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PHASE SEPARATION OF METHANOL/GASOLINE BLEND. Part II

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In this study, the possible use of methanol as a blending component in motor gasoline has been examined. The effect of various alcohol additives on the phase separation of 20/80 v/v methanol/ unleaded gasoline has been investigated. It has been observed that the water that could be tolerated without causing phase separation increased with increasing hydrocarbon chain of the alcohol activities.

Key words: Alcohol-gasoline blends.

INTRODUCTION

Serious attempts are being made to use methanol either as motor fuel or as a blending agent in gasoline. Methanol is being considered as an attractive substitute for gasoline as it can be produced on a large scale from cheap sources such as natural gas, biomass and coal. In certain countries where local supplies of methanol are very plentiful, it has been made mandatory by the governments of such countries to add methanol to gasolin.

The serious problem associated with methanol/gasoline blend is, that the mixture is not stable in the presence of small moisture content, and could have considerable impact on the economics of this material as a blending agent.

Previous Work

Many research papers [1,2,3,4] have appeared recently, describing the use of various additives in order to improve the phase stability and octane number of gasoline/ alcohol blends. Ingamells and Lindquist [1] studied over 150 water solubilizing additives and found that none produced sufficient improvement in water tolerance at reasonable concentration. Haq [2] discussed methanol as a blending component in motor gasoline and its associated problems. Roehm [3] used *iso*-butyl alcohol to improve the water tolerance of methanol / gasoline blends. Halstead [4] also investigated some aromatics and aliphatic hydrocarbon additives in order to improve the water tolerance of 15/85 v/v methanol/gasoline blends.

The objective of the present study is to investigate the effect of alcohol additives on the phase separation of 20/80 v/v methanol/gasoline blends in the presence of water. The experimental apparatus and procedure have been described in Part 1 of the paper.

EXPERIMENTAL

The effect of size and structure of various aliphatic alcohols on the water tolerance of methanol/gasoline blends was evaluated. The alcohols studied were ethyl, allyl, *iso*-propyl, sec.-butyl, *n*-butyl, *iso*-amyl, *n*-amyl and benzyl alcohols (Table 1). Fig. 1 shows the effect of 5 %v of these alcohols on the phase separation temperature of 20/80 v/v methanol/galoline blends with various water contents. As increase in the length of hydrocarbon chain from ethyl alcohol to *n*-amyl alcohol improved the water tolerance of the blends in increasing order. The phase stabilizing effect produced is more marked at low temperatures.

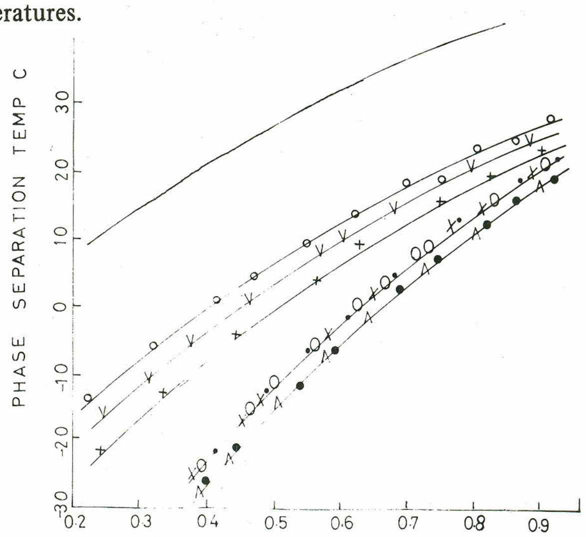

FIG.1 WATER CONTENT, %mass

Fig. 1. Effect of various alcohol additives on the water tolerance of 20/80v/v methanol/gasoline blends.

(–) Without any additive; (o) 5%v ethyl alcohol; (V) 5 %v allyl alochol;(+) 5 % V iso propyl alcohol; (O) 5 %v *n*-butyl alcohol; (X) 5 % v secondary butyl alcohol; (.) 5 %v benzyl alcohol; (●) 5 % v iso-amyl alcohol; (Λ) 5 %v *n*-amyl alochol.

Table 1.

S. No.	Alcohol used		Molecular weight
1.	Ethyl alcohol	(CH_3CH_2OH)	46
2.	Allyl alcohol	$(CH_2CH\ CH_2OH)$	58
3.	*Iso*-propyl alcohol	$(CH_3CH(OH)CH_3)$	60
4.	Sec.-butyl alcohol	$(CH_3CH(OH)CH_2CH_3)$	74
5.	*n*-Butyl alcohol	$(CH_3(CH_2)_3OH)$	74
6.	*Iso*-amyl alcohol	$((CH_3)_2CH\ CH_2CH_2OH)$	88
7.	*n*-Amyl alcohol	$(CH_3(CH_2)_3\ CH_2OH)$	88
8.	Benzyl alcohol	$(C_6H_5CH_2OH)$	108

It was observed from the experimental data that higher molecular weight alcohols are more effective water stablizing agents than the lower molecular weight ones. The water tolerance effect produced by *n*-butyl and secondary alcohol is identical; and so is the case with *iso*-amyl and *n*-amyl alcohols. This is perhaps, because of the same order of molecular weight. Aromatic benzyl alcohol seems to be an exceptional case. The water tolerance of the methanol/gasoline blend can be further improved by the use of higher alcohols, although the improvement factor is small, but yet positive [Fig. 1]. Hence, it can be concluded that higher alcohols are better stablizing agents and can be used with confidence.

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