

The primary objective of this project was to develop oxidation methods appropriate for the conversion of agriculturally derived simple sugars to their corresponding diacids (aldaric acids) for use as biobased chemical building blocks for new biodegradable polymers and other materials. Principal target diacids were D-glucaric, *meso*-xylaric, D-mannaric and L-arabinaric acid, each to be prepared by nitric acid oxidation of the naturally occurring precursor carbohydrates (monosaccharides) D-glucose, D-xylose, D-mannose and L-arabinose, respectively, all from hydrolysis of naturally abundant plant polysaccharides. These conversions were to be designed for scale up to a level suitable for transfer first to a pilot plant scale, and then to an industrial plant scale. The core of the project involved a comprehensive study of the title oxidation employing a computer controlled reactor. The plan of action involved defining experimental parameters to allow for control of the oxidations with considerable precision and reproducibility. The prototype oxidations were typically run using ca. 0.75 molar amounts of carbohydrate, with a goal of eventually doubling the reaction size when appropriate reaction parameters were established. During the course of the funding period for this grant, the fundamentals of reaction control were established for oxidation of D-glucose, a critical component of the project given the exothermic character of the reaction. The reactions were monitored using a reliable GC/MS protocol. The glucose to glucaric acid conversion represented the most important and potentially highest value conversion. During the grant period we were able to establish one workable system to carry out the glucose to glucaric acid conversion, but were not able to optimize the process or establish a protocol that was satisfactory for a scale up to a pilot plant scale. However, the work carried out showed the possibility that with appropriate innovation and continued effort, a prototype for a successful pilot plant scale operation might be possible. It was not possible to explore oxidations with the other simple sugars indicated during the time frame of this project.

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