Vegetable oil as biofuel

In view of concerns about pollution, there is much interest in several American and European Universities to develop the so-called biofuel (biodiesel) out of oils of plant origin. Blends of the fuel with diesel are used in Europe. The European Union plans to achieve 5% of total fuel by the year 2005. In the United Kingdom, cultivation of rapeseed is encouraged for this purpose. Introduction of biofuel helps farmers and reduces pollution. India too could take up production of this additional fuel from vegetable oils. Oils, at present inedible, could be employed for this purpose.

Esters of fatty acids have the greatest potential as fuels. Methyl esters as engine fuel produce exhaust with lower hydrocarbon content, carbon monoxide and particulate matter (Mittelbach, M., *JAOCS*, 1988, **65**, 1185). The esters are produced by transesterification of the oils by chemical reaction between the alcohol and triglyceride molecule in presence of an alkaline catalyst. With excess of alcohol, high yields of esters are obtained at room temperature (Peterson, C. L. *et al.*, 1989, ASAE Paper no. 896569). The effect of mixing the reactants has been studied in a continuous process (Noureddini, H. *et al.*, 1996, ASAE 08-96). Rapeseed oil and methanol are used in Europe (Ahn, E. *et al.*, *Sep. Sci. Technol.*, 1995, **30**, 2021–2033). Based on this technology a 15,000 ton/year plant is in operation in Austria. A 30,000 ton/year plant is under construction in the Czekh republic. In the United States of America, soybean oil has been used as a substitute for diesel.

With the objective of producing the biofuel, we have carried out laboratory experiments using ricebran oil and ethanol that is abundantly produced. Batch conversions were made, at room temperature and at the boiling point of alcohol, using sodium hydroxide as catalyst.

The experiment involved the following procedure: A solution of sodium hydroxide (0.1 to 1% by volume of oil) in ethanol (99.5%) was added to ricebran oil heated to about 70°C in a water bath. The mixture was shaken to achieve homogeneity. Excess alcohol was used at molar ratios of 1:6 to 1:9 (oil:alcohol). After the reaction was complete and after allowing the mixture to cool to room temperature and to settle down for several hours, the bottom phase of glycerin was drained out using a funnel. The top phase of ester solution in alcohol was neutralized and washed with water, collecting the insoluble ester layer. The ester was air-dried.

Groundnut oil and sunflower oil were also tried out.

The results from the experiments indicate that a conversion to as high as 95 to 100% is achievable within 10 min at a temperature of 78°C starting from a molar ratio of 1:9. It was also found that gentle stirring was enough to bring about homogenization. In case of unrefined oils one has to use more alkali and this causes soap formation, which may cause interference by emulsification. Drying under vacuum is preferable.

In conclusion, it may be stated that commercial production of diesel from vegetable oils is practicable. Conditions for good yields are refining/deacidification of the oil (for which process patent is pending), use of anhydrous ethanol at economic price and local fabrication of stainless steel equipment. Facilities required are steam source, cold water (refrigeration) and use of computerized process controls.

It will be a sound national policy to encourage the development of biofuel, which does not contribute to pollution and greenhouse effects. Developments of alternative fuels also reduce dependence on imports.

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Infrastructure in S&T in India

The woeful state of the infrastructure in Science and Technology in India is well acknowledged. Some years ago UGC came forward with an imaginative scheme called COSIST for strengthening Infrastructure in University Science Departments. Funds in the range of Rs 50 lakhs were given to selected Departments and kept several of these departments in animation. This scheme has worked reasonably well. It is understood that following the recommendation of the Scientific Advisory Committee to the Cabinet a similar scheme will soon be implemented. With the acronym FIST (Funds for Infrastructure in Science and Technology), DST has called for proposals from across the nation.

Naturally the call has been received with great enthusiasm. Some concerns are that the funds earmarked for this purpose are apparently in the region of Rs 20 crores. When one considers that the number of universities and the number of eligible Departments in them, we may have 1000 contenders. Even if we grant that only 5% of them have a past track record and future potential, the amount is too small. Enormous expectations have been aroused by the DST call for proposals. If FIST is not adequately funded and implemented, this welcome initiative may prove counterproductive for the growth of Indian science.

FIST represents a fantastic opportunity to inject modern research facilities into the Indian University science. If the strategic sector – DAE, DRDO, ISRO – will come forward and pledge Rs 20 crores each and perhaps have their representatives involved in the selection but route funds through DST, then a wonderful window will be open. Indeed the AICTE Committee headed by P. Rama Rao has recommended precisely such possibilities for reshaping post graduate engineering education and research.

Is any one listening?

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