

BIODIESEL: A CLEANER AND RENEWABLE ALTERNATIVE TO DIESEL

Green Ignitions, a startup nourished by SLTC Research University formulates their own Biodiesel process in aspiration to make it commercially available to Sri Lanka.

Large scale initiative by Manusha Wijesinghe, Kaiz Noorhamith, Sithira Sathsara, Sasanga Samarakoon and Theshan Samaraweera

At Green Ignitions, we are tackling Sri Lanka's current economic crisis and its impact on the transportation industry head-on. Our solution is Biodiesel made from waste edible oils. Our team has developed high-quality Biodiesel that surpasses ASTM standards and is a cost-effective and sustainable fuel alternative.



HOW DOES IT COMPARE WITH NORMAL DIESEL?

Pure Biodiesel (B100) is a renewable substitute to Auto diesel since it is made from waste and used edible oils. When used in vehicles it produces much cleaner emissions with no nitrous oxides nor carbon monoxides. This can be observed through light grey fumes from the exhaust in comparison to black fumes when normal diesel is burnt.

Biodiesel is ideal for heavy vehicles and generators due to high compression ratio giving it more efficiency and smoother performance. In other vehicles, biodiesel can be blended with normal diesel to improve lubricity of vehicles. B20 is a common blend of 80% diesel with 20% biodiesel which is implemented in countries such as Indonesia.



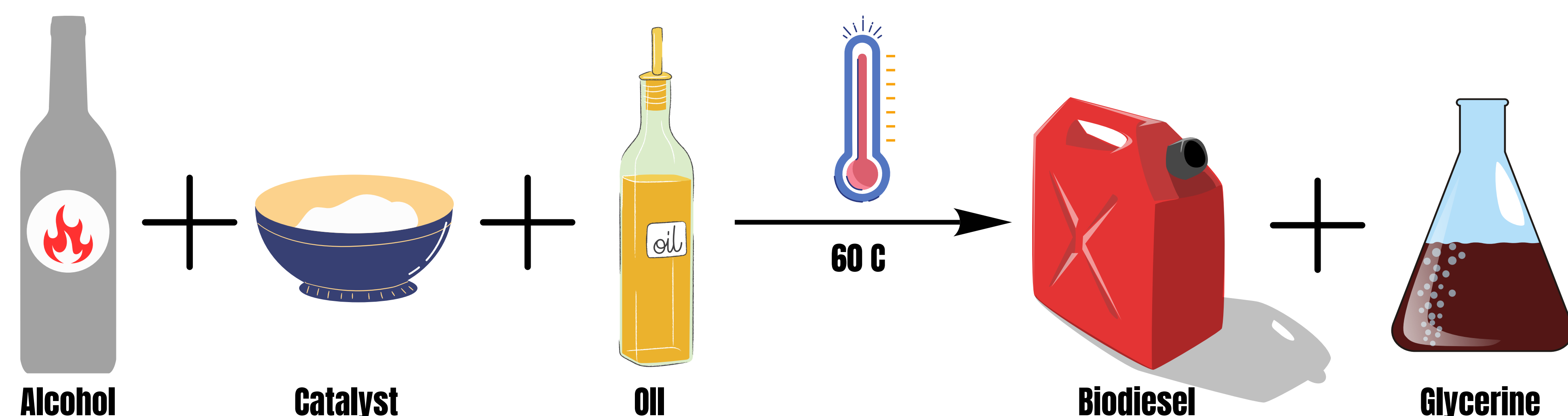
HOW IS IT MADE?

The basic ingredients to make biodiesel are:

- Oil that has Free Fatty Acids such as cooking oil, coconut oil, animal fat etc.
- Alcohols such as Ethanol and Methanol
- Catalysts such as Potassium Hydroxide or Sodium Hydroxide, this is used to speed up the reaction.

The first step is to mix the catalyst and alcohol to produce Alkoxide. This is reacted with the oil at 50-60 °C to undergo a reaction called Transesterification.

We know the reaction is over when we observe a separation of clear amber and dark maroon.



The separation is a result of low density Biodiesel on top and Glycerin at the bottom. The two must be separated using a separation funnel (as shown above). Glycerin is a byproduct which can be used to make soap. The extracted Biodiesel must then be washed with water or run through adsorbents to get rid of soaps formed during the reaction

Water should be sprinkled onto the biodiesel to dissolve the soaps into the water. Water does not mix with biodiesel so it can be separated out.

Once washing is done, we must check the pH, ideally pH must be between 7-9, anything higher indicates high soap levels so washing step must be repeated until reasonable pH is achieved.



