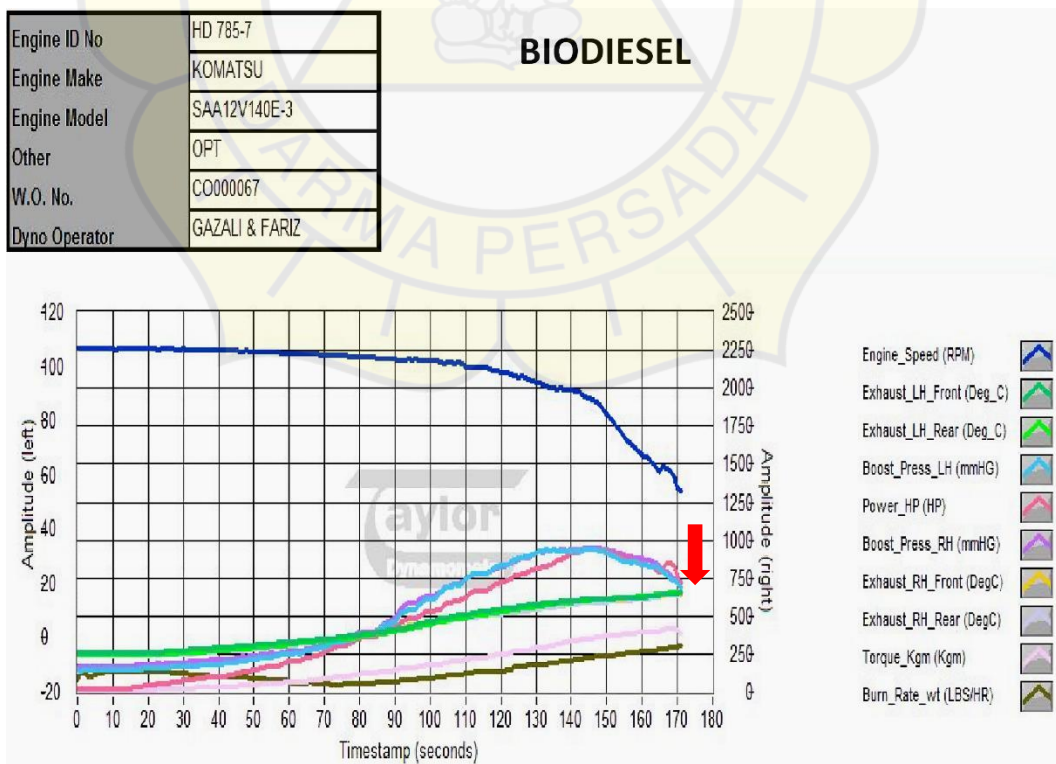
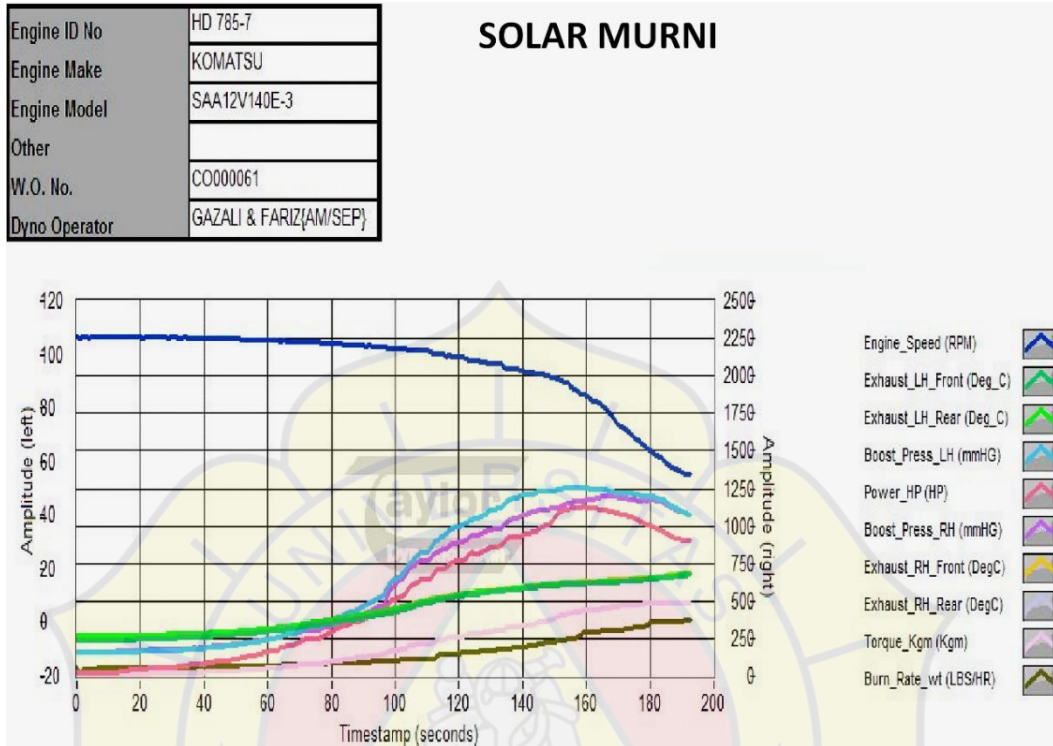


