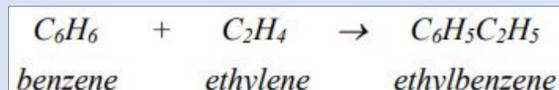


Abstract

To create a preliminary design for an ethylbenzene plant through a reaction of benzene and ethylbenzene. Adding this process to an already existing petrochemical plant will cut the cost of purchasing 80,000 tonnes/year of 99.8% ethylbenzene from an outside source. After designing and investigating if the reaction is feasible to have on-site, it is expected for the plant to maintain good public health, safety, and welfare, along with, environmental, social, and global factors.



Motivation

To reduce the cost of purchasing ethylbenzene from an outside source. Ethylbenzene is used in our styrene unit and bought at a cost of \$1,485/tonnes. This is a yearly cost of \$118,800,000 and could be eliminated by design an on-site ethylbenzene process. Displaying a 12 year economic analysis of the plant will determine if it is efficient and profitable. Along with presenting a positive or negative gain of buying feeds versus purchasing the product.

Economic Evaluation

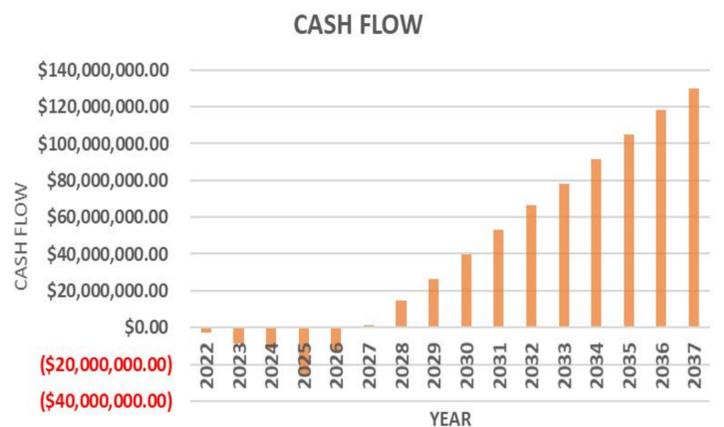
Total Capital Investment-TCI

\$24,160,307.08

Net Present Value:

Profitability / yr

\$13,343,943.99



Conclusion

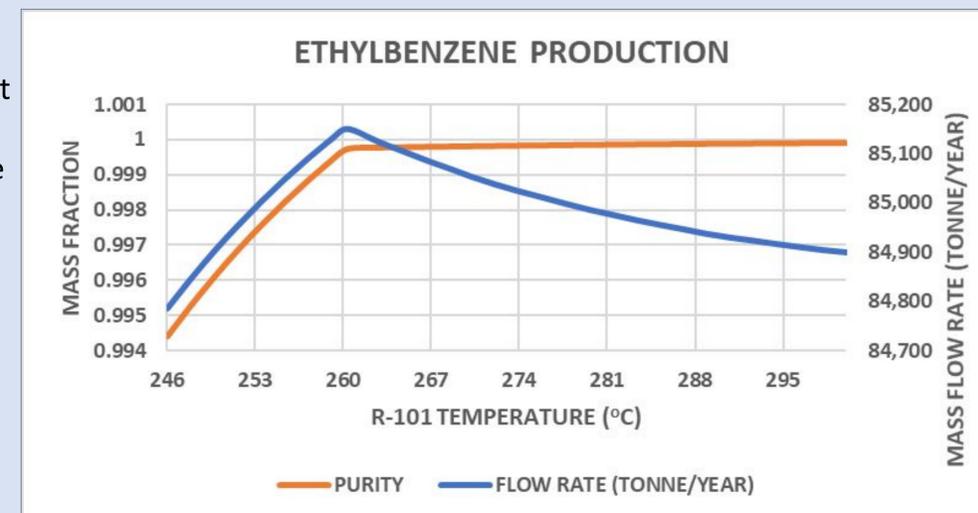
After designing the ethylbenzene process the purity has reach 99.972% with a mass flow rate of 85,148.2 tonnes/year. This process demonstrates a feasible solution for the years 2028 through 2037. For each year the plant makes a profit of \$13,343,943 totaling to 130,172,354 for the 12 years after startup.

Acknowledgement

The J.J.E.V. team would like to give a special thanks to Dr. Esteban Urena-Benavides and Professor Steve Skarke for meeting with us and supporting us through the semester with our design project, and an overall thank you to the rest of the Chemical Engineering Department for nurturing our knowledge in chemical engineering.

Simulation Results

A series of sensitivity analyses were generated to optimize the ethylbenzene plant in order to achieve a high purity percentage while producing a sufficient amount of product. The optimized plant was shown to have R-101 operating at 260°C to obtain a mass fraction of 0.9997 and a flow rate of 85,148 tonnes/year.



Process Flow Diagram

