Stage I

Technology at laboratory scale for the production of biofuels through enzymatic transesterification

Lipases are biocatalysts that can successfully be used to obtain fatty acid methyl esters (biodiesel). These enzymes catalyze both the transesterification of triglycerides and the alcoholysis of free fatty acids that is particularly important for low-cost vegetable oils / animal fats characterized by a high acidity. Indeed, such substrates, in the alkaline transesterification process must undergo a pretreatment stage or a preliminary esterification stage in the presence of an acid catalyst, followed by the biodiesel production process. Lipases can catalyze both reactions in one process, which gives a clear advantage when using such raw materials. These enzymes may function in the presence or absence of an organic solvent, which is a big advantage in terms of finding the optimal reaction conditions for each studied process. Lipases function in mild operating conditions, at room temperature and atmospheric pressure. Biocatalytic process does not lead to the formation of soap or other product. When the transesterification reaction is completed only methyl esters and glycerol are formed. This simplifies the following stages of purification and therefore reduces production costs. Lipases in immobilized form can be reused and thus can be used in continuous processes, thereby eliminating their main disadvantage of enzymatic biodiesel production process, namely cost.

To develop an enzymatic technology for biodiesel production at laboratory scale, the methanolysis of sunflower oil in two systems was studied: a system with continuous recirculation (continuous system) and a stirring system (batch). For each case the reaction was monitored for 12 h and the ester content was determined by gas chromatography. Reactions occurred at room temperature and *tert*-butanol was used as reaction medium to protect the enzyme against the inhibitory effects of both methanol and glycerol resulted during the reaction. Using the batch system the increase of ester content is much higher compared to continuous system for the area where the growth is linear, suggesting that the reaction for the batch system is much faster. But esters content reaches the highest value for the system with continuous recirculation, namely 89.9%, compared with only 78.6% for the stirring system.