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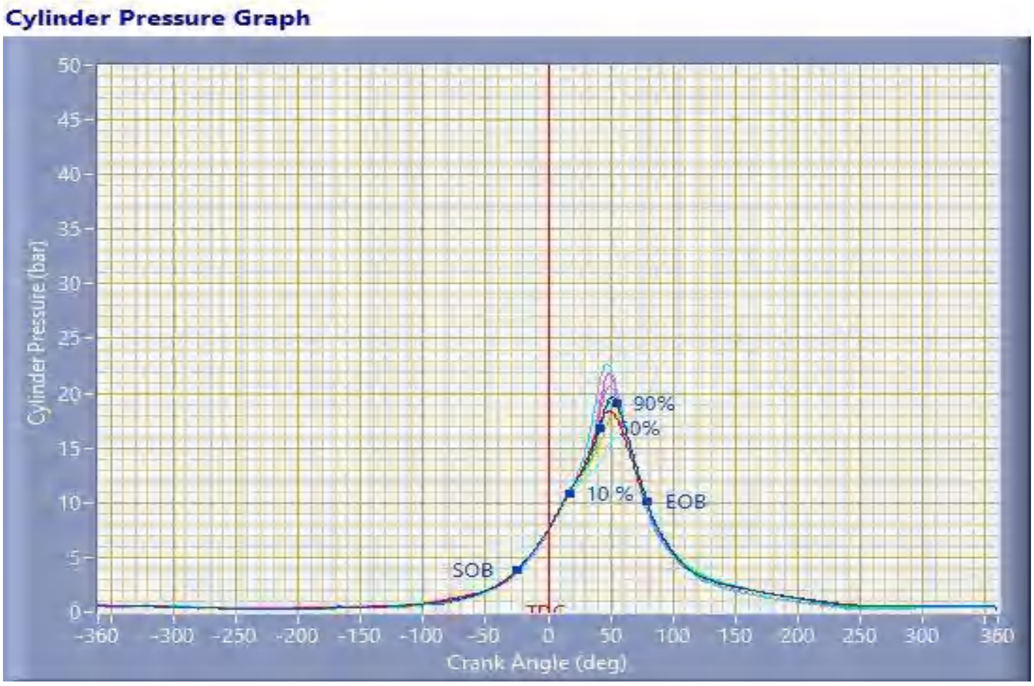
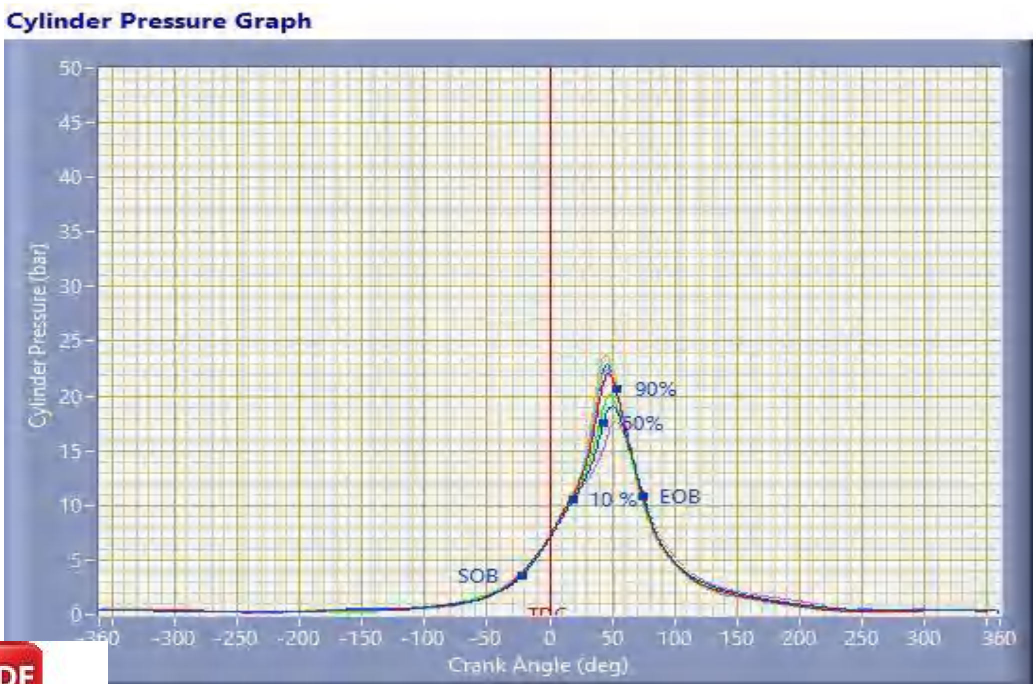
LAMPIRAN

