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Synthesis of expensive N-phenylmaleimide derivatives and its green Diels Alder reaction

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We propose the design and implementation of a less hazardous, environmentally friendly and energy efficient reaction within a sophomore level Organic Chemistry lab course curriculum - to synthesize efficient precursors that result in higher yields and lesser purification times for a Diels-Alder reaction. Our main objectives are to enable students to: (a) identify and understand various Green Chemistry principles associated with the Green reaction such as atom economy, use of safer chemicals, design for energy efficiency, and inherently safer chemistry for accident prevention; and (b) enable students to use ^{1}H NMR spectroscopy data to identify the synthesized Diels-Alder product. Additionally, we anticipate the following benefits from this research: (a) shorter laboratory experimental times via the use of efficient precursors; (b) synthesis of efficient precursors that are otherwise expensive to procure commercially. Substituted N-phenylmaleimides are a class of very expensive precursors that are used in certain organic chemistry reactions. We propose here that the students will synthesize a substituted N-phenylmaleimide in two steps to be used as a precursor in the Diels-Alder reaction. In the first step, the students grind the maleic anhydride and substituted amines under solventless conditions. In the second step, they will perform the cyclization of amide acid with acetic anhydride and sodium acetate. The reaction of substituted N-phenylmaleimide with 2,3-dimethyl-1,3,butadiene presents sophomore level undergraduate students with an opportunity to identify the position of the substitution (ortho, meta or para) of the alkyl (R) group in the product using ^{1}H NMR spectroscopy data. The students also explore and understand various Green Chemistry principles associated with the reaction such as: atom economy, use of safer chemicals, design for energy efficiency, and inherently safer chemistry for accident prevention.

Biography

Manisha Nigam is an Associate Professor of Organic/Green Chemistry at the University of Pittsburgh at Johnstown, PA. Her scholarship and professional development activities are primarily focused on Green Chemistry Education, where her key research goal is to develop environmentally friendly experiments for undergraduate laboratories and to introduce students about alternate methodologies for achieving chemical transformations without the use of hazardous chemicals. She primarily teaches Organic Chemistry courses as well as a course in Green Chemistry & Sustainability that she has developed. She has guided numerous research students, who have presented their work at various conferences. She is also an active advocate for efforts aimed at achieving a "green" campus.

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