

Authors: April Wright (BS Candidate in Chemical and Materials Engineering), Dr. Catherine Brewer (New Mexico State University), Dept of Chemical and Materials Engineering, Guangping Xu (Sandia, Org)



Fall 2021 LDRD Virtual Poster Session

Introduction and Motivation

What are chelators and why are they important?

- Ligands
- Prevent poisoning or leaching

Types of chelators

- Arsenic Chelators: Dimercaprol
- Copper Chelators: Dimercaprol, Penicillamine, Trientine
- Iron Chelators: Deferasirox, Deferiprone, Deferoxamine
- Lead Chelators: Dimercaprol, Ethylenediaminetetraacetic acid (EDTA), Succimer
- Mercury Chelators: Dimercaprol
- Uranium Chelators: TBP-HNO₃ complex

Applications of chelators

- Nutritional supplements
- Remove toxins from the body
- Chemical water treatment
- Fertilizers
- Upstream oil and gas

Why do we want to use chelators?

- Remove Rare Earth Elements (REEs) from fly ash
- Prevent leaching of toxic metals into the environment



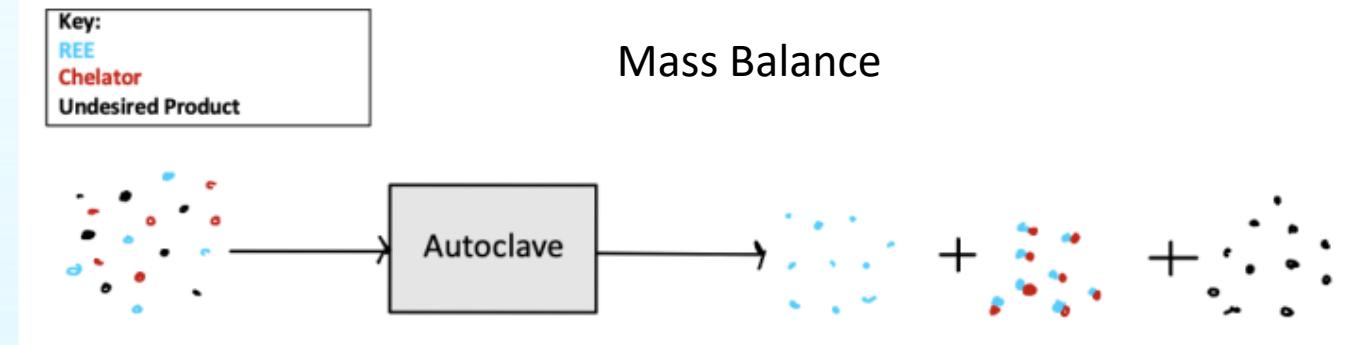
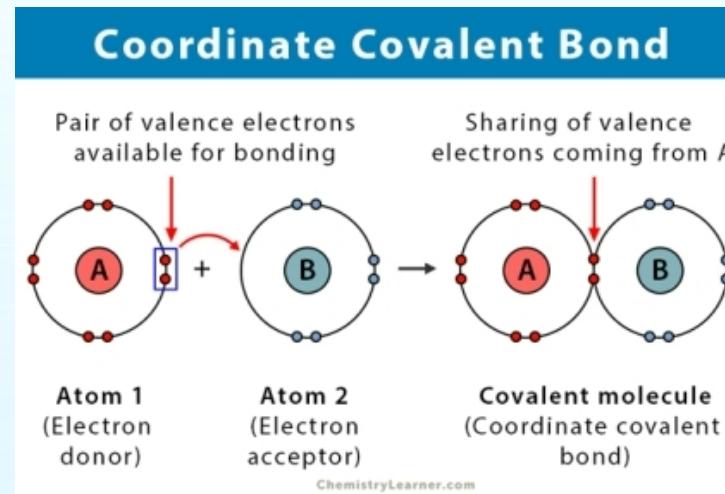
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Approach

Current objective: Observe the yield of REEs recovered from fly ash under various experimental parameters





