

*Lampiran 1***Data Hasil Penelitian****a. Total Petroleum Hydrocarbon (TPH) residu dan terdegradasi**

Perlakuan	Ulangan	Kadar TPH Residu			Kadar TPH Terdegradasi		
		Lama Waktu Inkubasi (Hari)			Lama Waktu Inkubasi (Hari)		
		3	7	14	3	7	14
K1	1	0,4459	0,4107	0,3406	0,1387	0,1739	0,2440
	2	0,4615	0,4205	0,3712	0,1231	0,1641	0,2134
	3	0,4032	0,3145	0,4261	0,1814	0,2701	0,1585
	Rata-rata	0,4369	0,3819	0,3793	0,1477	0,2027	0,2053
	SD	0,0302	0,0586	0,0433	0,0302	0,0586	0,0433
K2	1	0,4068	0,3592	0,3299	0,1778	0,2254	0,2547
	2	0,4537	0,3927	0,3011	0,1309	0,1919	0,2835
	3	0,4204	0,3154	0,4024	0,1642	0,2692	0,1822
	Rata-rata	0,4270	0,3558	0,3445	0,1576	0,2288	0,2401
	SD	0,0241	0,0388	0,0522	0,0241	0,0388	0,0522
F1	1	0,4735	0,4726	0,4328	0,1111	0,1120	0,1518
	2	0,4559	0,4361	0,4335	0,1287	0,1485	0,1511
	3	0,4386	0,4218	0,4412	0,1460	0,1628	0,1434
	Rata-rata	0,4560	0,4435	0,4358	0,1286	0,1411	0,1488
	SD	0,0175	0,0262	0,0047	0,0175	0,0262	0,0047
F2	1	0,5239	0,4441	0,4859	0,0607	0,1405	0,0987
	2	0,4989	0,5100	0,4339	0,0857	0,0746	0,1507
	3	0,5563	0,5583	0,4203	0,0283	0,0263	0,1643
	Rata-rata	0,5264	0,5041	0,4467	0,0582	0,0805	0,1379
	SD	0,0288	0,0573	0,0346	0,0288	0,0573	0,0346
F3	1	0,4755	0,4759	0,3878	0,1091	0,1087	0,1968
	2	0,4921	0,5068	0,3945	0,0925	0,0778	0,1901
	3	0,5531	0,4107	0,4841	0,0315	0,1739	0,1005
	Rata-rata	0,5069	0,4645	0,4221	0,0777	0,1201	0,1625
	SD	0,0409	0,0491	0,0538	0,0409	0,0491	0,0538
F4	1	0,4597	0,4220	0,4097	0,1249	0,1626	0,1749
	2	0,4052	0,4415	0,4104	0,1794	0,1431	0,1742
	3	0,4587	0,4169	0,4528	0,1259	0,1677	0,1318
	Rata-rata	0,4412	0,4268	0,4243	0,1434	0,1578	0,1603
	SD	0,0312	0,0130	0,0247	0,0312	0,0130	0,0247
F5	1	0,4252	0,4289	0,3964	0,1594	0,1557	0,1882
	2	0,4825	0,4326	0,3961	0,1021	0,1520	0,1885
	3	0,3973	0,4197	0,4461	0,1873	0,1649	0,1385
	Rata-rata	0,4350	0,4271	0,4129	0,1496	0,1575	0,1717
	SD	0,0434	0,0066	0,0288	0,0434	0,0066	0,0288

**b. Nilai kelarutan hidrokarbon dari *oil sludge* pada fase cair**

Perlakuan	Lama Waktu Inkubasi (Hari)		
	3 hari	7 hari	14 hari
K1	0,0697	0,1141	0,0912
K2	0,1094	0,1025	0,1070
F1	0,0349	0,0163	0,0245
F2	0,0149	0,0655	0,0738
F3	0,0784	0,0885	0,0915
F4	0,0508	0,0499	0,0205
F5	0,0432	0,0325	0,0188