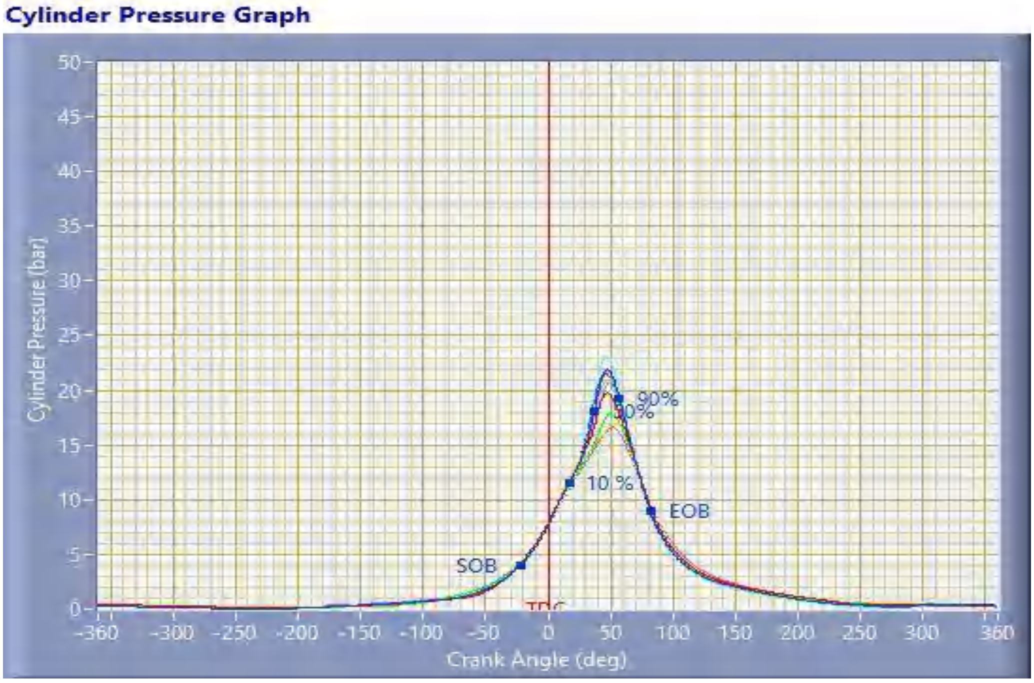
Lampiran 1. Tampilan Kinerja Pembakaran



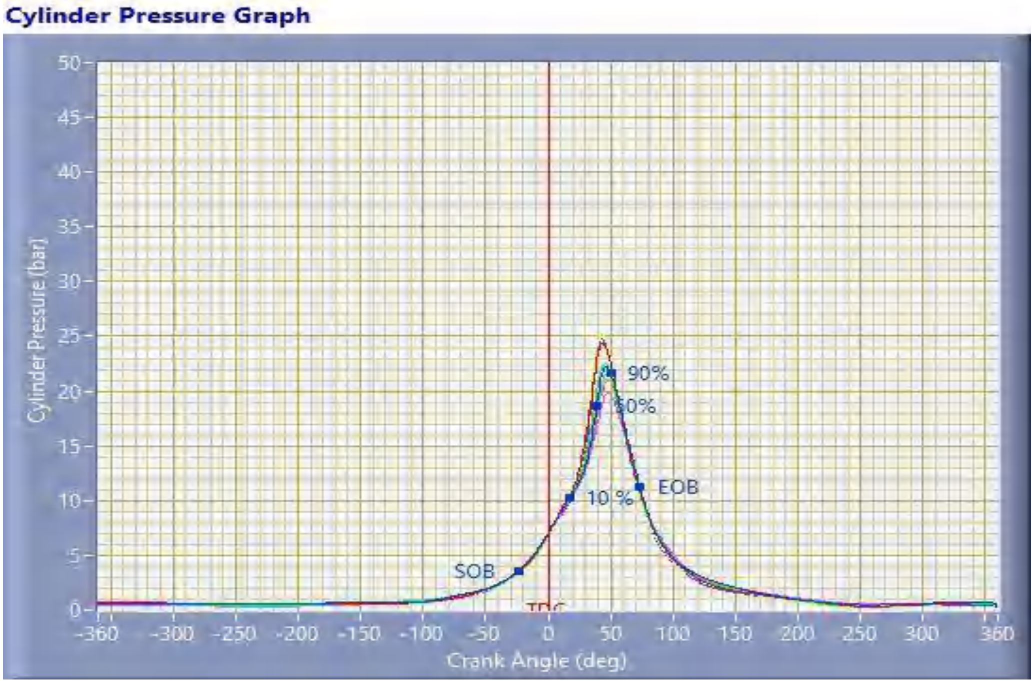
Tekanan silinder terhadap sudut engkol dengan bahan bakar
Pertamax murni pada beban 12kg dengan putaran mesin 1800rpm



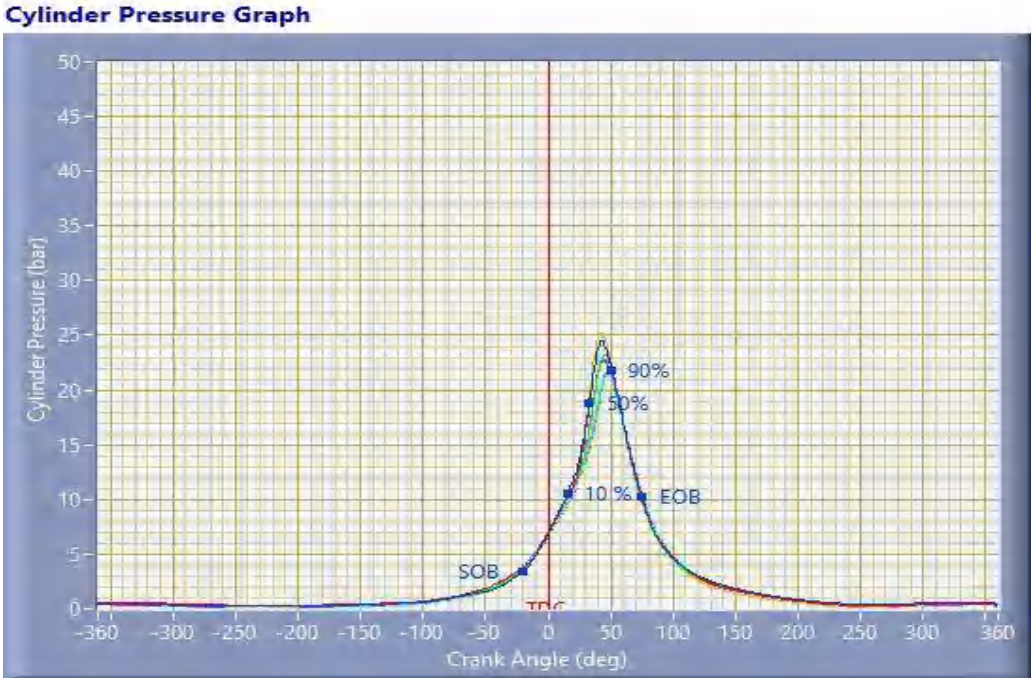
Tekanan silinder terhadap sudut engkol dengan bahan bakar
BE15 pada beban 12kg dengan putaran mesin 1800rpm



Tekanan silinder terhadap sudut engkol dengan bahan bakar BE15 + O3
(30 menit) pada beban 12kg dengan putaran mesin 1800rpm



Tekanan silinder terhadap sudut engkol dengan bahan bakar BE15 + O3
(60 menit) pada beban 12kg dengan putaran mesin 1800rpm



Tekanan silinder terhadap sudut engkol dengan bahan bakar BE15 + O^3 (120 menit) pada beban 12kg dengan putaran mesin 1800rpm