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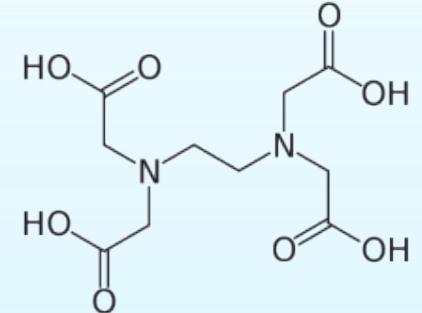
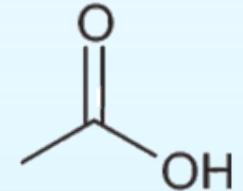
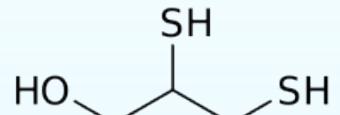
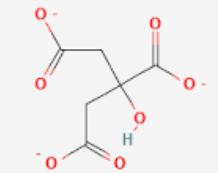
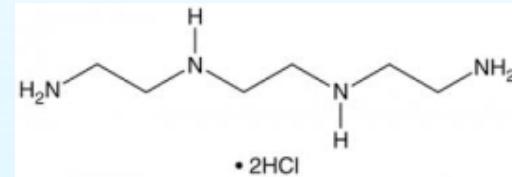
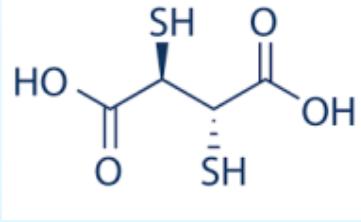


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Current Status and Results (if any)

Literature Review:

- Expanded chelator list
 - Potential advantages or disadvantages
- Little to no information on kinetics, temperature, pressure, thermodynamics
- Selectivity
 - Divalent and covalent





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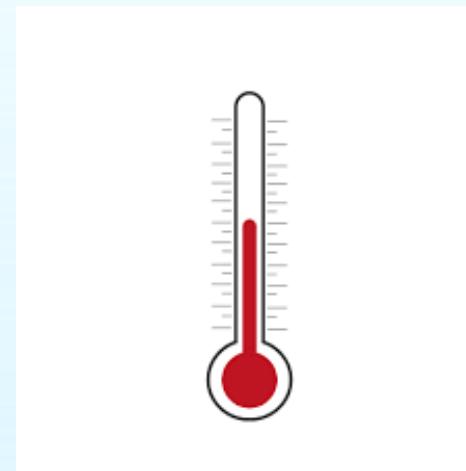
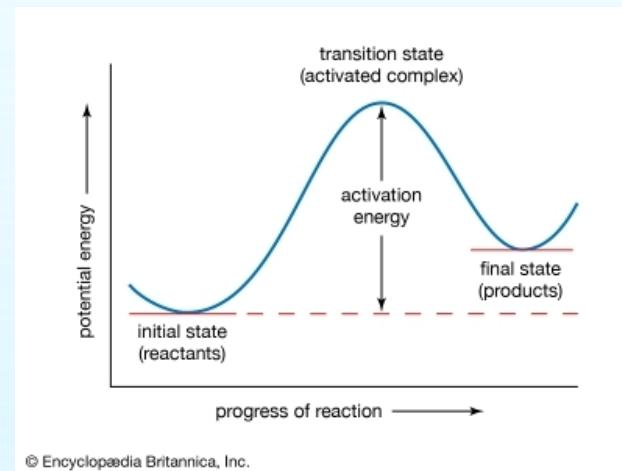


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Impact of Work

Continued literature review and future experimentation can introduce:

- A new understanding on how kinetics, temperature, pressure, and thermodynamics can affect how a chelator behaves
- Which chelators work best under certain conditions
- Which chelators are less hazardous/expensive





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Challenges and Risks / Next Steps and Future Work

- Bringing the REEs market back to the United States
- Not being able to recover high yields or REEs
- Which process works best?
 - Reactor, operation parameters
- Which chelator works best?
 - Selectivity
 - Does selectivity change under kinetics, temperature, pressure, residence time?
 - Ability to bond to REEs and other heavy metals
 - Will it be difficult to remove chelators from REEs? Will chelators digest REEs?