ENVIRONMENTAL-FRIENDLY TRI-FUEL EMULSION

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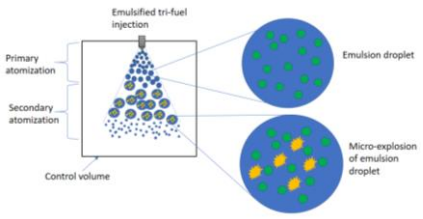
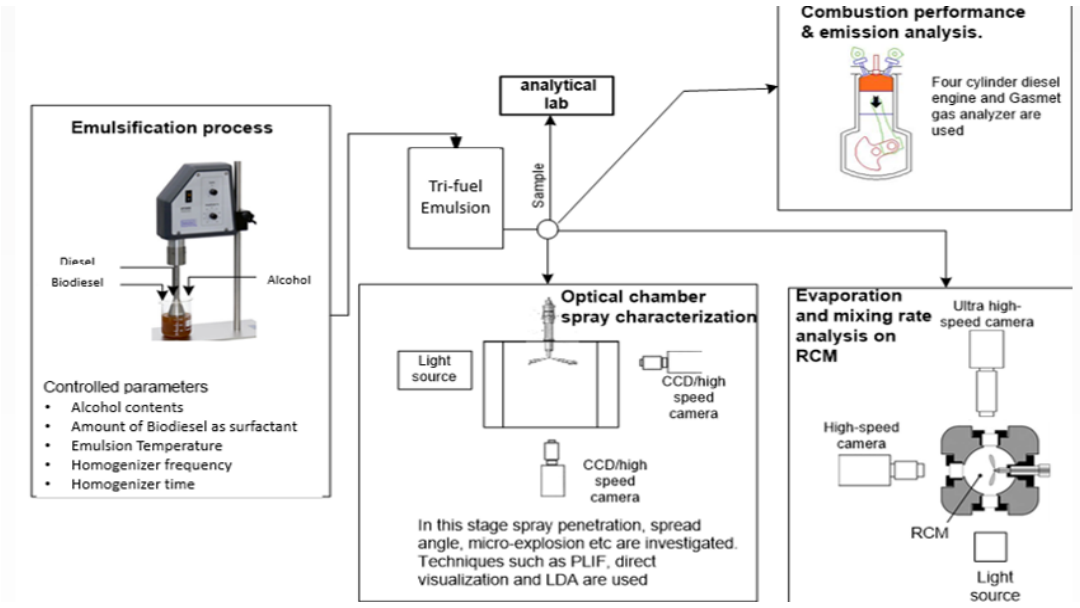
PRODUCT BACKGROUND

- Monitoring tool wear in machining processes is one of the critical factors in reducing downtime and maximizing profitability and productivity.
- Tool condition monitoring is gaining more attention in automated manufacturing processes in recent times.
- 20% of machining downtime is reported to be due to tool wear, which causes surface deterioration and can be detrimental to machine health.
- Ecological-nano-coolant is a **renewable and biodegradable water-based TiO_2 nano-coolant** for end milling machining process with environmental friendly minimum quantity lubrication (MQL).
- Providing better performance than flooded and oil-based conventional MQL cooling conditions. The drastic increase tool life and improve tool damage.



STATE OF ARTS /METHODS



BENEFITS/USEFULLNESS

7. While Malaysian fuel demand, mainly diesel, is increasing at alarming rate, the demand for biofuels is at its low.
8. The crude palm oil (CPO) industry is struggling with domestic CPO stock fluctuation.
9. Government of Malaysia (GOM) has introduced a policy on biofuels with its primary objective to increase the demand of CPO.
10. This policy was expected to support the COP industry by blending biodiesel in to diesel and introducing alcohol from waste of palm oil sector to be used as an energy source.

PUBLICATIONS

1. Tri-fuel emulsion fuel characterization, stability and the corrosion effect, Presented in **4th International Conference in Mechanical Engineering Research (ICMER 2017)**, Kuantan, Malaysia, 1-2 August, 2017
2. A study of the stabilities, microstructure and fuel characterization of tri-fuel (diesel-biodiesel-ethanol) using various fuel preparation methods, Presented in **4th International Conference in Mechanical Engineering Research (ICMER 2017),** Kuantan, Malaysia, 1-2 August, 2017
3. Characterization and performance of Biodiesel as an alternative fuel in diesel engine-A Review, **Renewable and Sustainable Energy Reviews**, Vol 75, 1281–1294, 2017. (SCOPUS/ISI Indexed, IF = 8.05)
4. Emulsification versus Blending on the Effect of Fuel Oxygenation and Substitution of Diesel for Compression Ignition Engine **Renewable and Sustainable Energy Reviews** 72, 497-509, 2017 (SCOPUS/ISI Indexed, IF = 8.05)
5. Experimental investigation of the impact of using alcohol-biodiesel-diesel blending fuel on combustion of single cylinder CI engine, **IOP Conference Series: Materials Science and Engineering** (Vol. 160, No. 1, p. 012038). IOP Publishing (Scopus).
6. Impact of oxygenated additives to diesel-biodiesel blends in the context of performance and emissions characteristics of a CI engine, **IOP Conference Series: Materials Science and Engineering** (Vol. 160, No. 1, p. 012060). IOP Publishing (Scopus).

COLLABORATORS

YANMAR

FOCUS APPLIED TECHNOLOGIES

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ENVIRONMENTAL IMPACT

1. Malaysia is still reliant on the more emission prone fossil-based fuels.
2. Besides, the performance improvement and cleaner emissions with the emulsion fuel, diesel fuel substitution by locally available resources would economically strengthen Malaysia. Commercialization of the product would strengthen local biofuel industry and contribute in the job creation.