**c. Log jumlah total mikroba konsorsium**

No.	Mikroba	OD	Jumlah (CFU/mL)	log TPC
1	<i>Micrococcus</i> sp.	0,5	$1,34 \times 10^{15}$	15,1271
2	<i>Bacillus subtilis</i>	0,5	$2,35 \times 10^{14}$	14,3711
3	<i>Acinetobacter faecalis type II</i>	0,5	$3,86 \times 10^{15}$	15,5862
4	<i>Pseudomonas putida</i>	0,5	$2,66 \times 10^{13}$	13,4249
5	<i>Actinobacillus</i> sp.	0,54	$2,51 \times 10^{16}$	16,4000
6	<i>Pseudomonas cepacia</i>	0,5	$7,00 \times 10^{12}$	12,8451
7	<i>Pseudomonas stutzeri</i>	0,6	$2,44 \times 10^{16}$	16,3881
8	<i>Pseudomonas pseudomallei</i>	0,6	$6,80 \times 10^{15}$	15,8325
9	<i>Pseudomonas fluorescens</i>	0,5	$3,03 \times 10^{10}$	10,4814
10	<i>Rhodotorula mucilaginosa</i>	0,5	$6,60 \times 10^3$	3,8195
11	<i>Candida famata</i>	0,5	$1,37 \times 10^4$	4,1367
12	<i>Candida parasilopsis</i>	0,5	$2,73 \times 10^4$	4,4362

**d. Log jumlah total mikroba**

Perlakuan	Ulangan	Waktu Inkubasi (Hari)		
		3	7	14
K1	1	6,1206	6,1673	6,8525
	2	6,0899	6,5490	7,5901
	Rata-rata	6,1052	6,3582	7,2213
	SD	0,0217	0,2699	0,5215
K2	1	10,0792	17,7324	16,7574
	2	11,2159	17,9345	19,6232
	Rata-rata	10,6475	17,8334	18,1903
	SD	0,8038	0,1429	2,0265
F1	1	21,2725	25,6139	24,0969
	2	21,0730	25,2806	23,7972
	Rata-rata	21,1728	25,4473	23,9471
	SD	0,1411	0,2357	0,2119
F2	1	17,1861	21,0233	25,6159
	2	17,2769	21,0107	25,9061
	Rata-rata	17,2315	21,0170	25,7610
	SD	0,0642	0,0089	0,2052
F3	1	17,1553	21,0286	24,5448
	2	17,2594	19,8976	23,9005
	Rata-rata	17,2073	20,4631	24,2227
	SD	0,0736	0,7997	0,4555
F4	1	20,7627	25,4890	27,8460
	2	21,6363	25,6790	27,6700
	Rata-rata	21,1995	25,5840	27,7580
	SD	0,6177	0,1344	0,1245
F5	1	21,6454	25,3408	27,4224
	2	23,0204	24,9269	27,2464
	Rata-rata	22,3329	25,1338	27,3344
	SD	0,9723	0,2927	0,1245

## e. Nilai pH Kultur

Perlakuan	Ulangan	Waktu inkubasi (hari)			
		0	3	7	14
K1	1	7	7	6,4	6,4
	2	7	7	6,7	6,4
	3	7	7	6,7	6,4
	Rata-rata	7	7	6,6	6,4
K2	1	7	6	6	5
	2	7	6	6	5
	3	7	6	6	5
	Rata-rata	7	6	6	5
F1	1	7	6,4	6,4	6,4
	2	7	6,4	6,4	6,4
	3	7	6,4	6,4	6,4
	Rata-rata	7	6,4	6,4	6,4
F2	1	7	6	6	6
	2	7	6	6	6
	3	7	6	6	6
	Rata-rata	7	6	6	6
F3	1	7	6	6	5
	2	7	6	6	5
	3	7	6	6	5
	Rata-rata	7	6	6	5
F4	1	7	6,4	6,4	6,4
	2	7	6,4	6,4	6,4
	3	7	6,4	6,4	6,4
	Rata-rata	7	6,4	6,4	6,4
F5	1	7	6,4	6,4	6,4
	2	7	6,4	6,4	6,4
	3	7	6,4	6,4	6,4
	Rata-rata	7	6,4	6,4	6,4

**Lampiran 2****Hasil Penghitungan Statistik****a. Total Plate Count (TPC) mikroba****1. Uji non parametric****One-Sample Kolmogorov-Smirnov Test**

		LogTPC
N		42
Normal Parameters <sup>a,b</sup>	Mean	19,6271
	Std. Deviation	6,74097
Most Extreme Differences	Absolute	,162
	Positive	,111
	Negative	-,162
Kolmogorov-Smirnov Z		1,051
Asymp. Sig. (2-tailed)		,220

a. Test distribution is Normal.

b. Calculated from data.

