

Conversion of Waste Cooking Oil into Biodiesel

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INTRODUCTION

About 20 million tons of waste cooking oil (WCO) are produced in China every year. The present method of converting WCO to biodiesel suffers from the problems of low economic efficiency and low product (quality). In fact, most of the WCO are illegally used for producing edible oil, which seriously harms the public health. This project is aimed at utilizing WCO to produce high-quality biodiesel to facilitate an effective use of the waste and minimize the environmental effect.

METHOD

This project uses ASPEN to simulate and optimize the WCO conversion process with heat integration, followed by performing economic analysis. The three-dimensional graph of the factory of the conversion process is drawn by LUMION. The sustainability of the proposed process is analyzed by LCA (life cycle assessment) and the FSPs (four sustainable principles).

RESULT

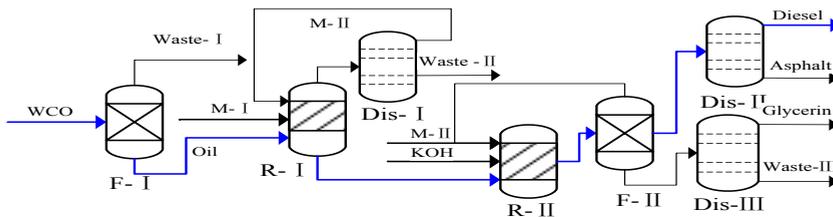


Figure 1 F-I: material pretreatment, R-II: esterification, R-III: transesterification, others are separation and purification

The designed process for converting WCO to biodiesel is illustrated in Figure 1. The simulation results indicate that the process could successfully produce high-quality biodiesel (ester content: ≥ 96 wt.%) and co-product, glycerol, by using waste oil and methanol as the raw material and enzyme produced by Novozymes. Waste water from these processes is collected by tanks and recycled to minimize pollution. The cost of utilities is reduced about 20% by heat integration and the low price of WCO, which makes the process economic feasible. Through the assessment of LCA and the FSPs, the process is proven to be eco-friendly due to the excellent biodegradability of the high-quality biodiesel as well as the low emissions when using the fuel.

CONCLUSION

A sustainable and economic feasible process for converting WCO to high-quality biodiesel is designed through ASPEN simulation. The proposed approach can alleviate the energy shortage and reduce the harmful effect of WCO on the environment as well as public health.