Lampiran 2. Data Perhitungan

PERTAMAX																							
Rasio Kompresi	RPM	Beban (kg)	Putaran (rpm)	Torsi (Nm)	BP (Kw)	FC (kg/h)	SFC (kg/kW.h)	IP	IMEP	Ma (kg/h)	Mth (kg/h)	AFR	ηvo (%)	ηth (%)	ηmech (%)	fuel (cc/min)	10^-3	pf	ho	pud	LHVbb	vs	vsx10^-3	Qtot
10	1500	6	1540	11,03	1,779	0,710	0,399	4,862	5,730	7,565	35,730	10,649	21,172	20,369	0,366	16	0,016	0,740	5,420	1,17	44250	0,661	0,00066	8,732
		9	1572	16,50	2,714	0,844	0,311	5,517	6,370	8,461	36,472	10,029	23,198	26,177	0,492	19	0,019	0,740	6,780	1,17	44250	0,661	0,00066	10,369
		12	1547	21,76	3,523	0,977	0,277	6,486	7,610	11,602	35,892	11,878	32,326	29,346	0,543	22	0,022	0,740	12,750	1,17	44250	0,661	0,00066	12,007
	1800	6	1809	11,03	2,089	0,888	0,425	5,531	5,550	10,865	41,971	12,235	25,886	19,141	0,378	20	0,020	0,740	11,180	1,17	44250	0,661	0,00066	10,915
		9	1813	16,44	3,120	1,021	0,327	6,043	6,050	11,652	42,064	11,410	27,702	24,857	0,516	23	0,023	0,740	12,860	1,17	44250	0,661	0,00066	12,552
		12	1803	21,92	4,137	1,110	0,268	7,778	7,830	14,837	41,832	13,367	35,468	30,323	0,532	25	0,025	0,740	20,850	1,17	44250	0,661	0,00066	13,644

BE15																							
Rasio Kompresi	RPM	Beban (kg)	Putaran (rpm)	Torsi (Nm)	BP (Kw)	FC (kg/h)	SFC (kg/kW.h)	IP	IMEP	Ma (kg/h)	Mth (kg/h)	AFR	ηvo (%)	ηth (%)	ηmech (%)	fuel (cc/min)	10^-3	pf	ho	pud	LHVbb	vs	vsx10^-3	Qtot
10	1500	6	1574	11,03	1,818	0,835	0,459	4,925	5,680	8,597	36,519	10,298	23,541	18,815	0,369	18	0,018	0,773	7,000	1,17	41663	0,661	0,00066	9,662
		9	1566	16,48	2,701	0,974	0,361	5,090	5,900	10,624	36,333	10,908	29,240	23,962	0,531	21	0,021	0,773	10,690	1,17	41663	0,661	0,00066	11,272
		12	1584	21,96	3,641	1,160	0,318	6,737	7,720	13,227	36,751	11,407	35,991	27,131	0,540	25	0,025	0,773	16,570	1,17	41663	0,661	0,00066	13,419
	1800	6	1804	11,02	2,080	1,020	0,491	5,059	5,090	13,314	41,855	13,049	31,811	17,615	0,411	22	0,022	0,773	16,790	1,17	41663	0,661	0,00066	11,809
		9	1813	16,48	3,127	1,206	0,386	6,492	6,500	13,492	42,064	11,188	32,074	22,407	0,482	26	0,026	0,773	17,240	1,17	41663	0,661	0,00066	13,956
		12	1808	21,92	4,149	1,252	0,302	7,829	7,860	15,344	41,948	12,253	36,580	28,627	0,530	27	0,027	0,773	22,300	1,17	41663	0,661	0,00066	14,492

BE15 + Ozon (30 Menit)																								
Rasio Kompresi	RPM	Beban (kg)	Putaran (rpm)	Torsi (Nm)	BP (Kw)	FC (kg/h)	SFC (kg/kW.h)	IP	IMEP	Ma (kg/h)	Mth (kg/h)	AFR	ηvo (%)	ηth (%)	ηmek (%)	fuel (cc/min)	10^-3	pf	ho	pud	LVHbb	vs	vsx10^-3	Qtot
10	1500	6	1571	11,02	1,811	0,824	0,455	4,613	5,33	8,424	36,449	10,221	23,113	18,167	0,393	19	0,019	0,723	6,72	1,17	43550	0,661	0,00066	9,971
		9	1558	16,50	2,690	0,868	0,323	5,811	6,77	12,735	36,147	14,678	35,230	25,632	0,463	20	0,02	0,723	15,36	1,17	43550	0,661	0,00066	10,496
		12	1560	21,96	3,586	0,954	0,266	7,022	8,17	14,582	36,194	15,280	40,289	31,057	0,511	22	0,022	0,723	20,14	1,17	43550	0,661	0,00066	11,545
	1800	6	1820	11,03	2,102	0,911	0,433	4,723	4,71	11,048	42,226	12,127	26,163	19,073	0,445	21	0,021	0,723	11,56	1,17	43550	0,661	0,00066	11,020
		9	1815	16,46	3,127	0,998	0,319	6,240	6,24	15,045	42,110	15,080	35,729	25,908	0,501	23	0,023	0,723	21,44	1,17	43550	0,661	0,00066	12,070
		12	1811	22,14	4,197	1,171	0,279	8,082	8,10	17,513	42,017	14,952	41,681	29,620	0,519	27	0,027	0,723	29,05	1,17	43550	0,661	0,00066	14,169

BE15 + Ozon (60 Menit)																								
Rasio Kompresi	RPM	Beban (kg)	Putaran (rpm)	Torsi (Nm)	BP (Kw)	FC (kg/h)	SFC (kg/kW.h)	IP	IMEP	Ma (kg/h)	Mth (kg/h)	AFR	ηvo (%)	ηth (%)	ηmek (%)	fuel (cc/min)	10^-3	pf	ho	pud	LVHbb	vs	vsx10^-3	Qtot
10	1500	6	1573	11,03	1,817	0,823	0,453	4,680	5,40	9,645	36,495	11,718	26,427	17,960	0,388	19	0,019	0,722	8,81	1,17	44241	0,661	0,00066	10,115
		9	1565	16,50	2,702	0,910	0,337	5,647	6,55	12,079	36,310	13,278	33,268	24,171	0,478	21	0,021	0,722	13,82	1,17	44241	0,661	0,00066	11,180
		12	1547	21,94	3,553	0,996	0,280	6,904	8,10	13,382	35,892	13,430	37,283	29,015	0,515	23	0,023	0,722	16,96	1,17	44241	0,661	0,00066	12,244
	1800	6	1820	11,03	2,102	0,866	0,412	4,763	4,75	11,405	42,226	13,164	27,010	19,742	0,441	20	0,020	0,722	12,32	1,17	44241	0,661	0,00066	10,647
		9	1820	16,48	3,139	1,040	0,331	6,317	6,30	13,770	42,226	13,245	32,611	24,569	0,497	24	0,024	0,722	17,96	1,17	44241	0,661	0,00066	12,777
		12	1816	22,32	4,243	1,126	0,265	7,984	7,98	15,000	42,133	13,318	35,601	30,654	0,531	26	0,026	0,722	21,31	1,17	44241	0,661	0,00066	13,842

