USAGE OF BIOFUEL TO MITIGATE THE CURRENT ENVIROMENTAL IMPACT OF AVIATION

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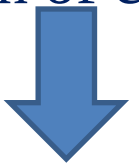
ABSTRACT

Aviation biofuel is a biofuel used for aircraft. Aviation biofuel is widely considered by the aviation industry to be one of the primary means by which the industry can reduce its carbon footprint.To Overcome the problems of fuel scarce and rapid increase in fuel cost and also to reduce increasing air pollution due to larger number of Civilian Aircrafts, more improvements have been made by using Bio-fuel blend 20 i.e., purified Jatropha seed oil 20% by volume and Jet A 80%-(HIGHLY PURIFIED KEROSENSE) by volume mixture for Turbine powered Engines; and the results obtained were good due to significant environmental and economical benefits.

The fuel mixture blend 20 reduces the emissions by Carbon dioxide(80% compared to Jet A), Water Vapour(H_2O),Nitric Oxide(NO) and Nitrogen Oxide(NO_2). It can extend the life of Turbine engine and also be used as a fuel lubricity additive in Jet A fuel.It results in a slight drop in fuel economy. It can be used in any turbine engines of aircraft and no modification to the engine and fuel system. It is an alternative fuel and provides a domestic renewable energy supply. Jatropha, one source of Potential biofuel, estimated using it could reduce green house gas emissions by up to 85%. The most effective way to decrease a carbon footprint is to decrease the dependence on carbon emitting fuels and to increase the dependence on biofuels. It is found that renewable energy supply fuels is responsible for less Co_2 than fossil fuel generation.

ENVIRONMENTAL IMPACTS

contribution of civil air craft



carbon dioxide (CO_2) and other greenhouse gases into the Earth's atmosphere

anthropogenic (human-made) climate changes significantly.

POLLUTANTS AFFECTING THE ATMOSPHERE

CARBONDIOXIDE (CO_2)

- CO2 emissions from aircraft-in-flight are the most significant and best understood element of aviation's total contribution to climate change.
- The level and effects of CO2 emissions are currently believed to be broadly the same regardless of altitude (i.e. they have the same atmospheric effects as ground based emissions)
- In 1992, emissions of CO2 from aircraft were estimated at around 2% of all such anthropogenic emissions, and that year the atmospheric concentration of CO2 attributable to aviation was around 1% of the total anthropogenic increase since the industrial revolution, having accumulated primarily over just the last 50 years.

OXIDES OF NITROGEN (NOx)

- At the high altitudes flown by large jet airliners around the tropopause, emissions of NOx are particularly effective in forming ozone (O3) in the upper troposphere.
- High altitude (8-13km) NOx emissions result in greater concentrations of O3 than surface NOx emissions, and these in turn have a greater global warming effect.
- The effect of O3 concentrations are regional and local (as opposed to CO2 emissions, which are global).
- NOx emissions also reduce ambient levels of methane, another greenhouse gas, resulting in a climate cooling effect. But this effect does not offset the O3 forming effect of NOx emissions.
- It is now believed that aircraft sulfur and water emissions in the stratosphere tend to deplete O3, partially offsetting the NOx-induced O3 increases.These effects have not been quantified. This problem does not apply to aircraft that fly lower in the troposphere, such as light aircraft or many commuter aircraft.

WATER VAPOUR (H2O)

- One of the products of burning hydrocarbons in oxygen is water vapour, a greenhouse gas.
- Water vapour produced by aircraft engines at high altitude, under certain atmospheric conditions, condenses into droplets to form Condensation trails, or contrails.
- Contrails are visible line clouds that form in cold, humid atmospheres and are thought to have a global warming effect (though one less significant than either CO2 emissions or NOx induced effects).
- Cirrus clouds have been observed to develop after the persistent formation of contrails and have been found to have a global warming effect over-and-above that of contrail formation alone.

PARTICULATES

- Least significant is the release of soot and sulfate particles. Soot absorbs heat and has a warming effect; sulfate particles reflect radiation and have a small cooling effect.
- In addition, they can influence the formation and properties of clouds. All aircraft powered by combustion will release some amount of soot.

