

## UTILIZATION OF CRUDE GLYCEROL OBTAINED IN BIODIESEL PRODUCTION AS AN ALTERNATE TO GLYCOGENIC FEED SUPPLEMENT FOR DAIRY COWS

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Duration	:	3 years
Budget	:	Rs. 55.58 lakhs
Funding Agency	:	DST, GoI
Collaborators	:	NDRI, KSCST

### Progress

The glycerol was obtained in small quantities from nearby Bioenergy Research information and Demonstration Centre (BRIDC) Established by Karnataka State Bioenergy Development Board (KSBDB) and protocol for purification was developed after several experiments. Meanwhile KSCST took up the procurement of the Transesterification Unit (TU) and the Atomic Absorption Spectrometer (AAS) by inviting tenders through the e-tendering portal of government of Karnataka. Both the TU and AAS have been procured, installed and commissioned at ICAR-NDRI, Bengaluru. KSCST also procured 100litres of Jatropha from Udaipur, Rajasthan and supplied to ICAR-NDRI. Using different Non edible oil seeds (Pongamia, Simarouba, Mahua, Neem and Jatropha) biodiesel was produced using the TU thereby producing crude glycerol as byproduct. The Crude glycerol in turn was refined at different levels of purity (100%, 90%, 80%, etc.,) for the invitro trials. Several invitro trials conducted to ascertain consistency in glycerol purity that could be used safely in livestock feed.

Maximum gas production was observed at 12-18h fermentation intervals in glycerol of different purity viz., 100%, 90%, 80%, 70% 60% and crude. Maximum gas production was observed in Simarouba glycerol of purity levels followed glycerol obtained from Jatropha Pongamia neem and Mahua. Based on pattern of gas production, lag time, t-half time, dual rate constant, extent and rate substrate fermentation from different source of glycerol obtained during biodiesel production was studied. Data was analysed for mean and variance using SPSS s/w V.25.0. Based on statistical significance glycerol fermentation was differentiated between various sources. Based on the invitro studies, *in vivo* experiments shall be carried out to evaluate effects of glycerol as energy supplement of milking cows.

### Production Biodiesel and Glycerol

#### 1. Jatropha Biodiesel

50 litres of oil was purchased from Super India Enterprises, Udaipur, Rajasthan and tranesterified the oil to biodiesel. 41 litres of biodiesel and 7 litres of crude glycerol were obtained. Crude glycerol was purified and stored for *in vivo* experiments.



Lab scale transesterification unit



Pilot Scale transesterification Unit

#### 2. Pongamia Biodiesel

100 litres of Pongamia oil was procured from BIDC, GKVK, Bengaluru and transesterified. 72 litres of biodiesel and 18 litre of glycerol were obtained. The obtained biodiesel analysed for quality test and engine performance. The results are as follows.

### Biodiesel Quality testing report

Sl. No	Parameters	Test method	Test results		Limits
			Lab Scale	Pilot scale	
1.	Viscosity @ 40°C	ASTM D445	5.403 mm <sup>2</sup> /s	6.07	1.9 – 6.0 mm <sup>2</sup> /s
2.	Cloud point	ASTM D2500	19.4 °C	18.3 °C	-
3.	Pour point	ASTM D97	19 °C	18.0 °C	-
4.	Flash Point	ASTM D93C	166 °C	130 min/ °C	130 °C
5.	CFPP	ASTM D6371	17 °C	15 °C	-
6.	Oxidation Stability	EN 14112	1.11h 110 °C	6hrs (B6-20) 3 hrs (B100)	6 h (B6-20) 2 h (B100)
7.	Acid Value	ASTM D664	0.68 mg KOH/g	1.17 mg KOH/g	0.5 Max mg KOH/g
8.	Iodine number	EN 14111	71.57 g/l <sub>2</sub> /100g	71.29 g/l <sub>2</sub> /100g	130 Max g/l <sub>2</sub> /100g
9.	Density	ASTM D 4052	898.001 kg/m	898.47 kg/m	850 -900 kg/m

### Glycerol Purification

The crude glycerol obtained during transesterification of oils from Pongamia, Neem, Mahua, Jatropha, Simarouba and waste cooking oil was solid at room temperature. Around 100g of the crude glycerol was melted at 55 °C min a 500ml beaker placed on a magnetic hot plate. The crude glycerol under gentle stirring was acidified with sulphuric acid to pH 2 and was kept for separation of organic layer.

From the bottom layer, the glycerol was extracted and neutralized using 1N NaOH solution followed by evaporation of water at 110 °C for 2h. The neutralized glycerol solution was precipitated to remove salts using chilled methanol. The salts were filtered through Whatman filter No 1 and methanol was recovered. The obtained glycerol was decolorized using activated charcoal and evaporated water to obtain pure colourless glycerol. Each litre of crude glycerol gave 100ml – 150 ml of glycerol purified glycerol.



### Conferences attended

1. Presented oral presentation on 'Nutritional Analysis of Pongamia Seed Cake for Animal Feed Supplement' at International Conference at Garden City University, Bengaluru held on September 19-20, 2019
2. Presented oral Presentation on "Purification and characterization of crude glycerol produced by biodiesel process from non- edible tree borne seed oils to be used as glycogenic supplement for cattle" at Hyderabad.
3. Presented Oral Presentation on Characterization of purified glycerol obtained from Jatropha biodiesel as cattle feed at ICLCHS 2019 at Ramaiah College of art, Science and commerce, Bangalore held on 22-24 October, 2019. Won best paper Award.

**Paper published** - Savitha .G., Lokesha.E., Thingujam Suson, Sondur.S.N.,and Bandla Srinivasa (2019). Effect of fortification of commercial glycerol and crude glycerol to straw based mixed substrate on fermentation kinetics and energy value. Indian Journal of Dairy Science: 72(4): 437-440.