BE15 + Ozon (120 Menit)																								
Rasio Kompresi	RPM	Beban (kg)	Putaran (rpm)	Torsi (Nm)	BP (Kw)	FC (kg/h)	SFC (kg/kW.h)	IP	IMEP	Ma (kg/h)	Mth (kg/h)	AFR	ηvo (%)	ηth (%)	ηmek (%)	fuel (cc/min)	10^-3	pf	ho	pud	LVHbb	vs	vsx10^-3	Qtot
[illegible]	[illegible]	6	1583	11,03	1,828	0,823	0,450	4,832	5,54	8,442	36,727	10,257	22,986	17,995	0,378	19	0,019	0,722	6,75	1,17	44436	0,661	0,00066	10,160
		[illegible]	[illegible]	16,50	2,718	0,866	0,319	5,741	6,62	8,958	36,519	10,339	24,529	25,414	0,473	20	0,02	0,722	7,60	1,17	44436	0,661	0,00066	10,694
		[illegible]	[illegible]	21,94	3,592	1,126	0,314	6,954	8,07	12,593	36,287	11,181	34,704	25,836	0,517	26	0,026	0,722	15,02	1,17	44436	0,661	0,00066	13,903
	[illegible]	[illegible]	[illegible]	11,02	2,099	0,910	0,434	5,104	5,09	11,752	42,226	12,918	27,830	18,688	0,411	21	0,021	0,722	13,08	1,17	44436	0,661	0,00066	11,229
		[illegible]	[illegible]	16,44	3,118	1,040	0,333	6,329	6,34	13,495	42,040	12,980	32,101	24,300	0,493	24	0,024	0,722	17,25	1,17	44436	0,661	0,00066	12,833
		[illegible]	[illegible]	22,50	4,263	1,170	0,274	8,107	8,13	14,996	41,994	12,821	35,710	29,530	0,526	27	0,027	0,722	21,30	1,17	44436	0,661	0,00066	14,437

Lampiran 3. Data Kinerja Mesin

DAYA EFEKTIF						
Putaran Mesin	Beban	Pertamax	BE15	BE15+Ozon 30m	BE15+Ozon 60m	BE15+Ozon 120m
1500 rpm	6	1,78	1,82	1,81	1,82	1,83
	9	2,71	2,70	2,69	2,70	2,72
	12	3,52	3,64	3,58	3,55	3,59
1800 rpm	6	2,09	2,08	2,10	2,10	2,10
	9	3,12	3,13	3,13	3,14	3,12
	12	4,14	4,15	4,19	4,24	4,26

TORSI						
Putaran Mesin	Beban	Pertamax	BE15	BE15+Ozon 30m	BE15+Ozon 60m	BE15+Ozon 120m
1500 rpm	6	11,03	11,03	11,01	11,04	11,03
	9	16,50	16,48	16,49	16,50	16,50
	12	21,76	21,96	21,95	21,94	21,94
1800 rpm	6	11,03	11,02	11,04	11,03	11,02
	9	16,44	16,48	16,45	16,48	16,45
	12	21,92	21,92	22,14	22,32	22,50

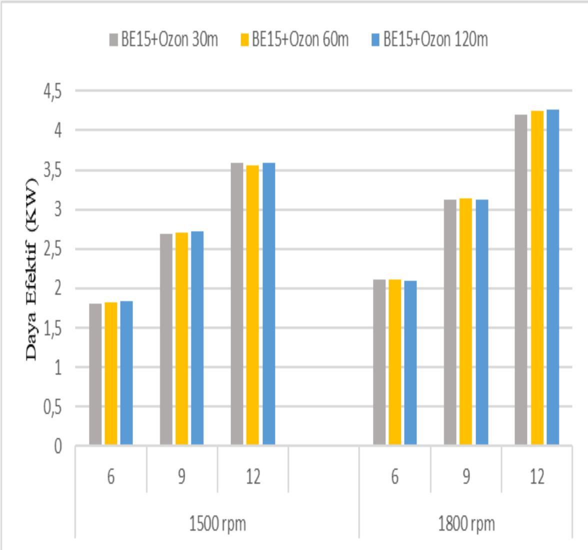
SFC						
Putaran Mesin	Beban	Pertamax	BE15	BE15+Ozon 30m	BE15+Ozon 60m	BE15+Ozon 120m
1500 rpm	6	0,399	0,459	0,455	0,453	0,450
	9	0,311	0,361	0,323	0,337	0,319
	12	0,277	0,318	0,266	0,280	0,314
1800 rpm	6	0,425	0,491	0,433	0,412	0,434
	9	0,327	0,386	0,319	0,331	0,333
	12	0,268	0,302	0,279	0,265	0,274

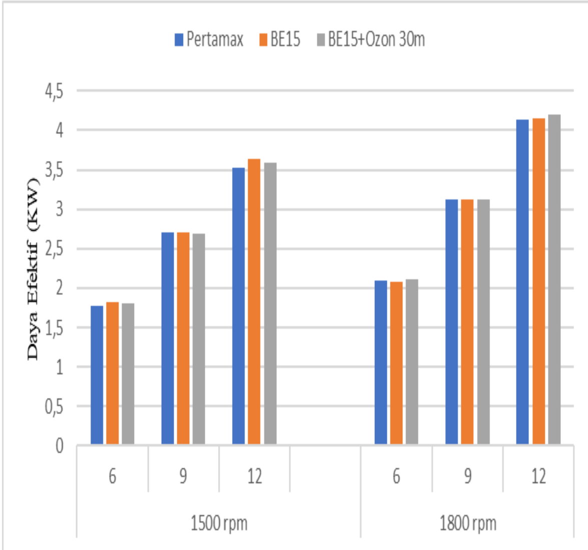
AFR						
Putaran Mesin	Beban	Pertamax	BE15	BE15+Ozon 30m	BE15+Ozon 60m	BE15+Ozon 120m
1500 rpm	6	10,649	10,298	10,221	11,718	10,257
	9	10,029	10,908	14,678	13,278	10,339
	12	11,878	11,407	15,280	13,430	11,181
	6	12,235	13,049	12,127	13,164	12,918
	9	11,410	11,188	15,080	13,245	12,980
	12	13,367	12,253	14,952	13,318	12,821

