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LAMPIRAN

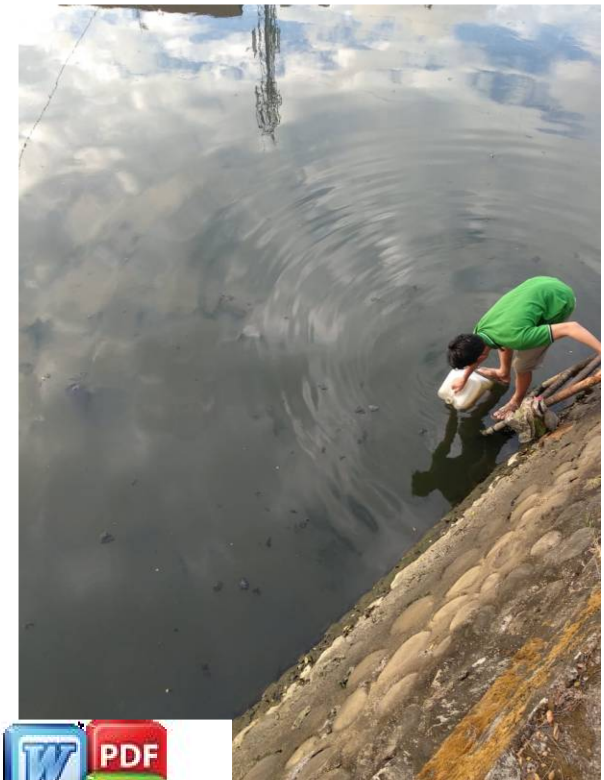
Lampiran 1. Reaktor MBBR

Reaktor 1

Reaktor 2

Reaktor 3

Lampiran 2. Proses pengambilan Air Limbah Uji



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Lampiran 3. Bakteri Aerob Untuk Proses Seeding

Lampiran 4. Pengujian sampel hasil pengolahan di Laboratorium Kimia FIKP UNHAS

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Lampiran 5. Pengaruh Jumlah *Kaldness* Terhadap Penyisihan Parameter Air Limbah

Descriptives

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean
						Lower Bound
BOD	*Kaldness* 20%	3	8.10000	4.445076	2.566366	-2.94218
	Kaldness 40%	3	14.08000	1.913740	1.104898	9.32601
	Kaldness 60%	3	6.46667	5.559535	3.209799	-7.34398
	Total	9	9.54889	5.062733	1.687578	5.65733
pH	*Kaldness* 20%	3	7.63667	.037859	.021858	7.54262
	Kaldness 40%	3	7.58000	.070000	.040415	7.40611
	Kaldness 60%	3	7.44333	.015275	.008819	7.40539
	Total	9	7.55333	.095131	.031710	7.48021
COD	*Kaldness* 20%	3	201.66667	144.424144	83.383318	-157.10280
	Kaldness 40%	3	188.33333	129.423079	74.722449	-133.17142
	Kaldness 60%	3	221.66667	133.665004	77.171526	-110.37561
	Total	9	203.88889	118.658591	39.552864	112.67982
Amoniak	*Kaldness* 20%	3	.21100	.056789	.032787	.06993
	Kaldness 40%	3	.21133	.050856	.029362	.08500
	Kaldness 60%	3	1.70933	1.331595	.768797	-1.59853
	Total	9	.71056	1.002928	.334309	-.06036
TSS	*Kaldness* 20%	3	19.28900	1.443102	.833175	15.70414
	Kaldness 40%	3	26.91633	6.016974	3.473901	11.96934
	Kaldness 60%	3	23.16533	6.474117	3.737833	7.08273
	Total	9	23.12356	5.564099	1.854700	18.84661

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Descriptives

		95% Confidence Interval for Mean		
		Upper Bound	Minimum	Maximum
BOD	*Kaldness* 20%	19.14218	5.390	13.230
	Kaldness 40%	18.83399	11.960	15.680
	Kaldness 60%	20.27732	2.150	12.740
	Total	13.44045	2.150	15.680
pH	*Kaldness* 20%	7.73071	7.610	7.680
	Kaldness 40%	7.75389	7.510	7.650
	Kaldness 60%	7.48128	7.430	7.460
	Total	7.62646	7.430	7.680
COD	*Kaldness* 20%	560.43613	35.000	290.000
	Kaldness 40%	509.83808	39.000	268.000
	Kaldness 60%	553.70894	68.000	311.000
	Total	295.09796	35.000	311.000
Amoniak	*Kaldness* 20%	.35207	.146	.251
	Kaldness 40%	.33767	.154	.251
	Kaldness 60%	5.01720	.710	3.221
	Total	1.48147	.146	3.221
TSS	*Kaldness* 20%	22.87386	17.921	20.797
	Kaldness 40%	41.86332	20.036	31.193
	Kaldness 60%	39.24793	16.393	29.293
	Total	27.40050	16.393	31.193

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Test of Homogeneity of Variances

		Levene Statistic	df1	df2	Sig.
BOD	Based on Mean	2.438	2	6	.168
	Based on Median	.314	2	6	.742
	Based on Median and with adjusted df	.314	2	4.377	.745
	Based on trimmed mean	2.106	2	6	.203
pH	Based on Mean	1.527	2	6	.291
	Based on Median	1.120	2	6	.386
	Based on Median and with adjusted df	1.120	2	4.087	.409
	Based on trimmed mean	1.508	2	6	.295
COD	Based on Mean	.051	2	6	.950
	Based on Median	.003	2	6	.997
	Based on Median and with adjusted df	.003	2	5.897	.997
	Based on trimmed mean	.041	2	6	.960
Amoniak	Based on Mean	11.198	2	6	.009
	Based on Median	1.729	2	6	.255
	Based on Median and with adjusted df	1.729	2	2.014	.366
	Based on trimmed mean	9.818	2	6	.013
TSS	Based on Mean	2.280	2	6	.183
	Based on Median	.697	2	6	.534
	Based on Median and with adjusted df	.697	2	3.867	.552
	trimmed mean	2.133	2	6	.200