**2. Uji homogenitas****Test of Homogeneity of Variances**

hasilTPC

Levene Statistic	df1	df2	Sig.
74858075477766	20	21	,000
592,000			

**3. Uji *Brown-Forsythe*****Robust Tests of Equality of Means**

hasilTPC

	Statistic <sup>a</sup>	df1	df2	Sig.
Brown-Forsythe	256,377	20	3,061	,000

a. Asymptotically F distributed.

#### 4. Uji Games-Howell

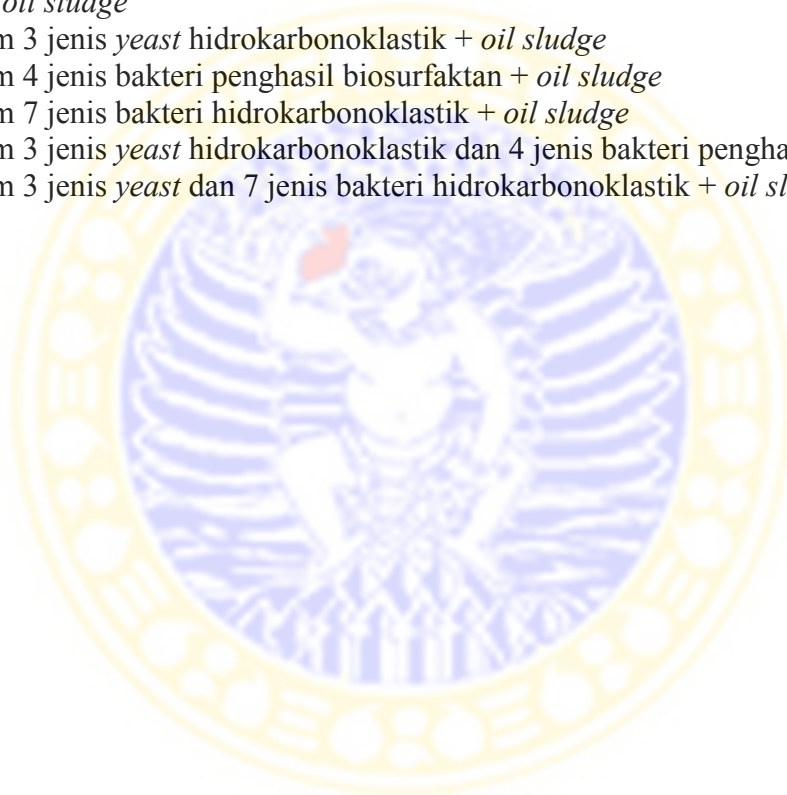
	K1H3	K2H3	F1H3	F2H3	F3H3	F4H3	F5H3	K1H7	K2H7	F1H7	F2H7	F3H7	F4H7	F5H7	K1H14	K2H14	F1H14	F2H14	F3H14	F4H14	F5H14	
K1H3		-	✓	✓	✓	-	-	-	✓	✓	✓	-	✓	✓	-	-	✓	✓	✓	✓	✓	✓
K2H3	-		-	-	-	✓	✓	-	-	-	-	✓	-	-	-	-	-	-	✓	-	-	-
F1H3	✓	-		✓	✓	-	-	✓	✓	✓	-	-	✓	-	✓	-	✓	✓	-	✓	✓	✓
F2H3	✓	-	✓		-	-	-	✓	-	✓	✓	-	✓	✓	-	-	✓	✓	-	✓	✓	✓
F3H3	✓	-	✓	-		-	-	✓	-	✓	✓	-	✓	✓	-	-	✓	✓	-	✓	✓	✓
F4H3	-	✓	-	-	-		-	✓	-	-	-	-	-	-	✓	-	-	-	-	-	-	-
F5H3	-	✓	-	-	-	-		-	-	-	-	-	-	-	✓	-	-	-	-	-	-	-
K1H7	-	-	✓	✓	✓	✓	-		✓	✓	✓	-	✓	✓	-	-	✓	✓	✓	✓	✓	✓
K2H7	✓	-	✓	-	-	-	-	✓		✓	-	-	✓	✓	-	-	✓	✓	-	✓	✓	✓
F1H7	✓	-	✓	✓	✓	-	-	✓	✓		-	-	-	-	✓	-	-	-	-	-	-	-
F2H7	✓	-	-	✓	✓	-	-	✓	-	-		-	-	-	-	-	-	-	-	-	✓	✓
F3H7	-	✓	-	-	-	-	-	-	-	-	-		-	-	✓	-	-	-	-	-	-	-
F4H7	✓	-	✓	✓	✓	-	-	✓	✓	-	✓	-		-	✓	-	-	-	-	-	✓	✓
F5H7	✓	-	-	✓	✓	-	-	✓	✓	-	-	-	-		✓	-	-	-	-	-	-	-
K1H14	-	-	✓	-	-	✓	✓	-	-	✓	-	✓	✓	✓		-	✓	✓	✓	✓	✓	✓
K2H14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-
F1H14	✓	-	✓	✓	✓	-	-	✓	✓	-	-	-	-	-	✓	-		-	-	✓	✓	✓
F2H14	✓	-	✓	✓	✓	-	-	✓	✓	-	-	-	-	-	✓	-	-		-	-	-	-
F3H14	✓	✓	-	-	-	-	-	✓	-	-	-	-	-	-	✓	-	-	-		-	-	-
F4H14	✓	-	✓	✓	✓	-	-	✓	✓	-	✓	-	✓	-	✓	-	✓	-	-		-	-
F5H14	✓	-	✓	✓	✓	-	-	✓	✓	-	✓	-	✓	-	✓	-	✓	-	-	-		-