PATENT

Patent filed

- Application No. PI 2017001318
- Filing date: 11 September 2017

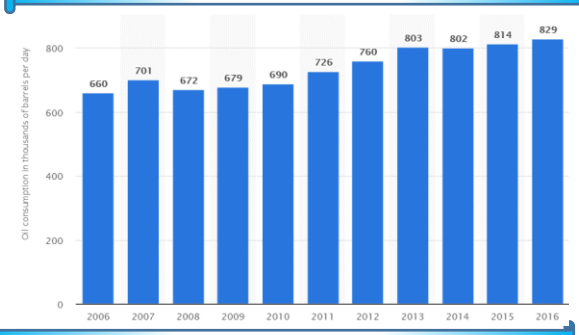
MARKETABILITY

•With the current blending and fuel distribution facility available, the product can be easily introduced in to the market.
•The fact that biodiesel acting as a surfactant in the emulsion, there is no additional chemical requirement for the stability (sustainable and clean).
•To increase confidence level of the engine manufacturers and vehicle insurers, detail marketing strategy and long run endurance tests is to be conducted with collaborating institutions

SUSTAINABILITY IMPROVEMENT

Environmental Friendliness improvement (%)	10
Fuel consumption reduction (%)	5
Fossil diesel replacement (%)	25
Renewable resource utilization (%)	25

MARKET SURVAY

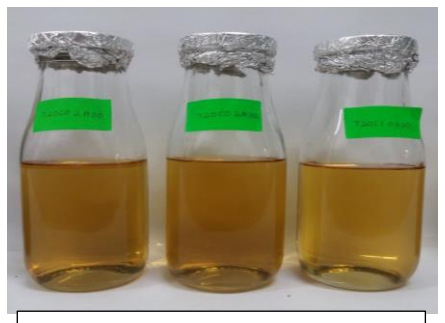


ACHIEVEMENTS AND AWARDS

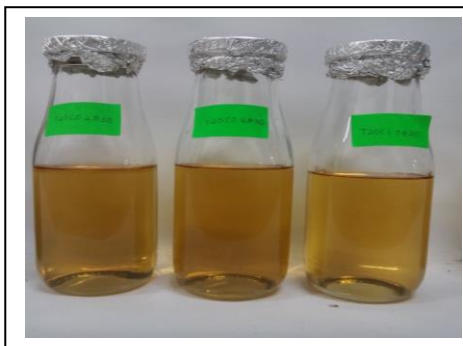
Gold Medal, CITREX 2018, Conference Main Hall, UMP, Malaysia
2nd Placed Special Award in Automotive Category, CITREX 2018 Conference Main Hall, UMP, Malaysia
Gold Medal, CITREX 2017, Conference Main Hall, UMP, Malaysia
Special Award in Automotive Category, CITREX 2017Conference Main Hall, UMP, Malaysia

PRODUCT CHARACTERISTICS

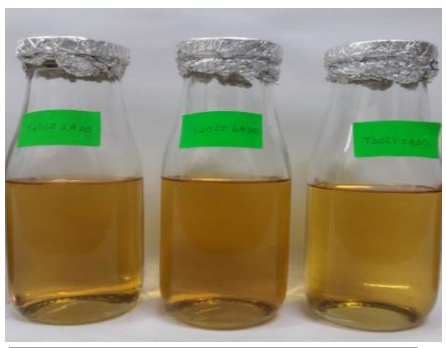
Emulsified fuel after 24 hours



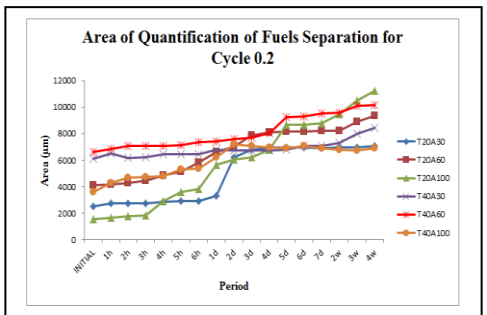
Emulsified fuel after 7 days

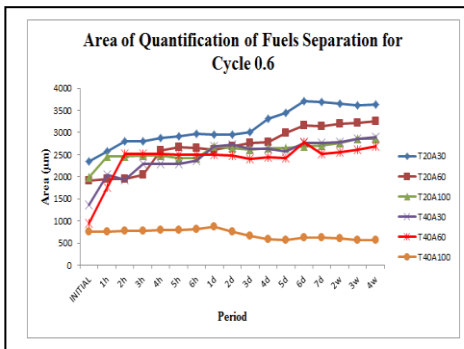


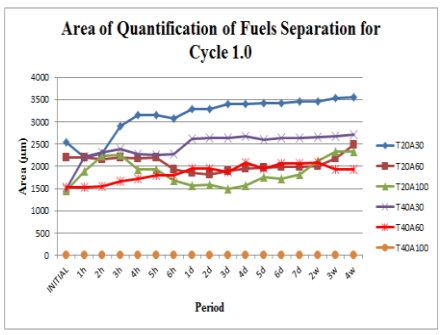
Emulsified fuel after 14 days



Emulsified fuel after 30 days







- These gradient patterns prove that the samples are all acceptable and the stability of the fuels in each sample are justified
- In conclusion of all the experimental analysis and parameterization, the emulsifying parameters that affect the stability of tri-fuel emulsion is optimized and an emulsion was reported to remain stable for over a month.