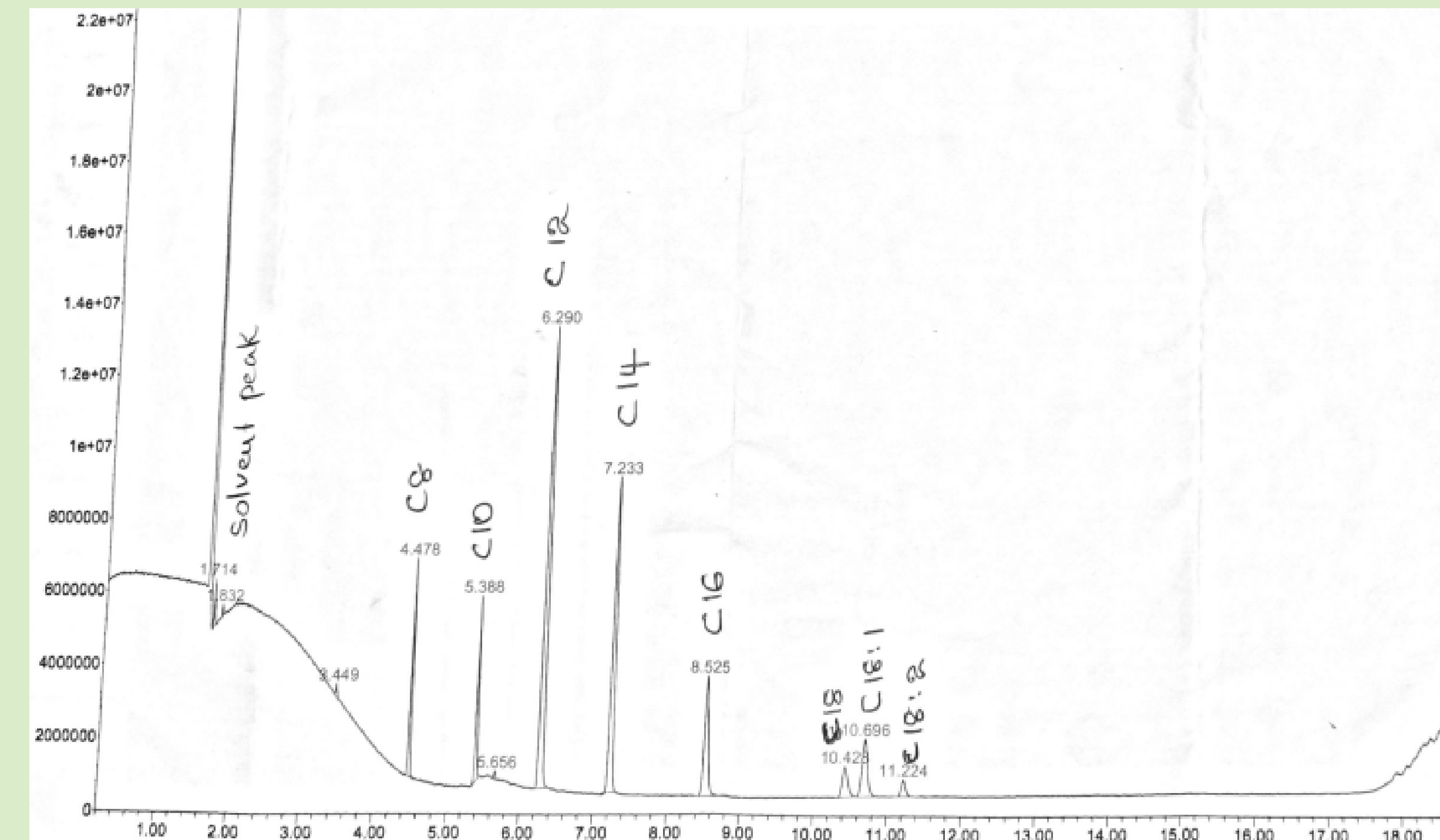
STANDARD OF OUR BIODIESEL

Making biodiesel might be a simple process but it is important to make it into an appropriate standard before using it in an engine.

To begin formulating the best biodiesel we made several samples with different raw materials and proportions. Then we selected the best samples for testing at SLINTEC and Industrial Technology Institute (ITI LABS)



GCMS REPORT



Gas Chromatography Mass Spectrometry identifies the compounds present in the Biodiesel Sample.

This graph illustrates a purity of 99.95% with no traces of glycerin present.

