Non-Confidential Description

Polymers Derived from Soybean Oil Exhibit Increased Crosslink Density, Superior Properties

Technology Case: RFT-318

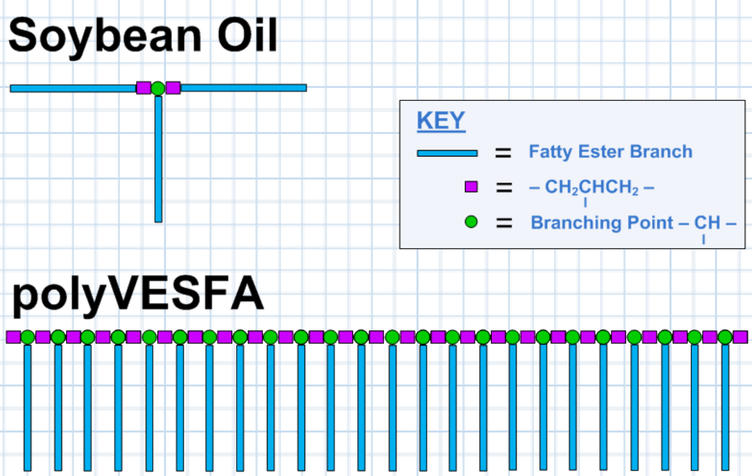


Illustration showing the significantly increased number of fatty ester branches for polyVESFA over soybean oil.

Invention Summary

Scientists at North Dakota State University have invented a novel soybean-based polymer polyVESFA (vinylether of soybean oil fatty acids) that has been shown to exhibit superior properties over polymers based on conventional soybean oil. polyVESFA has significantly more fatty ester branches per molecule than soybean oil that can be used to great advantage for many applications such as coatings and composites. polyVESFA has been shown to exhibit superior mechanical properties, including modulus, hardness, chemical resistance, corrosion resistance, and stain resistance. Besides these characteristics, polyVESFA exhibits reduced shrinkage upon cure and enhanced adhesion capabilities due to its higher molecular weight and higher number of fatty ester branches. Additionally, polyVESFA offers tremendous potential for desirable tailoring of the polymer as it can be copolymerized with other vinyl ether monomers.

Benefits

- Low cost of manufacture: chemical components such as ethylene glycol vinyl ether are relatively inexpensive.
- Superior mechanical properties, including improved modulus, hardness, chemical resistance, corrosion resistance, and stain resistance.
- Reduced shrinkage upon cure and enhanced adhesion capabilities due to higher molecular weight.
- Potential for additional tailoring properties for specific applications.

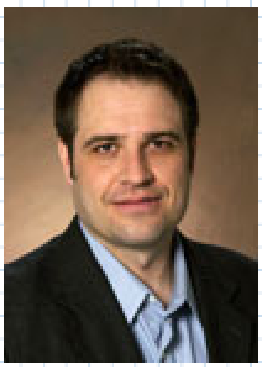
Invention Premise

A novel monomer was synthesized using base-catalyzed transesterification of soybean oil with ethylene glycol vinyl ether. The resulting monomer, referred to as “vinylether of soybean oil fatty acids (VESFA),” was isolated in high purity. Using a polymerization system with tailored reactivity, VESFA was successfully polymerized to polyVESFA. The primary difference between polyVESFA and soybean oil is that polyVESFA has an increased number of fatty ester branches per molecule over soybean oil, which is a great advantage for many applications in coatings and composite materials. Depending on the specific polymerization method used for VESFA, each molecule of polyVESFA can possess from tens to thousands of fatty ester branches, as compared to just three for soybean oil. Since each branch point in the molecule results in a crosslink for a cured material, it can be understood that properties that increase with increasing crosslink density, such as modulus, hardness, chemical resistance, corrosion resistance, stain resistance, etc., will be higher for materials based on polyVESFA as compared to analogous materials based on soybean oil.

Intellectual Property

This technology is patent pending with fully preserved world-wide patent rights available for licensing/partnering opportunities.

Lead Inventor



Bret Chisholm, Ph.D.
Senior Research Scientist

Dr. Bret Chisholm received his B.S. degree in Chemistry from North Dakota State University in 1989 and his Ph.D. in Polymer Science in 1993 from the University of Southern Mississippi. After graduation, Chisholm was employed by General Electric (GE) for 11 years and worked in the areas of organic coatings, combinatorial/high-throughput methods, hybrid organic-inorganic coatings, polymer blends, crystalline polymers, and ionomers. In October of 2004, Chisholm joined the Center for Nanoscale Science and Engineering as a Senior Research Scientist and Director of the Combinatorial Materials Research Laboratory. He is also an Adjunct Professor for the Department of Coatings and Polymeric Materials and serves as a thesis advisor for several graduate students. Chisholm holds 20 U.S. patents and has authored more than 100 publications.

Inquiries

Jonathan Tolstedt, Licensing Associate/Patent Agent
NDSU Research Foundation, Fargo, ND 58108-6050
Phone: 701-231-8173 Fax: 701-231-6661
Email: jtolstedt@ndsurf.org
Web: www.NDSUResearchFoundation.org

NDSU GREEN TECH