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**Sustainable Transportation**

**Blending methanol as renewable fuel in transportation sector towards controlling air pollution**

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**Abstract**

Alternative fuels on internal combustion engine recently has become an attention due to the concern for environmental protection, and needs on reducing dependency on fossil fuels and meeting the current stringent regulation. Alcohol fuel is one of the attractive alternative fuels as it can be produced from renewable resources and is oxygenated. Methanol fuel is a well-known alcohol fuel that can be blended at the lower blending ratio with gasoline and produce better engine operation in spark ignition engine. However, there is a problem related to its methanol properties, especially on its energy content and vapour lock characteristics. Alcohol with higher carbon number such as iso-butanol has high energy content and is able to displace more petroleum gasoline compared to the methanol-gasoline blended fuel. Adding alcohols into gasoline or diesel allows the fuel to have a complete combustion with the present of oxygen which increases its combustion efficiency and reduces greenhouse gas emission. The interest on alcohol as an alternative fuel in the automotive fuel market is expected to grow rapidly in the next decades. In terms of application, Brazil has successfully and widely used ethanol as a fuel for spark ignition engine operation.

**Methanol enhancing fuel economy goals**

Methanol has a number of physical properties that make it an ideal transportation fuel.  For refiners, the use of methanol allows for the expansion of gasoline supply over a greater number of vehicles, and the upgrading of regular gasoline to high premium grades by increasing octane.  For automakers, methanol contains oxygen for cleaner fuel combustion, a lower boiling temperature for better fuel vaporization, and a higher blending octane for smoother burning with reduced “knock.”  This last point has become a critical issue for the automotive industry, which is increasingly recognizing the benefit of using more alcohol – both ethanol and methanol have 109 Research Octane Number (RON) – to boost octane and facilitate higher engine efficiencies to facilitate compliance with CAFE fuel economy goals.

**Methanol 15 (M15) in petrol reduces pollution**

Methanol is a clean burning drop in fuel which can replace both petrol & diesel in transportation & LPG, wood, kerosene in cooking fuel. It can also replace diesel in Railways, marine sector, generator sets, power generation and methanol based reformers could be the ideal compliment to hybrid and electric mobility. Methanol Economy is the Bridge to the dream of complete hydrogen based fuel systems. Methanol burns efficiently in all internal combustion engines, produces no particulate matter, no soot, almost nil SOX and NOX emissions towards near zero pollution. Currently methanol accounts for almost 9% of transport fuel in China. Millions of vehicles running on methanol. China alone produces 65% of world methanol and it uses its coal to produce methanol. Israel, Italy have adopted the methanol 15% blending program with petrol and fast moving towards M85 & M100, Japan, Korea have extensive methanol & di methyl ether usage and Australia has adopted gasoline, ethanol & methanol fuels and blends almost 56% methanol. Methanol has become the choice of fuel in marine sector worldwide and countries like Sweden are at the forefront of usage. Large passenger ships carrying more than 1500 people are already running on 100% methanol. Eleven African and many Caribbean countries have adopted methanol cooking fuel and across the world generator sets and industrial boilers are running on methanol, instead of diesel. Renewable methanol by capturing CO2 back from the atmosphere is becoming very popular and is seen by the world as the enduring energy solution known to mankind. Methanol is a significant solution to the burning problem of urban pollution worldwide. With slight modifications to existing engines and vehicles structures and fuel distribution infrastructure, 15% of all vehicle fuels can be converted to methanol & di methyl ether (DME). India is planning to implement methanol 15 % blending program with petrol and cost of petrol is expected to come down immediately by 10% and M100 program for buses and trucks is also being implemented in near future.

**Methanol in Railways**

Indian Railways consumes about 3 billion litres a year and the annual diesel bill is in excess of Rs. 15000 Crores. A methanol locomotive prototype is being implemented by Indian Railways under a grant by Department of Science & Technology and once all 6000 diesel engines are converted to methanol at very minimal cost of less than 1 Crore a engine, the annual diesel bill can be reduced by 50%. Methanol conversion program in railways is complimentary to the goals of electrification in Railways.

**Conclusions:**

For methanol-blended fuel to actually reduce pollution, proper manufacturing of coal-based methanol must be followed. Petrol supplied in India is already blended with ethanol, however, due to the limited production of ethanol, this is not all across. Petroleum Ministry is improving this instead of building expensive petrol refineries.  Methanol-blended automotive fuel petrol and diesel is already in use in a few markets in various blended percentages right from 3 percent to 85 percent. Certain applications, for example some classes of racing cars, run on 100 percent methanol. While the Government had a firm stance on bringing in electric vehicles and even dissuading full hybrids from entering the market, it now seems open to exploring other strategies to reduce pollution.

This paper discusses latest trends in utilizing methanol as a renewable fuel in automotive industries towards air pollution prevention in various parts of the world.

**Keywords:** Alcohol fuel, iso-butanol, high energy content, better fuel vaporization, higher blending octane, anhydrous ethanol blends.