EXPERIMENTAL INVESTIGATION ON SYNERGITIC EFFECT OF MIXED (CARBON / METAL OXIDE) NANO PARTICLES ON CI ENGINE COMBUSTION

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INTRODUCTION:

Combustion of fuels in engines is an important activity during production of power or in transportation sector. It is very important to devise newer techniques for efficient burning of present fuels, adopt methodologies for burning different kinds of fuels in engines, unearth more fuels that match present day fuels in properties and conduct research on the above topics. The rapidly increasing consumption of fossil fuel and petroleum products in prime movers has been a matter of concern for many countries which imports crude oil since it causes huge foreign out-go. In general, increasing exhaust emissions and depletion of these fuels is a matter of serious concern for all. Hence it is necessary to develop renewable energy sources that satisfy the present-day requirements. Vegetable oils have capability to solve this problem because they are renewable in nature and lead to reduction in environmental pollution. Biodiesel developed from non-edible oils promise to be a very important prospective alternative fuel for diesel engines. Biodiesel commands crucial advantages such as technical feasibility of blending in any ratio with diesel fuel, use of existing storage facility, superiority from emission reduction etc.

This research aims to investigate the utilization of dairy waste scum as a viable feedstock for biofuel production, contributing to the development of renewable energy sources. The study also explores the integration of nano particles, specifically multi-walled carbon nanotubes (MWCNT) and titanium oxide (TiO2), to enhance the efficiency and reduce emissions in CI Engine combustion.

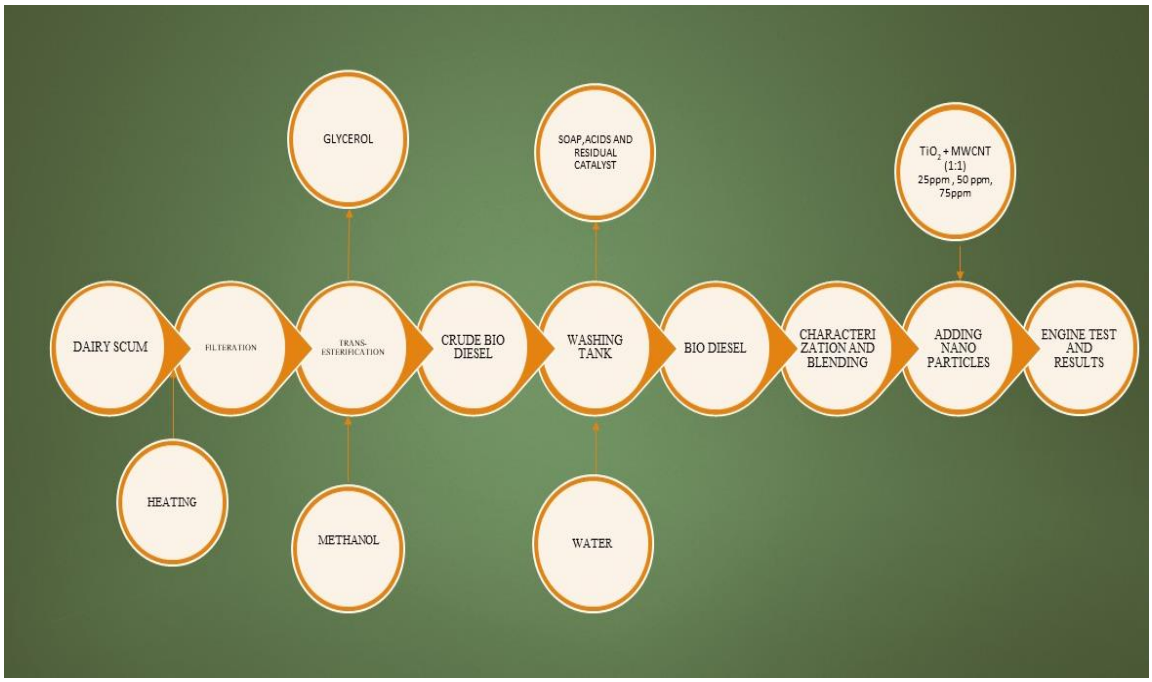
Dairy scum biodiesel is produced from dairy waste by the method of Transesterification. It is blended with diesel in 20% proportion. Titanium oxide (Metal oxide) and MWCNT (carbon based) are mixed in 1:1 proportion and it is loaded to produced B20 blend in various proportions (25ppm, 50ppm and 75ppm). Experimental investigations are carried out on a 4 stroke, single cylinder diesel engine with the produced biodiesel samples.

