**Biobased Resources Vs Fossil Feedstock**

- Renewable
- Removes CO₂ from atmosphere and incorporate into polymer
- Non-Renewable
- Environmental Issues
- Can’t credited with CO₂ removal

**Polyols and Polyurethanes**

\[ HO \rightarrow R-OH \]

**Polyol**

- Food (Sweetener)
  (e.g. candy, chewing gum)
- Cosmetics (Humectant/Hygroscopic)
  (e.g. Shampoos, lotions, shaving cream)
- Pharmaceutical (API)
  (e.g. Reduction in brain swelling)

**Polyurethane**

- Automotive
- Adhesives, Sealants & Binders
- Coatings & Paints
- Building & Construction

**Current Polyols and their Process of Synthesis**

**Comparison of Properties of Polyols and PU from Soybean Oil**

<table>
<thead>
<tr>
<th>Method</th>
<th>Extent of hydrolysis (%)</th>
<th>Molecular weight (g/mol)</th>
<th>Type of Polyol</th>
<th>% of PU (%)</th>
<th>Strength values (kg/mm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transesterification</td>
<td>93</td>
<td>96</td>
<td>264</td>
<td>Primary and Intermediate</td>
<td>3</td>
</tr>
<tr>
<td>Epoxidation</td>
<td>130</td>
<td>75</td>
<td>985</td>
<td>Secondary</td>
<td>6</td>
</tr>
<tr>
<td>Epoxidation</td>
<td>164</td>
<td>83</td>
<td>956</td>
<td>Secondary</td>
<td>12</td>
</tr>
<tr>
<td>Ozonolysis</td>
<td>228</td>
<td>97.9</td>
<td>128</td>
<td>Primary</td>
<td>22</td>
</tr>
</tbody>
</table>

**Disadvantages**

- Petroleum based polyols
  - Polyester polyols are prone to hydrolysis
  - Polyether polyols are prone to degradation by UV-light

- Biobased polyols
  - Polyols obtained from triglyceride oils have odor issues
  - Transesterification and epoxidation give mainly secondary hydroxyl group polyols which are less reactive
  - Expensive catalyst is required for hydrolysis
  - Ozonolysis gives mixture of polyols and preconcentration is required as same is reactive.

**Future Work**

- Polyol obtained from soymeal has self-catalytic property, high dimensional stability. Soymeal polyols are high functionality polyols suitable for high crosslink rigid foams. For its commercial production we need to design a process. For that it is required to study following things.

  **Key issues**
  - Effect of carbohydrates on properties of PU foam is unknown
  - Nicotixity of polyols is high
  - Optimization of reaction parameters

  **Kinetic study**

  - Development rate law for transamidation reaction

**Commercialization Team**

Biobased Materials Research Group (BMRG) design and engineer new biobased and biodegradable-compostable polymer materials and bio-processes using agricultural crops and residues (soybean, and corn), lignocellulosic biomass, and algae. These biobased products find commercial application in films for plastic bags, injection molded articles, thermofomed products, foamed sheets for protective and insulating packaging, arts and crafts and toy materials, and biomedical applications.

The group’s biobased materials technology platform is covered by 28 patents; 149 peer reviewed publications, and eight technologies have been licensed or licensed in a spin-off company. There are seven graduate students, several undergraduate students, two senior research staff and several visiting research fellows in the group.

**References**


Biobased Resources from Protein Biomass Residues for Polyurethane Applications

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