ABSTRACT

KEYWORDS: Gasoline, oxygenates, direct methanol fuel cell, hydrogenation, etherification, isopropanol, diisopropyl ether, methyl isobutyl ketone and zeolites

Oxygenates are being evaluated for blending with liquid fuels for increasing their combustion efficiency as well as octane number in addition to environmental concerns and mitigating ill-effects on the health of human beings. Among the portfolio of various oxygenates, ethers are the prime contenders. Though alcohols can also be another possible blending agent, phase separation and the water solubility are the factors against their exploitation.

Among the ethers, methyl tertiary butyl ether (MTBE) was considered as the first choice, but the possible ill effects of MTBE on human health have restricted its expansion as a blending agent. The next choice has been diisopropyl ether (DIPE) which can be produced from the refinery feed stocks by hydration/dehydration route of propylene or by hydrogenation/dehydration route of acetone. In the present investigation, various alternatives have been considered and possible strategies and methodologies have been evolved for the production of oxygenates which can be suitable for blending with liquid fuels. In essence, the main aspects that have been examined in this study are:

Oxygenate	Catalyst systems examined	Route
Diisopropyl ether	Solid acid catalysts Solid acid catalysts H-zeolite ß, HZSM5 and PW	Liquid phase hydration Liquid/Vapour phase dehydration Mixtures of IPA and propylene
Diisopropyl ether	Ni-Cu / H-zeolite ß	hydrogenation of acetone(Liquid phase)
Methyl isobutyl ketone	Ni-Cu-Mg/H-zeolite	Liquid phase(LP) from acetone

In each case, the studies have been carried out with the objectives of optimization of the experimental variables like temperature, pressure, catalyst composition, preparation methods of the catalysts and feed compositions so as to examine the feasibility of the processes for adaptation in refineries. The investigation therefore, outlines all these aspects examined and attempts to evolve strategies for possible utilization of these processes in the production of oxygenates for blending with liquid fuels making use of only refinery feed stocks. Similarly, new energy sources with cleaner technology like fuel cells have also to be evaluated to meet the future demand for energy. Developments of anode electrocatlyst for DMFC application have attracted considerable research interest in recent years. The investigation also deals with Pt/CDX-975 (a carbon material marketed by Ms Columbian Chemicals Company) CDX-975 is evaluated as support for a possible anode electro-catalyst for methanol oxidation in DMFC. Pt/CDX-975 with varying Pt loadings were prepared by formaldehyde reduction method, characterized and examined for methanol oxidation activity using cyclic voltammetry. Chronoamperometric studies were performed to evaluate the stability of the electrodes for methanol oxidation