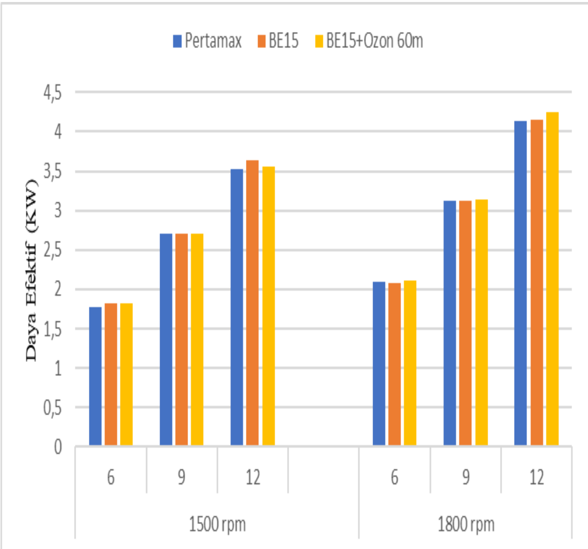
EFISIENSI THERMIS						
Putaran Mesin	Beban	Pertamax	BE15	BE15+Ozon 30m	BE15+Ozon 60m	BE15+Ozon 120m
1500 rpm	6	20,369	18,815	18,167	17,960	17,995
	9	26,177	23,962	25,632	24,171	25,414
	12	29,346	27,131	31,057	29,015	25,836
1800 rpm	6	19,141	17,615	19,073	19,742	18,688
	9	24,857	22,407	25,908	24,569	24,300
	12	30,323	28,627	29,620	30,654	29,530

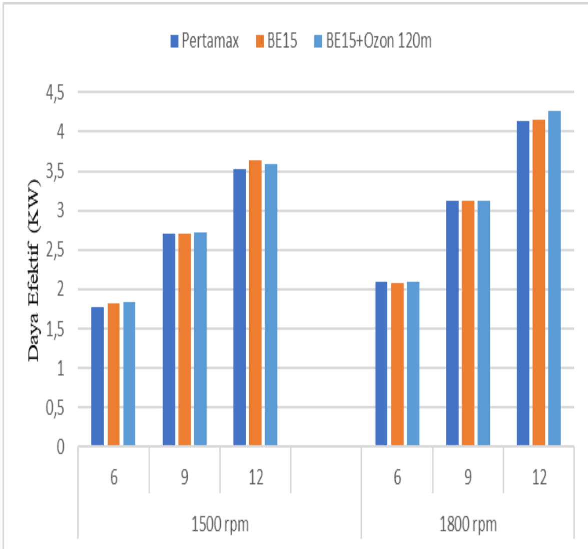
EFISIENSI VOLUMETRIK						
Putaran Mesin	Beban	Pertamax	BE15	BE15+Ozon 30m	BE15+Ozon 60m	BE15+Ozon 120m
1500 rpm	6	21,172	23,541	23,113	26,427	22,986
	9	23,198	29,240	35,230	33,268	24,529
	12	32,326	35,991	40,289	37,283	34,704
1800 rpm	6	25,886	31,811	26,163	27,010	27,830
	9	27,702	33,618	35,729	32,611	32,101
	12	39,493	36,580	41,681	35,601	35,710

Lampiran 4. Perbandingan daya efektif pada ozonisasi kombinasi bioetanol dan pertamax

