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Synthesis and Polymerization of (E,E)-[6.2]- (2,5)furanophane-1,5-diene

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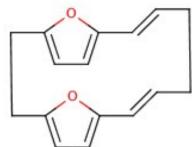
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Abstract

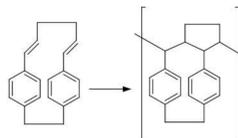
The goal of this research is to polymerize (E,E)-[6.2]-(2,5)furanophane to give a linear polymer. It will be synthesized by a 1,8-Hofmann Elimination using trimethyl-[(E)-3-(5-methyl-2-furyl)allyl] ammonium iodide.



This diene will then be polymerized. The resulting polymeric [3.2] furanophane will then be oxidized to form a polymeric macrocycle tetra ketone. This compound will be tested for cation complexation.

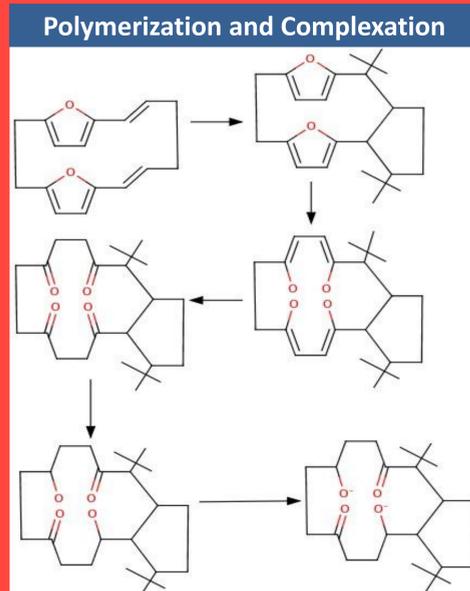
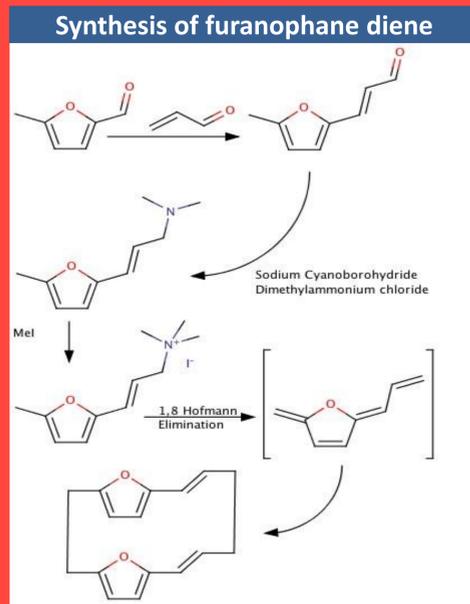
Introduction

- Cyclophanes are macrocycles that contain aromatic rings within the greater ring structure¹.
- The penchant for cyclopolymerization was demonstrated previously with [6.2]paracyclophane-1,5-diene².



- Our research uses furan in place of the benzene ring in the macrocycle. These are termed "furanophanes".
- We are trying to polymerize the furanophane. The intermediate diene: [6.2] furanophane diene has already been reported³.
- Through oxidation of the furan ring, we will attempt to create an organometallic complex; fixing and binding a metal in the center of the macrocycle.

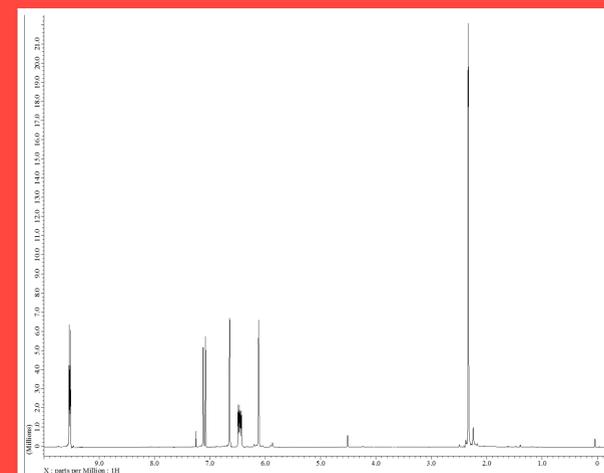
Reaction Scheme



Results

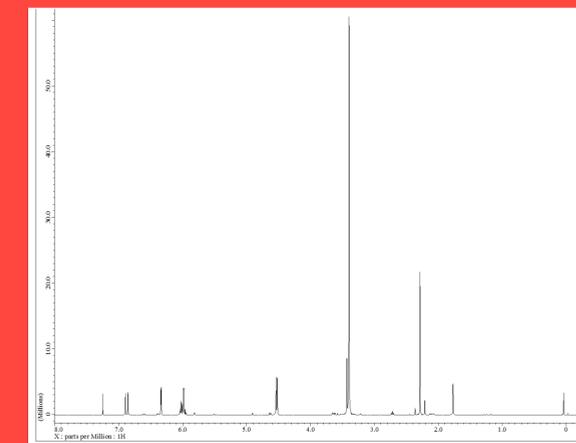
Synthesis of (E)-3-(5-methyl-2-furyl)prop-2-enal

- Aldol condensation of 5-methylfurfural and acetaldehyde in basic conditions⁴
- Isolated by vacuum distillation (bp 68-74°C @ approximately 25 mmHg)
- 62.4% isolated yield
- Structure and purity confirmed by ¹H and ¹³C NMR.



Synthesis of trimethyl-[(E)-3-(5-methyl-2-furyl)allyl] ammonium iodide

- Synthesis was a reductive amination with sodium cyanoborohydride and dimethylamine hydrochloride⁵
- The ammonium salt was formed with methyl iodide
- Isolated through crystallization
- 50.7% yield isolated yield
- Structure and purity confirmed by ¹H and ¹³C NMR



Next Steps:

- Improve yields of the completed reactions.
- Use the ammonium salt product in a 1,8-Hofmann Elimination to undergo cyclopolymerization to form the [6.2] furanophane diene.
- Polymerize to the [3.2] furanophane containing polymer.
- Oxidize the [3.2] furanophane containing polymer.
- Attempt to form organometallic compound through the complexation of cations.

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