## LAMPIRAN 1

### Data Test Bench Dyno Mesin



## Data Test Bench Dyno Mesin Dengan Solar Murni

Timestamp (seconds)	Engine_Speed (RPM)	Exhaust_LH_Front (Deg_C)	Exhaust_LH_Rear (Deg_C)	Boost_Press_LH (mmHG)	Power_HP (HP)	Boost_Press_RH (mmHG)	Exhaust_RH_Front (DegC)	Exhaust_RH_Rear (DegC)	Torque_Kgm (Kgm)	Burn_Rate_wt (LBS/HR)
180.20	1502.51	644.62	651.26	1199.63	1002.03	1172.16	655.98	656.74	484.07	360.73
181.20	1483.67	648.46	656.19	1193.97	995.12	1172.00	658.08	660.73	485.60	361.79
182.20	1471.40	650.12	657.87	1187.71	984.99	1167.02	659.70	664.00	486.04	362.67
183.20	1454.96	651.81	659.47	1179.47	975.23	1160.35	661.31	665.59	486.46	363.48
184.20	1434.92	653.45	661.11	1172.41	963.47	1152.55	664.61	668.99	486.44	364.22
185.20	1414.88	657.50	662.82	1158.37	948.75	1142.24	668.24	670.80	486.14	364.90
186.20	1398.81	659.95	666.44	1143.93	935.68	1131.25	672.74	673.81	484.64	365.52
187.20	1389.83	661.59	669.46	1132.51	928.89	1120.54	674.41	675.47	483.80	366.09
188.20	1378.33	663.25	671.10	1120.71	920.56	1109.10	677.61	677.05	484.10	366.60
189.20	1371.31	664.94	674.37	1107.85	915.03	1099.05	680.92	678.71	484.30	367.06
190.30	1360.20	666.57	675.97	1096.49	909.20	1093.75	682.63	680.32	485.64	367.49
191.30	1351.49	671.40	678.12	1085.76	905.80	1087.12	687.51	683.54	486.01	373.32
192.20	1343.38	673.09	681.91	1073.90	900.08	1079.12	690.71	685.09	486.38	373.57

## Data Test Bench Dyno Mesin Dengan Biodiesel

Timestamp (seconds)	Engine_Speed (RPM)	Exhaust_LH_Front (Deg_C)	Exhaust_LH_Rear (Deg_C)	Boost_Press_LH (mmHG)	Power_HP (HP)	Boost_Press_RH (mmHG)	Exhaust_RH_Front (DegC)	Exhaust_RH_Rear (DegC)	Torque_Kgm (Kgm)	Burn_Rate_wt (LBS/HR)
163.00	1506.12	630.22	636.47	830.96	821.84	859.96	630.17	618.11	395.23	274.27
164.00	1478.54	631.89	641.47	823.47	806.35	851.68	633.32	619.72	395.55	275.32
165.00	1452.80	635.23	644.41	810.21	793.44	832.44	635.14	623.05	394.94	277.78
166.00	1483.71	640.32	647.86	787.17	816.08	805.56	638.28	628.35	402.13	278.81
167.00	1474.57	643.57	649.53	769.33	852.76	786.35	641.89	629.86	421.26	279.82
168.00	1453.94	645.34	652.75	750.73	849.64	767.83	644.86	633.24	423.86	289.47
169.00	1430.57	648.37	655.16	729.72	834.17	746.14	646.45	634.60	421.88	290.40
170.00	1350.73	650.03	657.93	720.40	771.01	739.42	647.85	636.39	409.86	291.32
171.00	1319.20	651.61	659.61	692.40	712.01	720.62	649.71	638.18	390.21	302.40