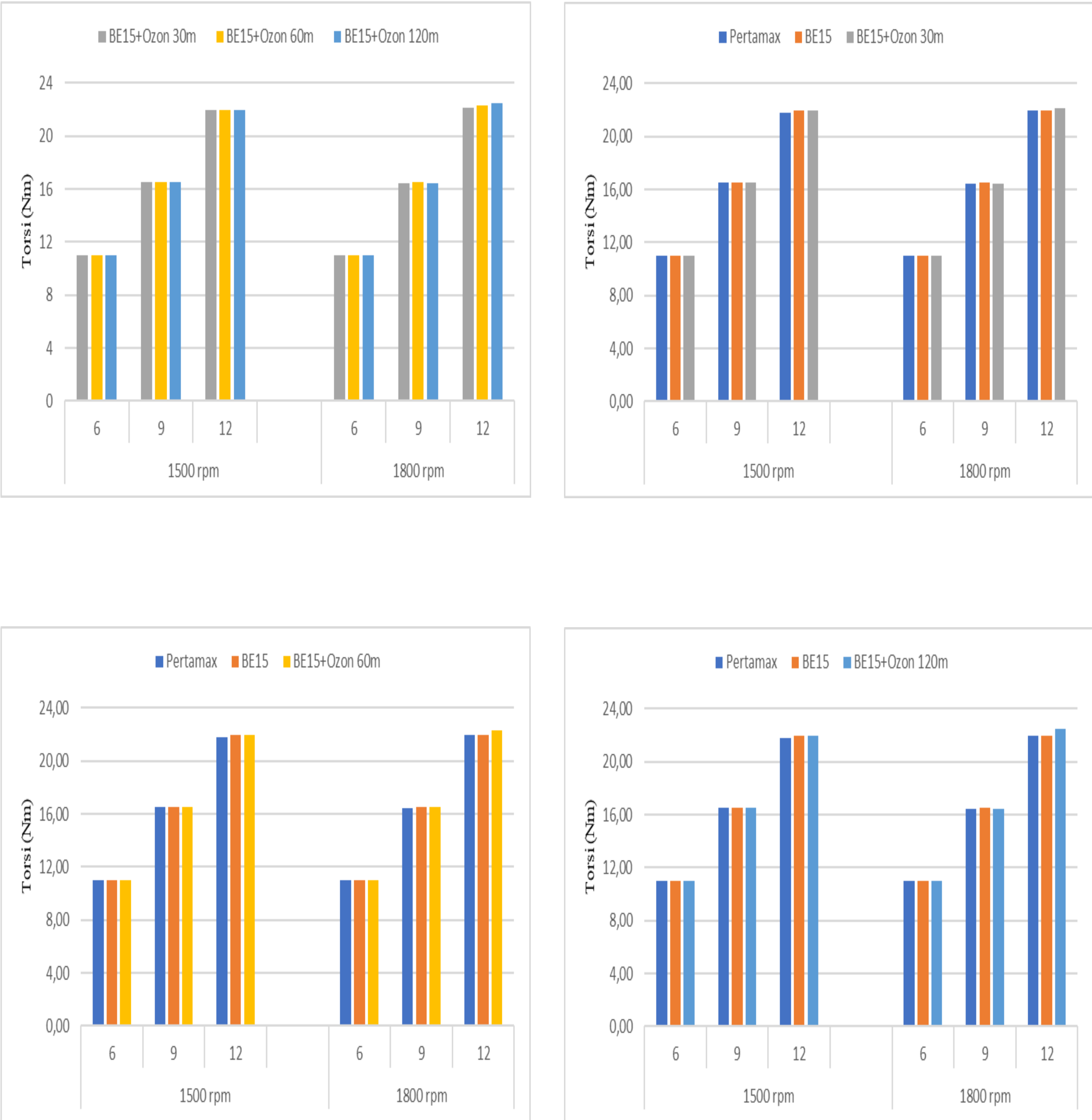




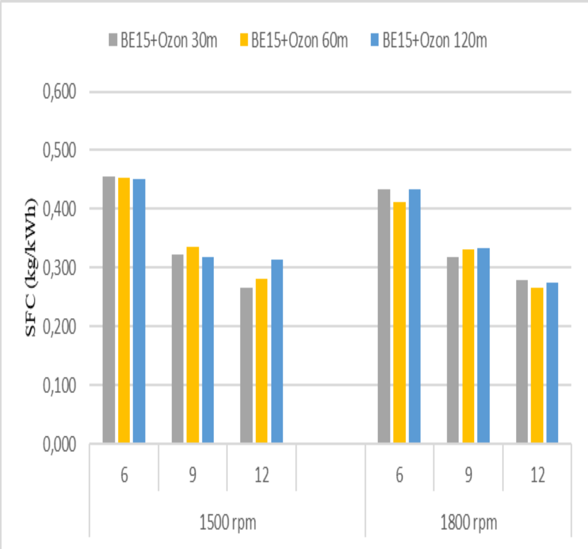


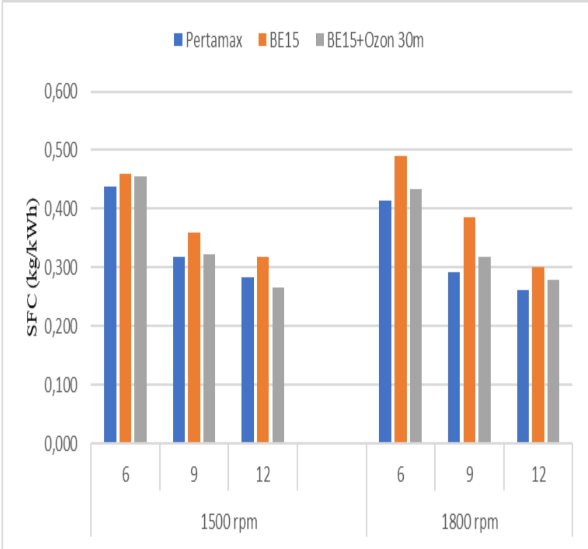


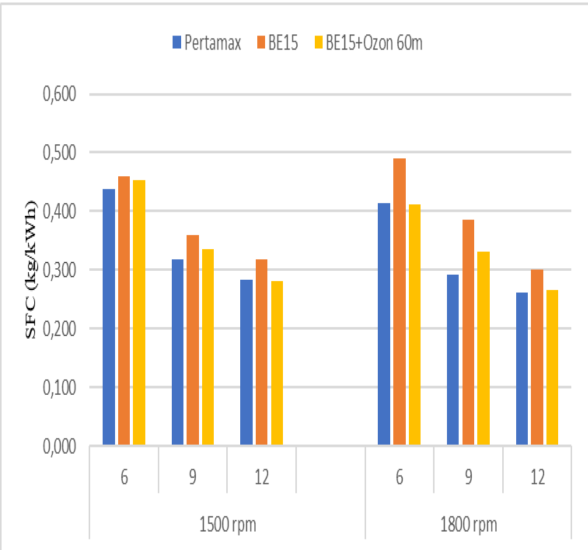
Lampiran 5. Perbandingan torsi pada ozonisasi kombinasi bioetanol dan pertamax

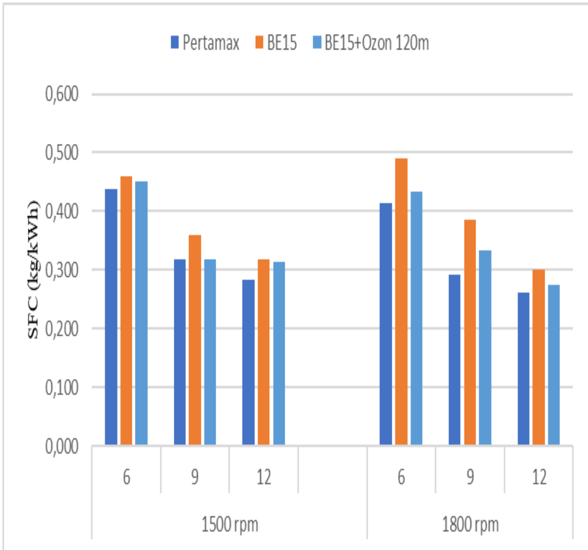


Lampiran 6. Perbandingan konsumsi bahan bakar spesifik pada ozonisasi kombinasi bioetanol dan pertamax

