

Economics of biodiesel production

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The future substitute for fossil fuels should be a fuel produced in a renewable and sustainable way. The substitute could be biodiesel, which can be added in small doses in fossil fuel without any modification of the engine of a normal car. The European Union has determined that 10 % of all fuel used in 2020 should be replaced by a biofuel.

The biodiesel can be produced in two different ways; the enzymatic catalyst way and the chemical catalyst way. This project was made to give an idea about the possibility of replacing the 10% fuel by biodiesel. It was concluded that it is not possible for Denmark to replace the 10 % fuel with biodiesel produced only by rapeseed oil coming from Denmark.

Furthermore this project contains an economic evaluation of two different plants, the enzymatic plant and the chemical plant. It was possible to determine the yearly budget for both the plants. The return of the chemical plant exceeds the enzymatic plant by nearly 4 times. The crucial difference between the plants was purging of the catalyst. The cost of the enzymatic catalyst was 17.3 mio.kr. higher than the chemical catalyst. To make the enzymatic plant competitive, the cost of the enzyme catalyst needs to be reduced from the current 5800 kr./kg to approximately 2100 kr. pr. kg. However, the study indicated that the enzymatic plant is expected to have an advantage because of the smaller and more flexible size and that no neutralization step is needed.

The residual from both plants is glycerol coming from the transesterification. To use the residual to the fullest, a smaller plant was designed to produce acrolein from glycerol. The plant consists of one reactor, two heat exchangers, two flash drums, one mixer and one splitter. Approximately 66 % of the glycerol was converted to acrolein. The amount of acrolein recovered was 315 kg/h. To obtain this amount recycling of not-converted glycerol was necessary. An economic analysis of this plant indicates a possible net result of 13.2 mio.kr. The conversion has financial benefits since the glycerol is only worth 2.3 mio.kr. if it is sold.