Use of Waste Carbon Dioxide as a Renewable Reagent to Catalytically Synthesize Commercially Useful Cyclic Carbonates

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Petroleum is heavily depended upon for energy production, the production of plastic, and the manufacturing of multiple important chemicals. Though petroleum is said to have broad areas of applications and the capacity to constantly produce a large amount of energy cheaply, it is also a nonrenewable resource that destroys our everyday environment. The extraction and burning of petroleum not only generates greenhouse gases which contribute to environmental pollution and leads to the increase of global warming, but when burned also releases toxic and carcinogenic (cancer causing) chemicals that are harmful both to us and the planet. As the population increase, the global demand for both energy and chemicals is gradually sky rocketing. Therefore, as a solution to this problem of utmost importance, the development of alternative and sustainable starting materials for chemical synthesis is necessary. The goal of this experiment was to utilize waste excess carbon dioxide readily available in the atmosphere as renewable reagent to develop and synthesize a commercially useful chemical – Cyclic carbonates. As cyclic carbonates are degradable and less toxic, they have a wide range of applications that include being used as polar aprotic solvents for paint and grease removal, to formulate certain pharmaceuticals and cosmetic products, precursors for polycarbonates, intermediates for small organic materials, and as an electrolyte medium for lithium ion batteries. The results suggested that cyclic carbonates could be produced in a one-pot reaction using commercially available synthetic alkenes such as styrene, octene, and cyclohexene. The carbonates synthesized were more economically and environmentally beneficial when compared to cyclic carbonates produced in recent literature.

Awards Won:

Third Award of $1,000

National Aeronautics and Space Administration: First Award of $2500