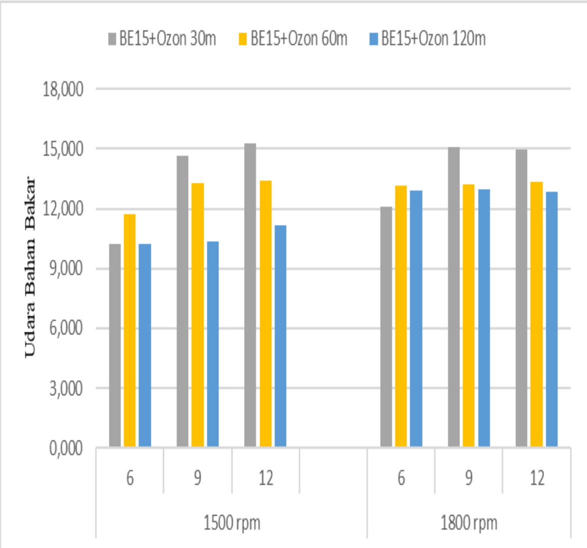


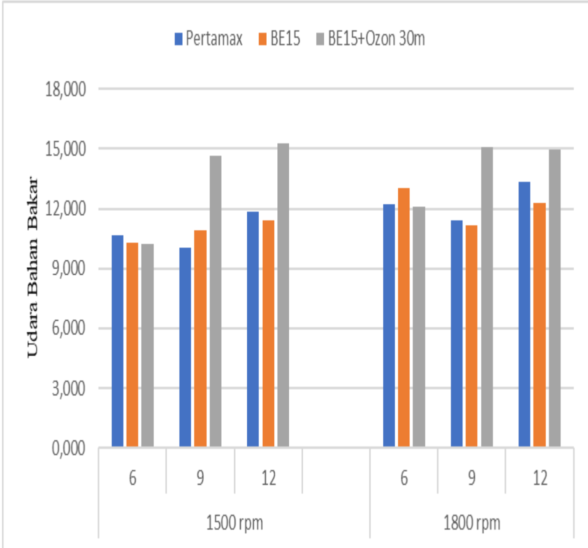


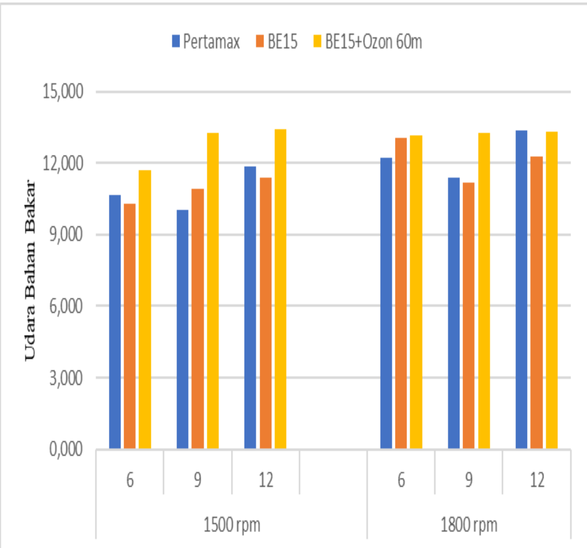


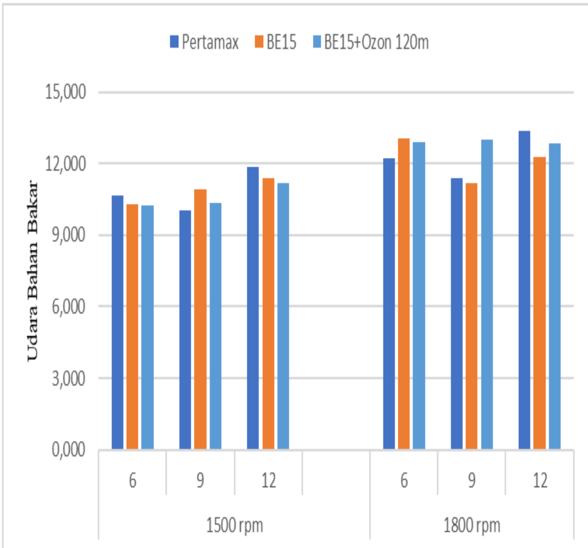


Lampiran 7. Perbandingan udara bahan bakar (AFR) pada ozonisasi kombinasi bioethanol dan pertamax