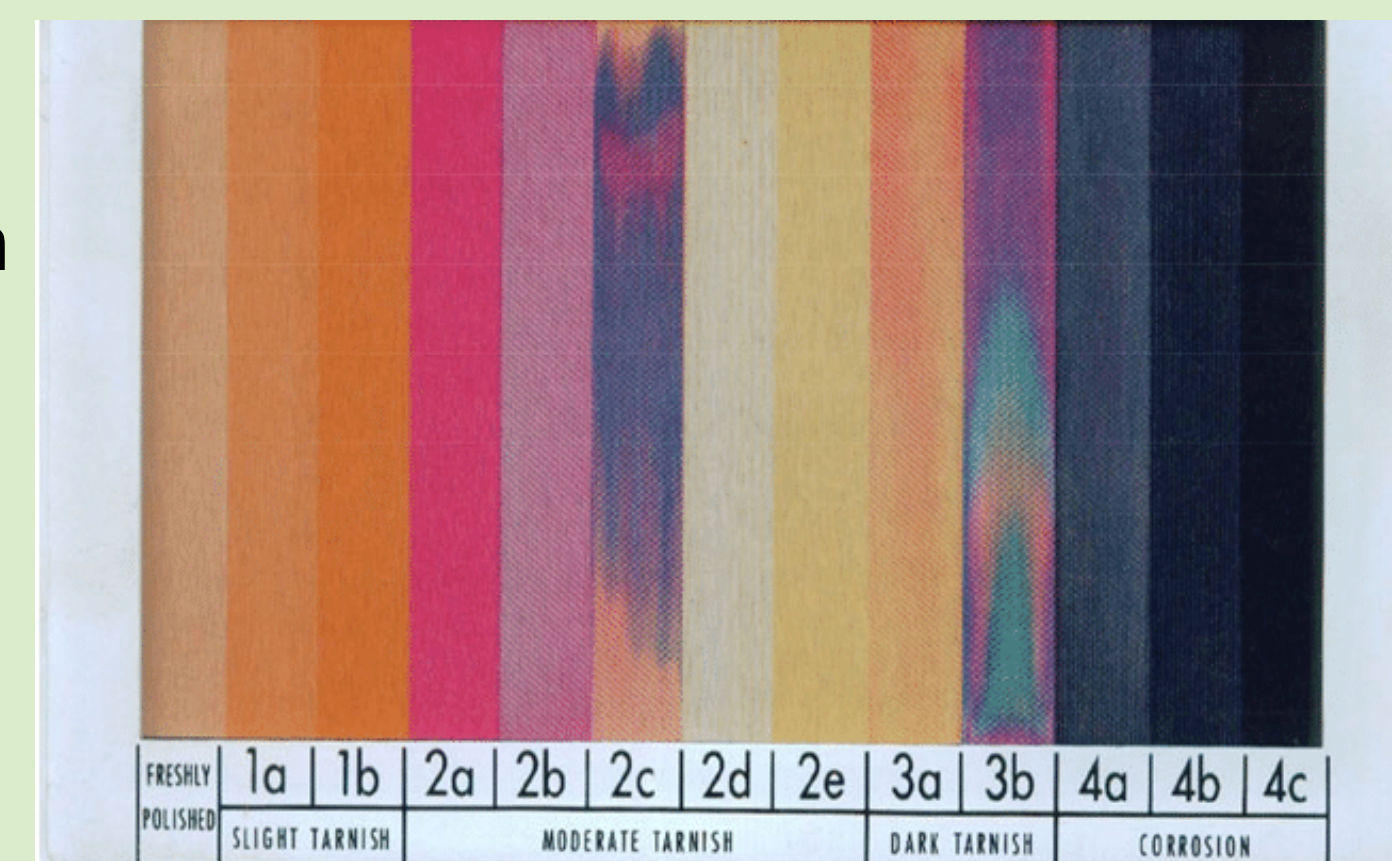
ENGINE TESTS RESULTS

The engine test is a series of tests that can identify important properties of biodiesel

1. CORROSION RESISTANCE - 1a

This test is done to test the potential to corrode copper metal.

1a means the lowest corrosion according to the ASTM copper corrosion standards.



2. FLASH POINT - 126°C

Lowest temperature at which its vapours can burn in air

3. KINEMATIC VISCOSITY - 4.174 cSt

A measure of how resistive a liquid flows under gravity.

4. DENSITY - 0.8821 g/cm³

The mass in a unit volume of Biodiesel.

5. CETANE INDEX - 43.5

This number gives an approximation to measure the combustion quality of diesel.

The range is between 0-100 where higher numbers indicate faster combustion. Our biodiesel is in the perfect range of regular diesel #2 which is recommended for heavy vehicles to travel long distances at consistent speed and higher fuel economy.

Hence, we can confidently say our high quality biodiesel possesses no harm to heavy vehicle engines.

SUCCESSFUL SUPPLY

We have produced biodiesel in large barrel quantities and run them successfully in several vehicles and generators namely Sri Lanka's First Ever Biodiesel Powered Bus which is supplied with 100 L per month.