## LAMPIRAN 2

### Hasil Analisa Pelumas Mesin



TECHENOMICS  
TECHNICAL ADVANCE FOR ECONOMIC GAIN

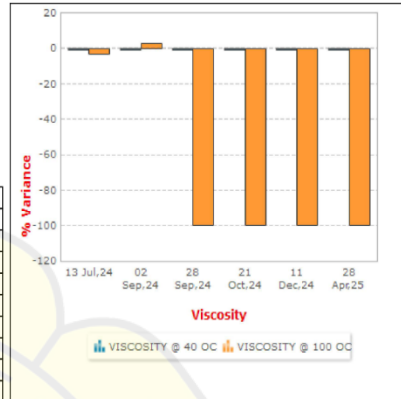


PROBLEM

**Wear Metal Report:** 50175863

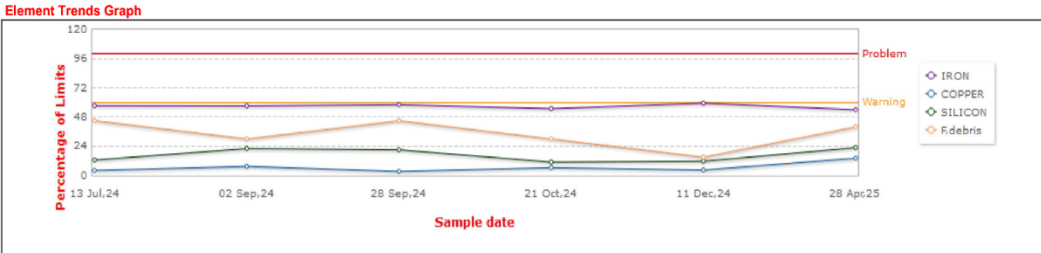
Client:  
Attention:  
Address:  
Machine: **HYUNDAI 850** ID No: EX080-005  
Oil Name: **SHELL RIMULA R3 MV 15W-40**  
Visc@40°C: 111 Visc@100°C: 14.6 TBN: 10.57  
Compartment: **ENGINE** S/N: -

Sample Date:	13/07/2024	02/09/2024	28/09/2024	21/10/2024	11/12/2024	28/04/2025
Received Date	23/07/2024	12/09/2024	25/10/2024	19/11/2024	19/12/2024	22/05/2025
Analysis Date:	23/07/2024	12/09/2024	25/10/2024	19/11/2024	19/12/2024	22/05/2025
Reported Date	24/07/2024	14/09/2024	26/10/2024	21/11/2024	21/12/2024	23/05/2025
Sample no:	50121303	50131784	50139679	50143998	50149562	50175863
SMU:(hrs)	5758	5998	6272	6570	6730	7001
Oil Hrs:	-	-	-	-	-	-
Oil Changed:	Yes	Yes	Yes	Yes	Yes	Yes
Component Hours	-	-	-	-	-	-
Wear Metal Rate	-	-	-	-	-	-



