Life Cycle Assessment of a Biodiesel plant|

Haydée Yrigoyen, Francesc Castells
Chemical Engineering Department, Universitat Rovira i Virgili, Av. Països Catalans 26, 43007 Tarragona, Spain

The environmental and economic profile of a standard biodiesel plant was obtained under two different configurations: using acid or alkali catalyst. This evaluation was performed through the application of a methodology and a tool that integrates process simulation, environmental and economic aspects.

A standard biodiesel process was simulated in ASPEN Hysys®. The environmental and economic profiles were automatically obtained by means of the developed tool. According with the Life Cycle approach; the inventory and the Life Cycle Assessment consider the electricity generation and the production of the raw material associated to the biodiesel process (methanol, sulfuric acid, sodium hydroxide, calcium oxide, glycerol and deionized water). The glycerol produced as parallel product in both configurations is treated in the Life Cycle Inventory as avoided environmental load.

In the environmental impact analysis, when the categories associated to emissions and releases are evaluated, the lower values correspond to the acid-catalyzed process. An important reduction (~70%) is obtained compared to the alkaline option. However, the impact assessment related to natural resources extraction and land use has the opposite behavior. The methanol and glycerol production have the most important contribution to all the impact categories, the first one as an unfavorable behavior, whereas the second one minimize the environmental impact. From the economic point of view, the economic indicators of the acid-catalyzed process are better than the alkali-catalyzed.

According to economic and environmental indicators it can be decided that the acid catalyzed configuration is the best option. A sensitivity analysis, included in the methodology, identifies the variables with the higher contribution to the impact categories. By means of the developed tool, it is possible to change the topology and the operation conditions of the plant and automatically to perform the economic and environmental analysis that enables the decision of the best alternative.

Project funded by the Spanish "Ministerio de Educación y Ciencia", (Reference CTM2004-05800-C03-02)