Synthesis of Graft Copolymers using Diels-Alder chemistry
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**Introduction**
- Water soluble polymers: create surfactants
- Surfactants are soap, detergents, foaming agents etc
- Phenolic maleimide starting material to synthesize polymer
- Polymer graft to use Diels-Alder to synthesize and break apart arms and backbone
- Potential use to clean up oil

**Project Goal**

**Synthetic Route (Building the arms)**

**Synthetic Route (Building backbone)**

**hv-ATRP**
Light atom transfer radical polymerization (hv-ATRP) is a controlled synthetic method for polymerizing. In hv-ATRP a photoinitiated catalyst is used for radical formation. hv-ATRP does not progress in the absence of light.

- Becomes Photoexcited
- Activates alkyl halide
- Generates radical
- Deactivates radical
- Returns to ground state
  - (Ph-PTZ)

**Gel Permeation Chromatography (GPC)**
Verifying the arms

**Dynamic Light Scattering**

<table>
<thead>
<tr>
<th>Compound</th>
<th>2 mg/mL</th>
<th>0.2 mg/mL</th>
<th>0.02 mg/mL</th>
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</thead>
<tbody>
<tr>
<td>MSK 36 A 39</td>
<td>46.3</td>
<td>48.6</td>
<td>-</td>
</tr>
<tr>
<td>MSK 36 A 39 HT</td>
<td>39.6</td>
<td>42.4</td>
<td>-</td>
</tr>
<tr>
<td>M(_V) 14 A 16</td>
<td>40.8</td>
<td>38.8 (35.2, 39.1)</td>
<td>66.7 (50.2)</td>
</tr>
<tr>
<td>M(_V) 14 A 16 HT</td>
<td>31.8</td>
<td>33.2</td>
<td>7.6 (37.6)</td>
</tr>
<tr>
<td>M(_V) 15 A 17</td>
<td>45.6</td>
<td>75.2 (70.7)</td>
<td>15.1</td>
</tr>
<tr>
<td>M(_V) 15 A 17 HT</td>
<td>34.8</td>
<td>40.3</td>
<td>39.2</td>
</tr>
<tr>
<td>M(_V) 16 A 18</td>
<td>87.9</td>
<td>84.0</td>
<td>51.7</td>
</tr>
<tr>
<td>M(_V) 16 A 18 HT</td>
<td>30.1</td>
<td>31.8</td>
<td>13.4 (32.8)</td>
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<td>MSK 39 A 42</td>
<td>36.2</td>
<td>38.5</td>
<td>-</td>
</tr>
<tr>
<td>MSK 39 A 42 HT</td>
<td>36.0</td>
<td>32.4</td>
<td>-</td>
</tr>
</tbody>
</table>

**Future work**
- Test different ratios of NIPAM to arms for water solubility, LCST, DLS
- Test different degrees of polymerization for arms (DP)
- Dye testing

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