RESEARCH PAPER

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Biodiesel production from sunflower oil using extracellular lipase as catalyst

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Biodiesel consists monoalkyl esters of long chain fatty acids. It is produced from vegetable oil or fats by transesterification with methanol using chemical / enzyme lipase. This process has, therefore, been widely utilized for biodiesel fuel production in a number of countries. The enzymatic process offers several advantages over the chemical routes. The handicap of increase in process cost because of the cost of the enzyme can be overcome by using efficient production process for enzyme and using reusable derivatives of enzymes, such as extracellular enzyme. In the present investigation, therefore, optimization of process parameters for high lipase production by the microbes *viz*., *Mucor racemosus, Rhizopus nigricans* and *Aspergillus terreus* using Czapek' Dox medium were carried out. Culture filtrates were used as extracellular crude enzyme source, as catalyst for conversion of sunflower oil to biodiesel and the parameters such as quantity of enzyme and methanol needed for significant yield of biodiesel was standardized.

Key words : Biodiesel, Lipase, Sunflower oil, Extracellular enzymes and Transesterification

INTRODUCTION

The high energy demand in the industrialised world, as much in the domestic sector, as in transport and industry, its increase, and the derived problems of the widespread use of fossil fuels, make increasingly necessary the development of renewable energy sources of limitless duration and smaller environmental impact than the traditional ones.

The need for clean energy source is necessary because of the carcinogenic particulate emissions from diesel engines, which cause pollution and 'global warming'. The depleting reserves of petroleum – based products have also made scientists look for renewable sources of energy.

The upgrading of plant oils is a subject of great interest from an economic and societal point of view.

Energy crops have been considered as one of the best alternatives in the agricultural sector, whose production satisfies both food purposes and helps in the development of new industries such as the agro-energy industry. The concept of biodiesel addresses these twin issues.

Biodiesel obtained from energy crops produces favourable effects on the environment, such as a decrease in acid rain and in the greenhouse effect caused by combustion. Due to these factors and to its biodegradability, the production of biodiesel is considered an advantage to that of fossil fuels. In addition to this, it also shows a decrease in the emission of CO_2, SO_2 and unburned hydrocarbons during the combustion process.

"Biodiesel" means a monoalkyl esters that is derived from domestically produced vegetable oils, renewable lipids, rendered animal fats or any combination of those ingredients and meets the requirements of ASTM standards.

Vegetable oils are chemically triglycerides molecules, in which three fatty acids groups are esters attached to one glycerol molecule. The problem with direct use of such oils arise because of their higher viscosity and lower ignition quality as compared to diesel. The problems are more severe in the case of direct – injection engines than in the less efficient engines having precombustion engines. In the case of direct engines, very dilute blends of oils in diesel can be used. The production of free fatty acid methyl esters from the vegetable oils is a far more satisfactory approach. This conversion of the oil into the esters which are essentially a transesterification reaction, which can be catalysed by acid, alkali or using lipase enzyme.

Enzymatic transesterification is a potential method for modification of the physical and chemical properties of edible oils and fats. Oleic acid, present in large quantities in plant oils, is of special interest due to its high thermal-oxidation stability. New hybrid varieties of sunflower contain more than 80–90% of this fatty acid, whereas classic sunflower oil contains only 40% (Purdy, 1986).

Enzyme technology will be able to compete with the chemical route if selective and stable processes are developed. Selectivity will allow a precise formulation to be obtained according to the product desired. Stability of