

IOWA STATE UNIVERSITY

Materials Science & Engineering Department

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Final Oral Examination
PhD Student with Michael Kessler

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“Bio-based polymeric materials from vegetable oils”

Vegetable oils have been extensively utilized in developing bio-based polymeric materials in my research work. Bio-based polyhydroxy fatty acids have been subject to ring-opening epoxidized soybean oil with alkaline catalyst DBU to generate polyols with varying OH numbers for polyurethane applications. The polyhydroxy fatty acids were also used as internal emulsifiers in anionic polyurethane dispersion synthesis due to the presence of carboxylic acid groups in their structures. In addition, acrylated epoxidized soybean oil was involved in another project. 2-methyl aziridine was added to acrylic groups via Michael addition mechanism under mild conditions. The resulting aziridine-containing compound could be polymerized with bio-based polyacids rapidly at room temperature. Plus, thermal polymerization of soybean oil has been studied. The heat-bodied soybean oils were subject to ozonolysis followed by reduction in order to produce polyols with primary hydroxyls, which are relatively reactive. The principle of the research is to develop products with considerably high bio-content. The soaring price of petroleum has become a global issue so that industry and academia have been seeking bio-renewable substitutes which can be potentially converted to versatile products that have comparable properties to petroleum-based merchandise.