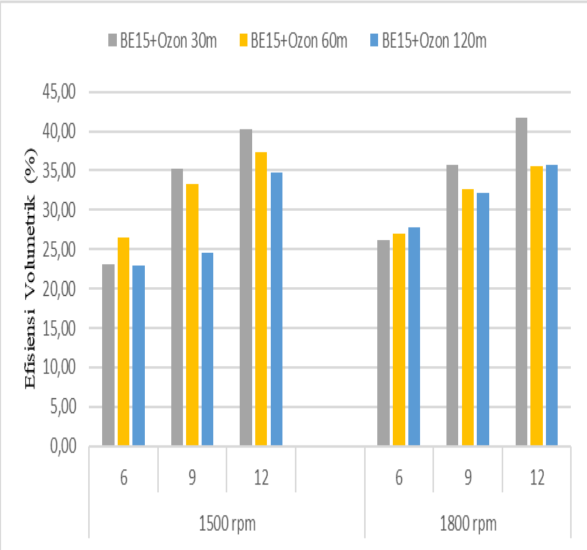


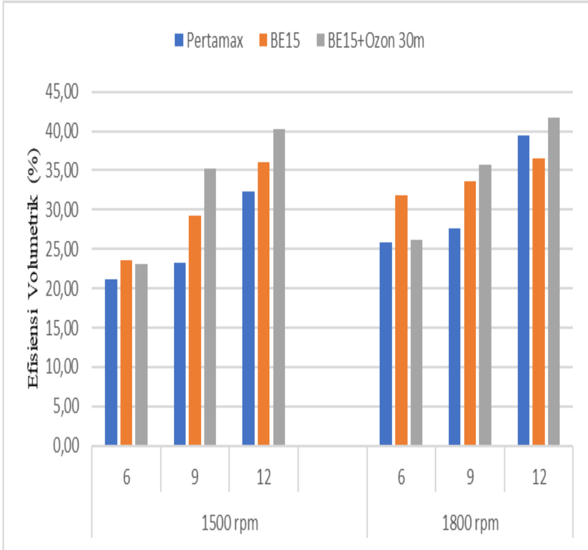


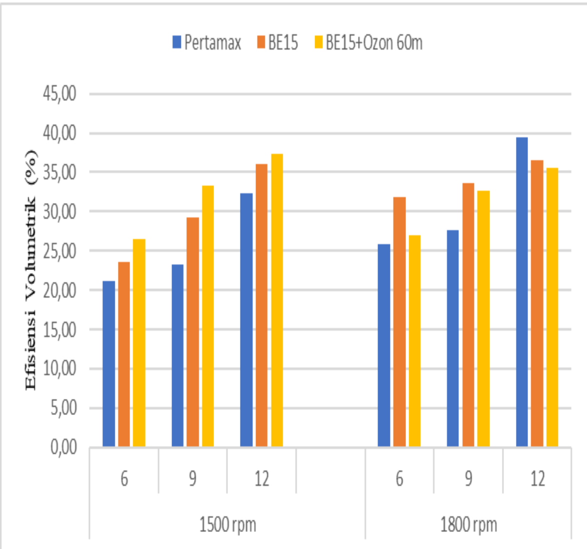


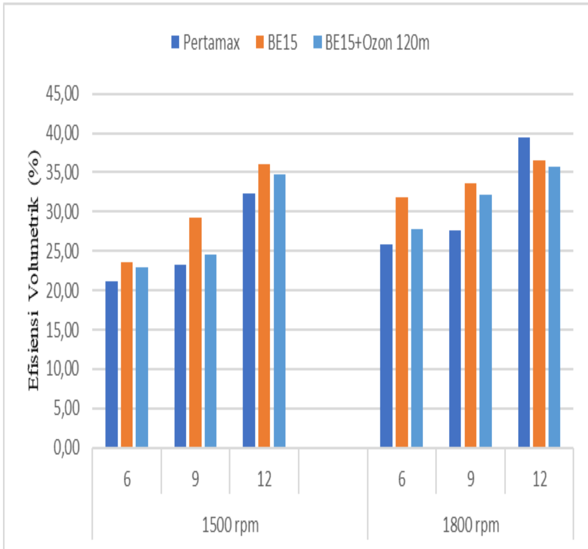


Lampiran 8. Perbandingan efesiensi volumetrik pada ozonisasi kombinasi bioethanol dan pertamax

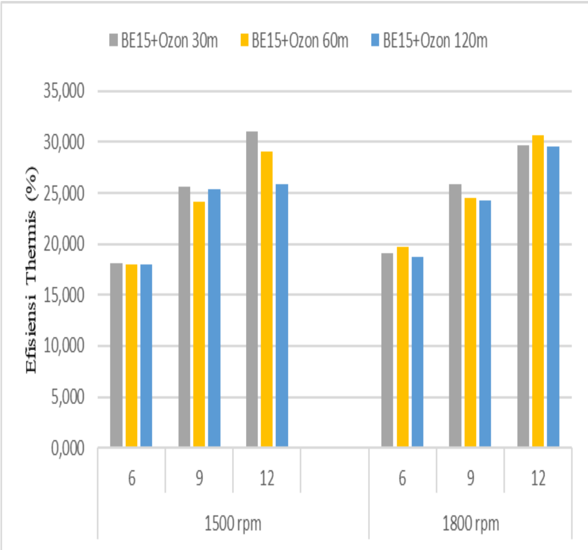


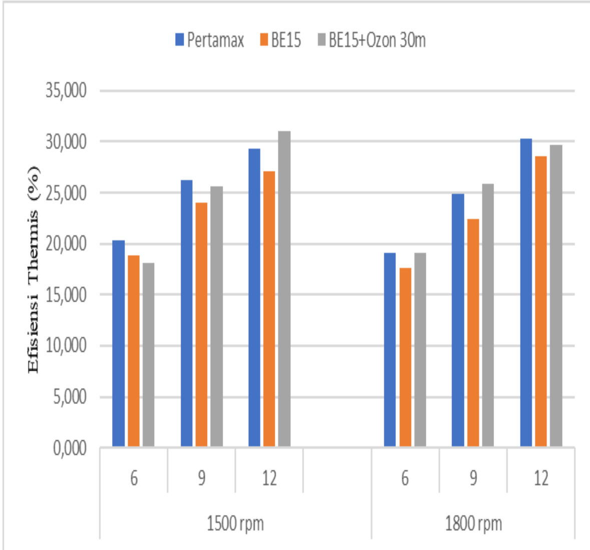


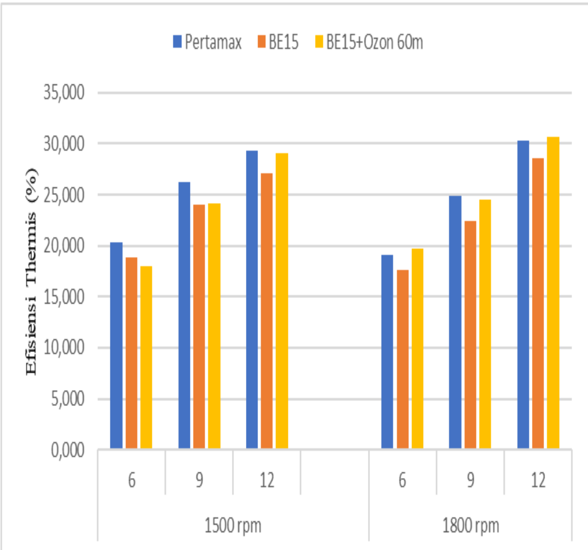


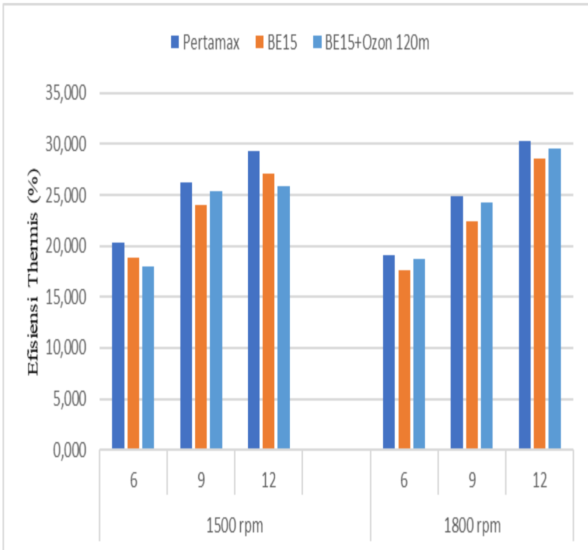


Lampiran 9. Perbandingan efesiensi thermis pada ozonisasi kombinasi bioethanol dan pertamax









Lampiran 10. Dokumentasi

Proses kombinasi bahan bakar

Proses ozonisasi

Hasil bahan bakar setelah ozonisaisi

Pengujian densitas

Pengujian viskositas

Pengujian nilai kalor bahan bakar

Pengambilan data mesin TV-1