Altering Variables in the Half-Reaction for the Synthesis of Selenium Nanoparticles on Supports

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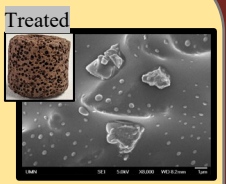
Background

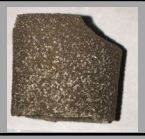
- Materials containing selenium (Se) nanoparticles can be used to remove mercury (Hg) from water to prevent or control pollution.
- Members of the Abbas Lab have previously observed a color change to dark red-brown when elemental selenium is formed. The SEM image to the right depicts nanoparticles formed on treated ceramic to support this.
- The synthesis of elemental Se has been successful on polyurethane sponge, but expansion into ceramic materials would be useful for high-temperature industrial purposes.
- This synthesis is believed to be characterized by the half-reaction: $SeO_3^{2-} + 4e^- + 6H^+ \rightarrow Se^0 + 3H_2O$. The purpose of this project was to investigate whether this was true by varying each key reactant.



Methods

- To understand and optimize the half-reaction, the following parameters of the previously-developed synthesis process were varied:
  - Se-containing substance (Selenous acid and sodium selenite)
  - Source of electrons (polyurethane, ceramic, sucrose, and glucose)
  - Concentration of protons (pH 1 and pH 8)
- Color changes were compared for each variation to analyze the success of the synthesis.

Results

	Selenous acid, pH 1	Selenous acid, pH 8	Sodium selenite, pH 1	Sodium selenite, pH 8
Ceramic				
Ceramic with sucrose				
Ceramic with glucose				
Poly-urethane sponge				

Conclusion

- Ceramic with no sugar treatment is not a suitable source of electrons.
- When sucrose or polyurethane is the electron source, synthesis is inhibited at a higher pH.
- The Se-containing substance did not have a definitive effect on the success of the synthesis, but selenous acid is favorable because it has a naturally lower pH.
- The half-reaction listed above is the mechanism for synthesizing elemental Se.

References

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