{201}Tl (EC, $t_{½}$ = 3.04 d)

Experimental Procedures

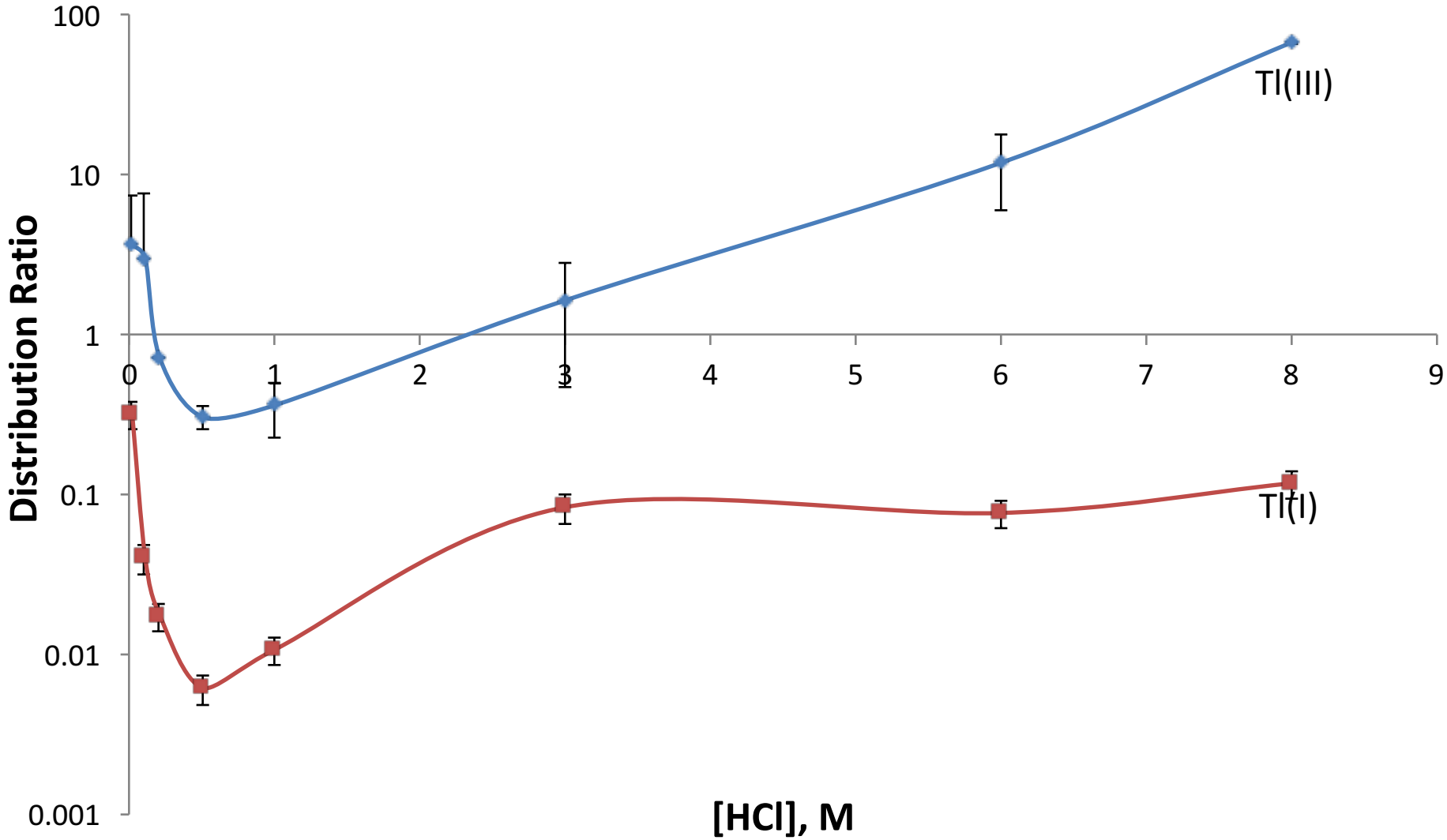


$$D = \frac{A_{org}}{A_{aq}} \frac{V_{aq}}{V_{org}}$$

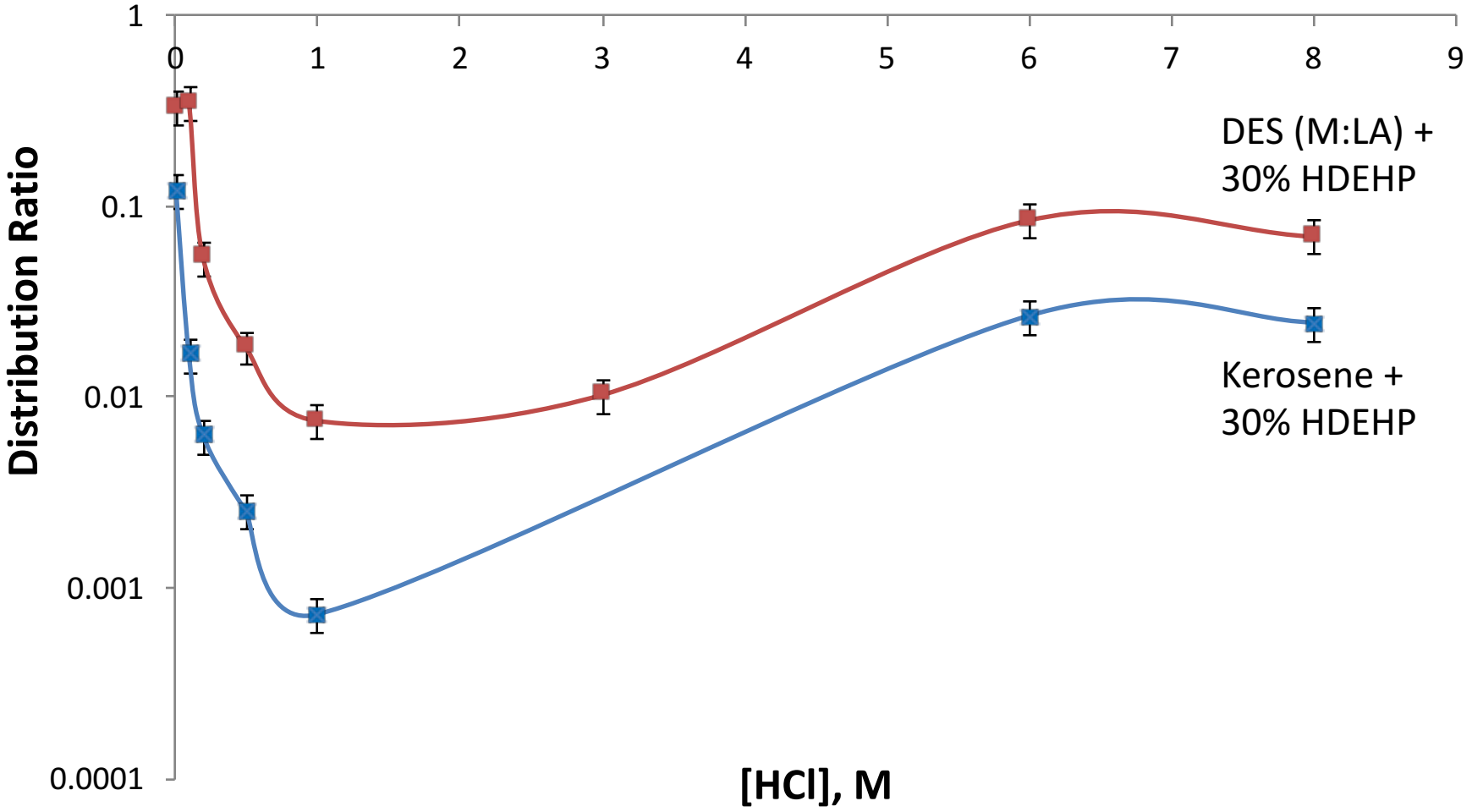
Comparison of Tl(I) and Tl(III) Extraction in pure DES (M:LA)



Comparison of Tl(I) and Tl(III) Extraction in 30% HDEHP in DES M:LA



Extraction of Tl(I) in 30% HDEHP in DES(M:LA) and 30% HDEHP in Kerosene



Conclusion

- Distribution ratio for Tl(I) for all investigated systems are below 1.0
- 30% HDEHP in DES M:LA system extracted Tl(I) better than 30% HDEHP in kerosene
- Tl(III) was extracted significantly better than Tl(I) with DES M:LA system, both with and without HDEHP
- Difference in behavior of Tl(I) and Tl(III), as well as previous work done on In ($D > 3000$) could be exploited in a future experiment on the chemical behavior for element 113

Acknowledgements

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References

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