1. OBJECTIVES OF THE PROJECT

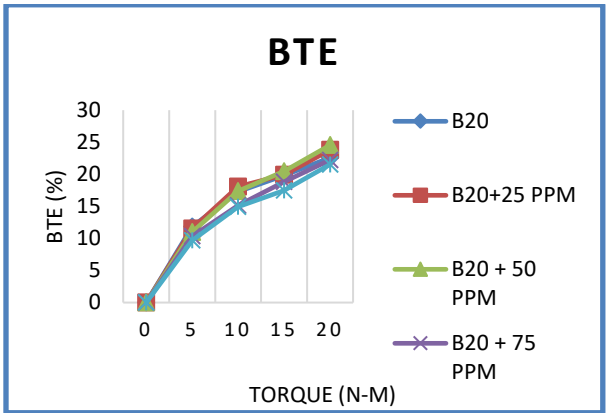
- Extraction of oil from biological sustainable source like dairy scum
- Production of biodiesel from the extracted oil by the method of Transesterification
- To blend the produced Biofuel with Diesel in various proportions (B10, B20, B30).To find out the properties of various blends (B10, B20, B30) like Specific gravity, Flash point, Fire point, Viscosity, Calorific value etc., as per the ASTM Standards.
- To mix titanium oxide (Metal oxide) and MWCNT (carbon based) in 1:1 proportion and load the best performing blend out of B10, B20 and B30 in various proportions.
- To conduct performance and emission tests in a single cylinder four stoke diesel engine and to compare the performance, combustion and emission parameters with that of diesel.

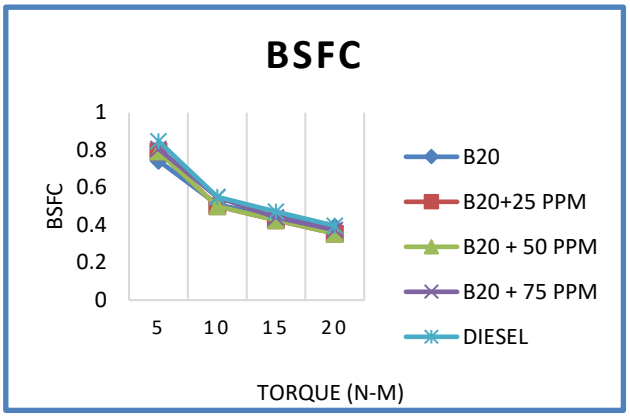
2. METHODOLOGY:

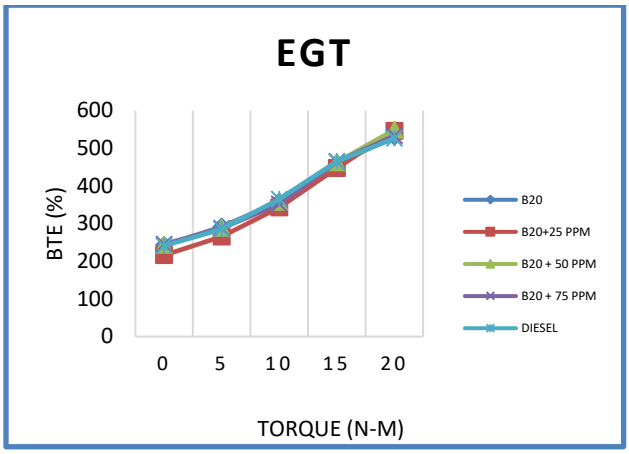
The methodology used in the project is shown in the following flow chart