Keterangan: tanda ✓ = Ada beda signifikan, tanda - = tidak ada beda signifikan



Keterangan uji *Games-Howell*

- K1 : *tween-20* (=CMC) + *oil sludge*  
K2 : AMS molase + akuades + *oil sludge*  
F1 : AMS molase + konsorsium 3 jenis *yeast* hidrokarbonoklastik + *oil sludge*  
F2 : AMS molase + konsorsium 4 jenis bakteri penghasil biosurfaktan + *oil sludge*  
F3 : AMS molase + konsorsium 7 jenis bakteri hidrokarbonoklastik + *oil sludge*  
F4 : AMS molase + konsorsium 3 jenis *yeast* hidrokarbonoklastik dan 4 jenis bakteri penghasil biosurfaktan + *oil sludge*  
F5 : AMS molase + konsorsium 3 jenis *yeast* dan 7 jenis bakteri hidrokarbonoklastik + *oil sludge*  
H3 : waktu inkubasi 3 hari  
H7 : waktu inkubasi 7 hari  
H14 : waktu inkubasi 14 hari



## b. Total Petroleum Hydrocarbon (TPH) terdegradasi

### 1. Uji non parametrik

One-Sample Kolmogorov-Smirnov Test

		formula	lamahari	TPHterdegradasi
N		63	63	63
Normal Parameters <sup>a,b</sup>	Mean	4,0000	2,0000	,151337
	Std. Deviation	2,01606	,82305	,0540503
	Absolute	,125	,221	,099
Most Extreme Differences	Positive	,125	,221	,099
	Negative	-,125	-,221	-,073
Kolmogorov-Smirnov Z		,993	1,755	,790
Asymp. Sig. (2-tailed)		,277	,004	,561

a. Test distribution is Normal.

b. Calculated from data.

