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Determination of the effect of biodiesel blends on agricultural tractor during real time measurement

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ABSTRACT : An experiment was carried out to determine the physico-chemical properties of selected blends of karanja biodiesel with petro-diesel *viz.,* B_0, B_{20}, B_{40} and B_{60} and to study the effect of these blends on specific draft, drawbar power, fuel consumption and fuel efficiency of 50 hp (2WD Mahindra 585DI) tractor and analyzed the emission characteristics of the tractor at three selected forwards *viz.,* 2.5, 3.5 and 4.5 km h^{-1} during ploughing operation. The results indicated that the kinematic viscosity, specific gravity, flash and fire points and free fatty acids of biodiesel blends were decreased with increased percentage of biodiesel in petro-diesel while their calorific value was decreased. The performance parameters like specific draft and drawbar power of tractor were not affected by the blends of biodiesel but these were significantly affected by the speed of operation. Whereas, both the blends of biodiesel and forward speeds showed significant effect on fuel consumption and fuel efficiency. The fuel consumption of tractor was increased by 7.69 per cent for B_{60} blend as compared to petro-diesel at forward speed of 3.5 km h^{-1}. The CO and CO_2 emission were decreased with the increase in blends of biodiesel as compared to petro-diesel while, the NOx emission was increased during ploughing operation. Among the blends tested, B_{20} performed comparably with petro-diesel in terms fuel consumption, fuel efficiency and NOx emission. The fuel consumption and NOx emission increased and fuel efficiency decreased with increased percentage of biodiesel beyond B_{20}. Hence, B_{20} blend of karanja biodiesel may be recommended to use in tractor for ploughing operation.

KEY WORDS : Agricultural tractor, Biodiesel, Exhaust emission, Fuel efficiency, Specific draft

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The main energy source of agricultural tractor engines is diesel fuel. All the modern tractors are equipped with multi cylinder diesel engine in which diesel is used as fuel. Due to the possibility of depletion of oil reserves in this century, usage of renewable energy sources are being considered as alternative energy sources. The price of crude oil was 26.65 dollars per barrel in 2001 but the current oil prices has reached more than 85.09 dollars per barrel in international market (Anonymous, 2011). Another drawback of petro-diesel was environmental pollution caused by its abundant usage in all the sectors. Concerns about oil supply and energy security have motivated many countries to find an alternative fuel source to petro-diesel such as biodiesel.

The developed countries are producing biodiesel from sunflower, peanut, palm and several other feed stocks which are essentially edible in Indian context. Hence, it is not possible to divert these edible oil sources for biodiesel production in India. Therefore, the developing country like India is producing biodiesel from non-edible oil sources which can be extensively grown in the waste lands. It has been reported that non-edible oils available in India are karanja, jatropha, rubber, simarouba, etc. (Anonymous, 2003 and Belum *et al.*, 2008). If 5 per cent biodiesel fuel is blended with petro-diesel to the present diesel consumption in India would save about Rs. 4000 crore a year in foreign exchange (Misra and Murthy, 2011). As India's economy is mostly depend on agriculture, the use of biodiesel with petro- diesel will create a new demand in the export market, thus it will help to strengthen India's position as a leading producer and exporter of biodiesel. The blends of biodiesel with mineral diesel fuel can be used in diesel engines (Pramanik, 2003 and Forson *et al.,* 2004).

In the majority of previous studies, biodiesel was usually tested on single-cylinder engines under laboratory test conditions. Ejilah *et al.* (2010) evaluated the performance of 2.43 kW IC engine fuelled with blends of jatropha biodiesel in proportion of B_5, B_{10}, B_{15} and B_{20} and reported that the break