Wear Metals	METHOD	RESULT						Caut	High	Comments on elevated results
lead (Pb)(mg/kg)	ASTM D6595	0.1	0.1	0.9	0.8	0.2	0.6	48	80	Viscosity tidak terbaca, air 0.2% High Soot Fe Wear increase Wear Cylinder liner valve train oil pump crankshaft Check abnormal noise. Check valve mechanism, Check oil pressure. Check filter cut. Check abnormal temperature. Check performance. Check Turbocharger pressure. Check air intake dan exhaust gas system blockage or leakage. Check fuel system malfunction (check injector check setting FIP timing). Lakukan perbaikan. (Febri - Lab jkt)
iron (Fe)(mg/kg)	ASTM D6595	54.5	54.4	55.3	52.2	56.5	51.4	57	95	
aluminium (Al)(mg/kg)	ASTM D6595	6.7	3.3	1.0	2.7	2.9	8.5	28	46	
copper (Cu)(mg/kg)	ASTM D6595	1.8	3.3	1.5	2.9	2.0	6.4	27	45	
chromium (Cr)(mg/kg)	ASTM D6595	2.3	4.8	5.4	6.1	5.2	8.1	9	15	
tin (Sn)(mg/kg)	ASTM D6595	1.3	1.5	1.8	3.2	1.2	1.8	9	15	
nickel (Ni)(mg/kg)	ASTM D6595	1.7	1.2	0.1	0.3	5.6	2.3	9	15	
<b>Contaminants</b>										
silicon (Si)(mg/kg)	ASTM D6595	5.1	8.8	8.4	4.4	4.7	9.1	24	40	
sodium (Na)(mg/kg)	ASTM D6595	7.2	12.1	5.0	13.1	12.4	15.7	60	100	
<b>Oil Additives</b>										
magnesium (Mg)(mg/kg)	ASTM D6595	916	167	63	29	16	3	0	0	
zinc (Zn)(mg/kg)	ASTM D6595	921	575	365	675	537	452	0	0	
molybdenum (Mo)(mg/kg)	ASTM D6595	28	20	10	17	16	14	0	0	
calcium (Ca)(mg/kg)	ASTM D6595	2752	3475	3571	3814	3034	3808	0	0	
phosphorus (P)(mg/kg)	ASTM D6595	943	708	637	632	739	724	0	0	
boron (B)(mg/kg)	ASTM D6595	11	25	12	14	46	5	0	0	
<b>Infra Red</b>										
TBN(mgKOH/g)	ASTM D4739	7.60	7.60	6.00	6.70	7.60	7.90	-25%	-50%	
TAN(mgKOH/g)	ASTM D974	n/a	n/a	n/a	n/a	n/a	n/a	0	0	
soot(Abs/cm)	ASTM E2412	111	184	262	214	156	165	35	70	
glycol(% vol)	ASTM E2412	0	0	0	0	0	0	18	30	
oxidation(x.100)abs/0.1mm	ASTM E2412	6	6	2	2	2	5	60	100	
nitration(x.100)abs/0.1mm	ASTM E2412	11	9	4	4	6	9	60	100	
sulphation(x.100)abs/0.1mm	ASTM E2412	12	10	8	3	6	5	60	100	
<b>Physical Tests</b>										
water(ppm)	ASTM D6304	n/a	n/a	n/a	n/a	n/a	n/a	0	0	ISO 4406 - 04   -
fuel dilution(% vol)	In-house	0.00	0.00	0.00	0.00	0.00	0.00	1	2	ISO 4406 - 06   -
water(%)	ASTM E2412	0.00	0.00	0.20	0.20	0.20	0.20	0	0	ISO 4406 - 14   -
F.debris(mg Fe/L)	ASTM D8120	9	6	9	6	3	8	12	20	Count 1ml   -
visc @ 100oC(mm2/s)	ASTM D445	14.13	15.10	0.00	0.00	0.00	0.00	+10	+30	
visc @ 40oC(mm2/s)	ASTM D7279	n/a	n/a	n/a	n/a	n/a	n/a	+0	0	
Iso Code (Part/mL)	ISO 4406	-/-	-/-	-/-	-/-	-/-	-/-	0	0	
<b>Particle Cleanliness Analysis</b>										

Approved by : Stephanus Sasongko ( Manager Lab )



## LAMPIRAN 3

## Hasil Analisa Biodiesel



**PT PETROLAB SERVICES**  
Independent Laboratory

## ANALYSIS REPORT

No. 00505/BBM/SO/IV/25

Customer Name : Unit No/SN :  
Address : Eng. Type/Model :  
For Customer : Sample Name : SOLAR  
Eng Location : - Typical : SOLAR B40 CN 48