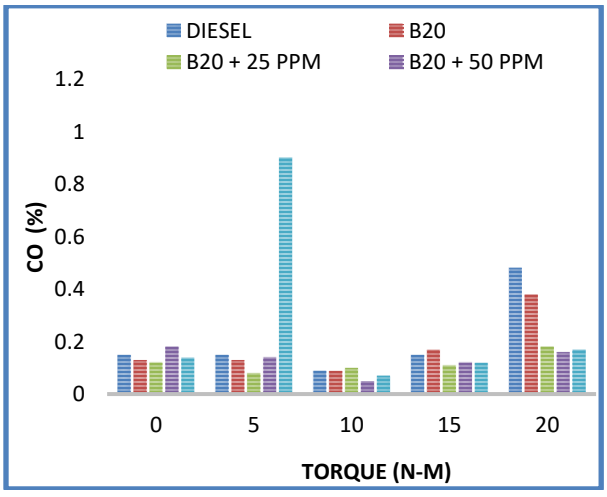


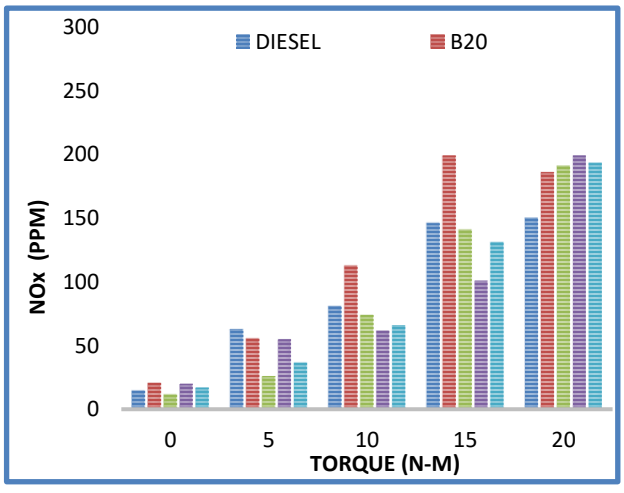
3. RESULTS AND CONCLUSIONS:

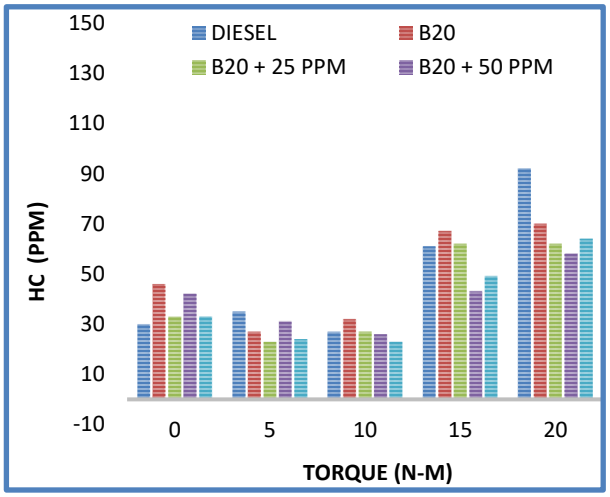












The results of the experimentation can be briefed as: -

- The measured properties of produced methyl ester (kinematic viscosity, flash point, fire point) met the ASTM biodiesel standards.
- In general it is observed that blending of biodiesel with diesel yields better thermal efficiency.
- There was an increase in NOx emissions by using the biodiesel blends.
- It is observed that in case of B20 dairy scum biodiesel blend, the BTE increased by 1.05% in comparison with diesel at highest toque applied. With respect to fuel additive blends there was a significant improvement in BTE up to addition of 50 PPM of mixed nanoparticle addition and further addition (75 PPM) of nanoparticles led to reduction in efficiency. In comparison to B20 blend, there is an increase in BTE of 1.21%, 1.96% and 0.35% for B20 + 25 PPM, B20 + 50 PPM and B20 + 75 PPM blends respectively.
- It is observed that in case of B20 dairy scum biodiesel blend, the SFC decreased by 1.58% in comparison with diesel at highest toque applied. With respect to fuel additive blends there was a significant reduction in SFC up to addition of 50 PPM of mixed nanoparticle addition.
- It is observed that in case of B20 biodiesel highest exhaust gas temperature was 530^0C for B30 blend at highest torque which is 4^0C higher as compared to that of diesel. Similar trends are observed in case of nanoparticle blended samples.
- The addition of mixed nano particles decreases the CO emission as compared to that of base blend B20, The CO emission is found to be reduced by 52.63%, 57.89% and 55.26%.

- The HC emission in case of nanoparticle blended samples is found to be 11.42%, 17.14% and 8.5 % lower for 25, 50 and 75 PPM blends respectively at maximum applied torque compared to based blend B20.
- The NOx emission in case of nanoparticle blended samples is found to be 2.68%, 6.98% and 3.7 % higher for 25, 50 and 75 PPM blends respectively at maximum applied torque compared to based blend B20.