Ethyl Lactate Production

By: *Jeremy Jones, Trung Pham, Kristin Smart, David Splinter, and Michael Steele*
Capstone Design Project- University of Oklahoma - Spring 2003

Executive Summary

The purpose of this report is to consider the economic implications of producing ethyl lactate as an environmentally friendly solvent. Ethyl lactate can be compared to traditional solvents produced from nonrenewable resources. Characteristics of a good industrial-grade solvent include the amount of toxic releases, a low evaporation rate, and a relation of the ability for the solvent to maintain its properties for reuse. By comparing these characteristics, it was shown that ethyl lactate is more environmentally sound, less costly per solvent effectiveness, and capable of surviving drastic environmental regulations.

Input specifications were obtained for a business plan that determines whether ethyl lactate production could be a worthwhile economic venture. A process was designed to produce ethyl lactate from an esterification reaction involving ethanol and lactic acid. These reactants would be created from fermentation units, while the sugars necessary for fermentation would be available from a biomass raw materials milling process. The fixed capital investment and operating costs were varied with the annual ethyl lactate production. Additionally, possibilities for raw materials, market locations, and production plant locations were analyzed. Corn was found to serve as the most cost efficient raw material based on processing costs and overall conversion

A model considered all of the input specifications and used them to try and maximize the net present worth for ethyl lactate production. The results revealed that for such a process Dubuque, Iowa was the optimum location for a single production plant. After including capital improvements and budgeting, the model calculated a NPW of $64.1 million when an initial capital of $52 million was available. Sensitivity further validated that these optimal conditions were possible. Initially, the annual capacity of the plant would be approximately 24 million lbs, but the process would undergo several capital improvements to meet with increasing demand for a maximum annual capacity of 198 million lbs.

It is recommended that a more thorough analysis for plant and raw material locations be performed around the Dubuque, Iowa area. Also, further analyses within the detailed process design, raw materials cost fluctuations, and freight costs will create a more accurate and realistic model.