Test Detail				Overall Analysis Result	
Lab Number	00455/F/25			 Urgent	
Sample Date	2025-03-01				
Receive Date	2025-03-21				
Analysis Date					
Report Date	2025-04-08				
Hours on Oil					
Hours on Unit					
Sample Name	SOLAR				
No	Parameter	Unit	Method	Result	Typical
1	Appearance	-	MU/7.2/APP (Visual)	Clear	Clear and Bright
2	Density at 15 °C	kg/m <sup>3</sup>	ASTM D1298-12b (Reapproved 2017)e1	854.8	815 - 880
3	Kinematic Viscosity at 40 °C	cSt	ASTM D445-21e2	2.891	2.0 - 5.0
4	Total Acid Number (TAN)	mg KOH/g	ASTM D974-22	0.12	Max. 0.6 (ASTM D664)
5	Water Content by Karl Fischer	ppm	ASTM D6304-20	698 / C	Max. 380
6	Ash Content	%wt	ASTM D482-19	0.002	Max. 0.01
7	Cetane Index		ASTM D4737-21	45.5 / C	Min. 48
8	Conradson Carbon Residue On 10% Distillate Residue	%wt	ASTM D189-06 (Reapproved 2019)	0.04	Max. 0.1
9	FAME Content <sup>1</sup>	%vol	ASTM D7806	46.0 / B	40
10	Sulphur (S) (%wt)	%wt	ASTM D5185-18	0.04	Max. 0.20 (ASTM D 4294)
11	Sulphur (S) (ASTM D4294) <sup>2</sup>	%wt	ASTM D4294-16e1	0.05	
12	Color ASTM	ASTM Color	ASTM D1500-12 (Reapproved 2017)	L 1.5	Max. 3
13	Sediment by Extraction	%wt	ASTM D473-22	0.004	Max. 0.01
14	Copper Strip Corrosion (3h at 50 °C)	Class	ASTM D130-19	1a	Max. Class 1
15	Particle Counter		ISO 4406:2021 and ISO 11500:2022		
	>4 µm	Counts/ml		21736	
	>6 µm	Counts/ml		5729	
	>14 µm	Counts/ml		128	
	ISO CODE 4406	-		22/20/14 / B	18/16/13 **

Berdasarkan Spesifikasi Bahan Bakar Minyak Jenis Minyak Solar Dengan Campuran Biodiesel (B100) Sebesar 40% (B40) Dengan Angka Cetane (CN) 48 No. 384.K/MG.06/DJM/2024 Tanggal 31 Desember 2024

\*\*Worldwide Fuel Charter 2019

\*\*\*Diesel Fuel Storage And Handling Guide

## Remark

Analisis:

## 1. Kandungan Air Tinggi

Kandungan air yang tinggi dapat menyebabkan:

- Korosi pada sistem bahan bakar.
- Gangguan proses pembakaran.
- Pertumbuhan mikroba di dalam tangki.

## 2. Cetane Index (CI) Rendah

Nilai CI yang rendah menunjukkan kualitas pembakaran yang buruk, yang dapat menyebabkan:

- Sulit menyalakan mesin.
- Ketukan (knocking).
- Efisiensi mesin menurun.
- FAME Rendah

Kandungan FAME yang rendah bisa menandakan bahwa kadar biodiesel lebih rendah dari spesifikasi, menunjukkan solartidak sesuai dengan regulasi yang berlaku.

## 3. ISO Cleanliness Tinggi

Kandungan partikel padat melebihi batas, berpotensi menyebabkan:

- Penyumbatan filter.
- Kerusakan pada injector dan pompa bahan bakar.

Rekomendasi:

## 1. Pengendalian Kandungan Air

- Gunakan water separator atau lakukan drain tangki secara berkala.
- Simpan bahan bakar di tempat yang tertutup dan kering.

## 2. Pastikan Kualitas Cetane Index dan FAME Sesuai

- Gunakan bahan bakar dengan nilai CI yang sesuai standar mesin.
- Pastikan kandungan FAME sesuai dengan spesifikasi.

## 3. Tingkatkan Kebersihan Bahan Bakar

- Gunakan filter berkualitas saat transfer dan distribusi.