### 2. Uji homogenitas

Between-Subjects Factors

		Value Label	N
formula	1,00	K1	9
	2,00	K2	9
	3,00	F1	9
	4,00	F2	9
	5,00	F3	9
	6,00	F4	9
	7,00	F5	9
lamahari	1,00	H3	21
	2,00	H7	21
	3,00	H14	21

Levene's Test of Equality of Error Variances<sup>a</sup>

Dependent Variable: TPHterdegradasi

F	df1	df2	Sig.
1,651	20	42	,085

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + lamahari + formula \* lamahari



### Tests of Between-Subjects Effects

Dependent Variable: TPH terdegradasi

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	,123 <sup>a</sup>	20	,006	4,497	,000
Intercept	1,443	1	1,443	1050,963	,000
formula	,082	6	,014	9,994	,000
lamahari	,029	2	,014	10,523	,000
formula * lamahari	,012	12	,001	,743	,702
Error	,058	42	,001		
Total	1,624	63			
Corrected Total	,181	62			

a. R Squared = ,682 (Adjusted R Squared = ,530)

### 3. Uji Duncan

#### persentaseTPHdegradasi

Duncan<sup>a,b</sup>

formula	N	Subset				
		1	2	3	4	5
F2	9	15,7715				
F3	9	20,5440	20,5440			
F1	9		23,8606	23,8606		
F4	9		26,3143	26,3143	26,3143	
F5	9			27,3045	27,3045	
K1	9				31,6874	31,6874
K2	9					35,7281
Sig.		,118	,074	,284	,096	,183

Means for groups in homogeneous subsets are displayed.

Based on observed means.

The error term is Mean Square (Error) = 40,172.

a. Uses Harmonic Mean Sample Size = 9,000.

b. Alpha = 0,05.

#### Persentase TPH degradasi

Duncan<sup>a,b</sup>

lamahari	N	Subset	
		1	2
H3	21	21,0865	
H7	21		26,6010
H14	21		29,9741
Sig.		1,000	,092

Means for groups in homogeneous subsets are displayed.

Based on observed means.

The error term is Mean Square (Error) = 40,172.

a. Uses Harmonic Mean Sample Size = 21,000.

b. Alpha = 0,05.

## TPHdegradasi

Duncan<sup>a</sup>

formulahari	N	Subset for alpha = 0.05						
		1	2	3	4	5	6	7
F2H3	3	9,9612						
F3H3	3	13,2911	13,2911					
F2H7	3	13,7644	13,7644	13,7644				
F3H7	3	20,5497	20,5497	20,5497	20,5497			
F1H3	3		21,9979	21,9979	21,9979			
F2H14	3		23,5888	23,5888	23,5888	23,5888		
F1H7	3		24,1362	24,1362	24,1362	24,1362		
F4H3	3		24,5296	24,5296	24,5296	24,5296		
K1H3	3		25,2708	25,2708	25,2708	25,2708		
F1H14	3		25,4476	25,4476	25,4476	25,4476		
F5H3	3			25,5901	25,5901	25,5901		
F5H7	3				26,9472	26,9472		
K2H3	3				26,9643	26,9643		
F4H7	3				26,9928	26,9928		
F4H14	3				27,4205	27,4205	27,4205	
F3H14	3				27,7911	27,7911	27,7911	
F5H14	3				29,3762	29,3762	29,3762	
K1H7	3					34,6733	34,6733	34,6733
K1H14	3					35,1180	35,1180	35,1180
K2H7	3						39,1436	39,1436
K2H14	3							41,0765
Sig.		,067	,050	,057	,164	,070	,051	,268

