SYNTHESES AND CHARACTERIZATIONS OF SULFONATED 1,3-CYCLOHEXADIENE POLYMERS

Kunlun Hong[1] and Jimmy W. Mays[1,2]

[1]Chemical Science Division, Oak Ridge National Laboratory, Oak Ridge TN 37831
[2]Department of Chemistry, University of Tennessee, Knoxville TN 37996

Research sponsored by the Division of Chemical Sciences, Geosciences, and Biosciences, Office of Basic Energy Sciences, U.S. Department of Energy, under contract DE-AC05-00OR22725 with Oak Ridge National Laboratory, managed and operated by UT-Battelle, LLC.

"The submitted manuscript has been authored by a contractor of the U.S. Government under contract No. DE-AC05-00OR22725. Accordingly, the U.S. Government retains a nonexclusive, royalty-free license to publish or reproduce the published form of this contribution, or allow others to do so, for U.S. Government purposes."

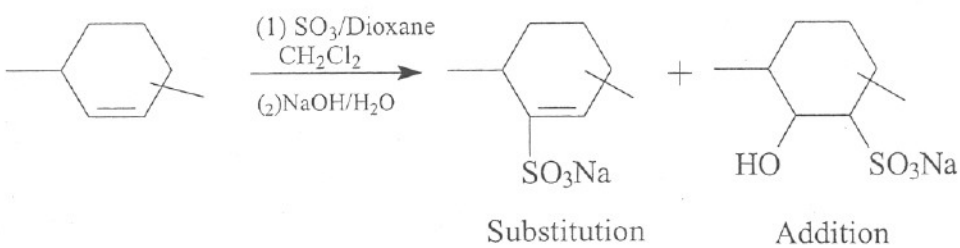
SYNTHESES AND CHARACTERIZATIONS OF SULFONATED 1,3-CYCLOHEXADIENE POLYMERS

Kunlun Hong[1] and Jimmy W. Mays[1,2]

[1] Chemical Science Division, Oak Ridge National Laboratory, Oak Ridge TN 37831
[2] Department of Chemistry, University of Tennessee, Knoxville TN 37996

Polyelectrolytes have attracted considerable interest from a basic scientific standpoint because they can form a multitude of structures at various length scales in solution and thus display a variety of properties not found in neutral polymers. There are many approaches to synthesize polyelectrolytes, and sulfonation of well-defined neutral polymers is one of the most widely used methods for preparing model polyelectrolytes. In this presentation we report the syntheses and characterizations of polyelectrolytes containing sulfonated poly(1,3-cyclohexadiene) (PCHD) block. We expect the resulting polyelectrolytes to be well-defined and with possibly lower inherent flexibilities than poly(styrene sulfonate), the most common synthetic polyelectrolyte, due to the PCHD ring being incorporated into the polymer backbone.

The sulfonations of PCHD homopolymers were carried out by using the sulfur trioxide-complexes in various solvents. One of the most feasible sulfonation approaches is using sulfur trioxide-1,4-dioxane complex in dichloromethane. The sulfonated PCHD (s-PCHD) is a mixture of substituted alkene and addition products, as shown in Scheme 1. Aqueous SEC of the s-PCHDs shows that narrowly polydispersed products were obtained. All the s-PCHDs were characterized with NMR, FT-IR, elemental analysis and light scattering. The solution properties of these materials show many unique characteristics, such as very strong dipolar interactions.



Scheme 1

Selective sulfonation of PCHD block copolymers, including PS-PCHD, PEO-PCHD, was also studied. The sulfur trioxide-1,4-dioxane complex was used as the sulfonation agent since it sulfonates PCHD blocks and leaves PS or PEO blocks intact. Other sulfonation agents, such as sulfur trioxide-triethyl phosphate complex and acetyl sulfate, do not have such selectivities. The resulting polymers were characterized with NMR, FT-IR, viscosity, elemental analysis and light scatterings. The solution properties of those novel materials are being explored.