



Capstone Design Project Abstract

Project Title: Biobased Adipic Acid Production for Nylon-6,6

Sponsor: University of Georgia

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Adipic acid is one of the two key inputs for the formation of Nylon-6,6, a polymer utilized throughout the world in the production of various plastic goods, namely plastic fibers. Typically, adipic acid is produced as a white crystalline powder using petroleum feedstocks. This process is non-ideal for two major reasons, the first is that the main feedstock is non-renewable, and the second is that it is a major contributor to NO₂ pollution, a super pollutant more potent than carbon dioxide. With petroleum supply becoming increasingly limited and Nylon 6,6 demand only growing with time, development of an adipic acid production line with a renewable feedstock that does not release mass amounts of NO₂ has become increasingly more desirable.

The goal of this project is to define a method of producing adipic acid of polymerizing quality, at a rate high enough to produce 85 MM pounds of Nylon-6,6 annually, while also following all required regulations from the Environmental Protection Agency (EPA) and Occupational Safety and Health Administration (OSHA). To meet production requirements 8 major unit operations were chosen. First is fed-batch fermentation of d-glucose into muconic acid via *E. coli* BL21(DE3) in several 300,000L reactors, what follows is separation of generated muconic acid from fermentation broth using centrifugation and reverse osmosis. Next is phase separation of muconic acid from the solution using pH shift crystallization, then drying and full separation of purified muconic acid crystals from solution by spray drying where adipic acid can then be synthesized from muconic acid via catalytic hydrogenation. Finally, the adipic acid is filtered and spray dried to yield 86 million pounds of adipic acid per year.