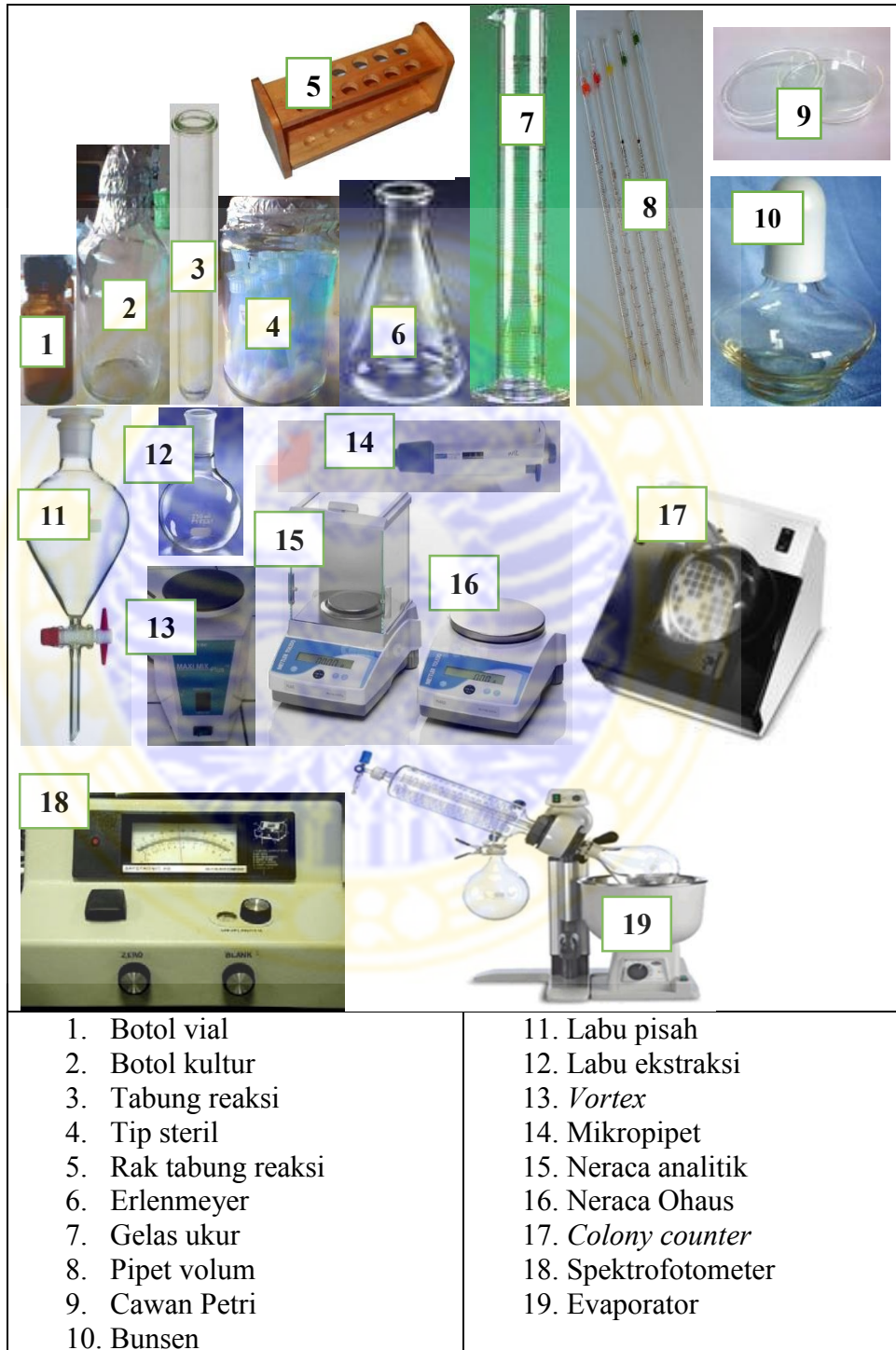
Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 3,000.

**Lampiran 3****Karakteristik *Oil Sludge* PT VICO Indonesia**

No	Parameter	Hasil
1	pH (1 : 2,5 H <sub>2</sub> O)	8,1
2	Kadar air	29,46 %
3	Densitas	0,9947 gr/cm <sup>3</sup>
4	<i>Spesific gravity</i>	0,9956
5	Viskositas 30 <sup>0</sup> C	7 dpa.s
6	Viskositas 50 <sup>0</sup> C	4,5 dpa.s
7	Viskositas 70 <sup>0</sup> C	3 dpa.s
8	N	0,1194 %
9	P	<i>Not detected</i>
10	Fe	0,7497 %
11	Ca	0,2756 %

(Sumber: Ni'matuzahroh, *et al.*, 2013)

**Lampiran 4****Dokumentasi Penelitian****a. Alat Penelitian**



**b. Hasil Penelitian**