REDUCING ENVIRONMENTAL IMPACT OF AVIATION

- Aviation biofuel is widely considered by the aviation industry to be one of the primary means by which the industry can reduce its carbon foot print.
- Currently aviation represents 2% of global emissions, but is expected to grow to 3% by 2050.
- Jatropha, one source of Potential biofuel, estimated using it could reduce green house gas emissions by up to 85%. Biofuel do not contain sulfur compounds and thus do not emit sulfur dioxide.
- The most effective way to decrease a carbon footprint is to decrease the dependence on carbon emitting fuels and to increase the dependence on biofuels. It is found that renewable energy supply fuels is responsible for less Co2 than fossil fuel generation.
- In addition to increase market advantage and differentiation eco efficiency can also help to reduce costs where alternative energy system.

By using a biofuel demonstration with boeing during 2008 and this was a world first flight using biofuel by a commercial airline.

YEAR	AIRLINE	AIRCRAFT	BIOFUEL
Dec 2008	Air Newzealand	Boeing 747	Jatropha
Nov 2010	TAM	Airbus A 320	Jatropha
Oct 2011	Air China	Boeing 747-400	Jatropha
Jul 2011	Inter Jet	Airbus A 321	Jatropha
Aug 2011	Air Mexico	Boeing 777-200	Jatropha

MATERIALS AND METHODS

It is significant to point out that, the non-edible vegetable oil of Jatrophacarcus has the requisite potential of providing a commercially viable alternative to Jet A fuel, since it has desirable physio chemical and performance characteristics comparable to Jet A. The comparison of properties of Jatropha oil and standard specifications of Jet A are shown in Table I

Specification	Standard specification of Jatropha oil	Fuel Specififcation for Jet fuel A
Specific gravity	0.91	0.72-0.84
Flash point	110°c	>60°c
Carbon residue	0.64	0.1 to over 30%
Cetane value	51	40-50
Distillation point	295°c	176°c
Kinematic viscosity	50.73cs	7.9cs
Sulphur(%)	0.13%	0.25%
Calorific value	9470Kcal/kg	10400Kcal/kg
Freezing point	2°c	-40°c

The result obtained by using the blend mixture B20 was some what good due to significant environmental benefits and also results in a slight drop in fuel economy.

JATROPHA PLANT WITH FRUITS

JATROPHA SEED AND OIL

Analysis of the Jatropha seed shown following chemical composition

Table II

Moisture	**6.20%**
Protein	**18.00%**
Fat	**38.00%**
Carbohydrates	**17.00%**
Fiber	**15.50%**
Ash	**5.30%**
Oil Content	**33-40%**
Saponification Value	**Very high**

- The Jatropha seeds are dried thoroughly and then by using Rotary oil extractor, the oil is being extracted, then the oils and fats are filtered and pre-processed to remove water and contaminants.

- If free fatty acids are present, they can be removed in to bio fuel using special pretreatment technologies, for every 3 kg of seeds, 1kg of oil will be extracted.

- The pretreated oils and fats are then mixed with methanol and NaOH used as a catalyst. The Oil molecules are broken reformed in to methylesters and glycerol, which are then separated from each and purified.

- The purified oil named as Biofuel refers to the pure fuel before blending with Jet A fuel. Finally 20% of volume of pure fuel of Biofuel mixed with 80% by volume of Jet A fuel and named as biofuel blend B20.

RESULTS AND DISCUSSIONS

Jatropha, one source of Potential biofuel, estimated using it could reduce green house gas emissions by up to 85%. The most effective way to decrease a carbon footprint is to decrease the dependence on carbon emitting fuels and to increase the dependence on biofuels. It is found that renewable energy supply fuels is responsible for less Co2 than fossil fuel generation.

Using Biofuel mixed as blend with Jet A fuel and bio fuel blends are denoted as 'BXX' with 'XX' representing the percentage of biofuel contained in the blend as follows

Name of Blend	Percentage of Biofuel (Purified Jatropha Oil)	Percentage of Jet A by volume
B10	10	90
B15	15	85
B20	20	80
B25	25	75

CONCLUSION

To overcome the problems of fuel scarce and rapid increase in fuel cost and also to reduce increasing air pollution due to large number of aircraft, more improvements have been made by using Biofuel blend 20 purified Jatropha seed oil 20% by volume and Jet A 80% by volume mixture for Turbine engines; and the results obtained were good due to significant environmental and economic benefits.

The fuel mixture blend 20 reduces the emissions by carbon monoxide, carbondoxide (75% compared to Jet A fuel), Nitrous Oxide and Sulphur dioxide.

It can extend the life of turbine engines and also it results in a slight drop in fuel economy.

It can be used in any turbine engines of aircraft and no modification to the engine and fuel systems.

It is an alternative fuel and provides a domestic renewable energy supply.