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UJI ANOVA (Reaktor)

		Sum of Squares	df	Mean Square	F	Sig.
BOD	Between Groups	96.391	2	48.196	2.661	.149
	Within Groups	108.659	6	18.110		
	Total	205.050	8			
pH	Between Groups	.059	2	.030	13.538	.006
	Within Groups	.013	6	.002		
	Total	.072	8			
COD	Between Groups	1688.889	2	844.444	.046	.956
	Within Groups	110950.000	6	18491.667		
	Total	112638.889	8			
Amoniak	Between Groups	4.489	2	2.245	3.785	.086
	Within Groups	3.558	6	.593		
	Total	8.047	8			
TSS	Between Groups	87.272	2	43.636	1.632	.272
	Within Groups	160.401	6	26.734		
	Total	247.674	8			

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Post Hoc Tests

Multiple Comparisons

Dependent Variable		(I) Reaktor Uji	(J) Reaktor Uji	Mean Difference (I-J)	Std. Error	Sig.
BOD	Tukey HSD	*Kaldness* 20%	*Kaldness* 40%	-5.980000	3.474655	.273
			Kaldness 60%	1.633333	3.474655	.887
		Kaldness 40%	*Kaldness* 20%	5.980000	3.474655	.273
			Kaldness 60%	7.613333	3.474655	.151
		Kaldness 60%	*Kaldness* 20%	-1.633333	3.474655	.887
			Kaldness 40%	-7.613333	3.474655	.151
pH	Tukey HSD	*Kaldness* 20%	*Kaldness* 40%	.056667	.038200	.362
			Kaldness 60%	.193333*	.038200	.006
		Kaldness 40%	*Kaldness* 20%	-.056667	.038200	.362
			Kaldness 60%	.136667*	.038200	.027
		Kaldness 60%	*Kaldness* 20%	-.193333*	.038200	.006
			Kaldness 40%	-.136667*	.038200	.027
COD	Tukey HSD	*Kaldness* 20%	*Kaldness* 40%	13.333333	111.030526	.992
			Kaldness 60%	-20.000000	111.030526	.982
		Kaldness 40%	*Kaldness* 20%	-13.333333	111.030526	.992
			Kaldness 60%	-33.333333	111.030526	.952
		Kaldness 60%	*Kaldness* 20%	20.000000	111.030526	.982
			Kaldness 40%	33.333333	111.030526	.952
Amoniak	Tukey HSD	*Kaldness* 20%	*Kaldness* 40%	-.000333	.628748	1.000
			Kaldness 60%	-1.498333	.628748	.119
		Kaldness 40%	*Kaldness* 20%	.000333	.628748	1.000

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			Kaldness 60%	-1.498000	.628748	.119
		Kaldness 60%	*Kaldness* 20%	1.498333	.628748	.119
			Kaldness 40%	1.498000	.628748	.119
TSS	Tukey HSD	*Kaldness* 20%	*Kaldness* 40%	-7.627333	4.221656	.246
			Kaldness 60%	-3.876333	4.221656	.650
		Kaldness 40%	*Kaldness* 20%	7.627333	4.221656	.246
			Kaldness 60%	3.751000	4.221656	.667
		Kaldness 60%	*Kaldness* 20%	3.876333	4.221656	.650
			Kaldness 40%	-3.751000	4.221656	.667

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Multiple Comparisons

Dependent Variable		(I) Reaktor Uji	(J) Reaktor Uji	95% Confidence Interval Lower Bound	Upper Bound
BOD	Tukey HSD	Kaldness 20%	Kaldness 40%	-16.64120	4.68120
			Kaldness 60%	-9.02786	12.29453
		Kaldness 40%	Kaldness 20%	-4.68120	16.64120
			Kaldness 60%	-3.04786	18.27453
		Kaldness 60%	Kaldness 20%	-12.29453	9.02786
			Kaldness 40%	-18.27453	3.04786
pH	Tukey HSD	Kaldness 20%	Kaldness 40%	-.06054	.17388
			Kaldness 60%	.07612	.31054
		Kaldness 40%	Kaldness 20%	-.17388	.06054
			Kaldness 60%	.01946	.25388
		Kaldness 60%	Kaldness 20%	-.31054	-.07612
			Kaldness 40%	-.25388	-.01946
COD	Tukey HSD	Kaldness 20%	Kaldness 40%	-327.33881	354.00548
			Kaldness 60%	-360.67214	320.67214
		Kaldness 40%	Kaldness 20%	-354.00548	327.33881
			Kaldness 60%	-374.00548	307.33881
		Kaldness 60%	Kaldness 20%	-320.67214	360.67214
			Kaldness 40%	-307.33881	374.00548
Amoniak	Tukey HSD	Kaldness 20%	Kaldness 40%	-1.92950	1.92884
			Kaldness 60%	-3.42750	.43084
		Kaldness 40%	Kaldness 20%	-1.92884	1.92950
			Kaldness 60%	-3.42717	.43117
		Kaldness 60%	Kaldness 20%	-.43084	3.42750

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			Kaldness 40%	-.43117	3.42717
TSS	Tukey HSD	Kaldness 20%	Kaldness 40%	-20.58053	5.32587
			Kaldness 60%	-16.82953	9.07687
		Kaldness 40%	Kaldness 20%	-5.32587	20.58053
			Kaldness 60%	-9.20220	16.70420
		Kaldness 60%	Kaldness 20%	-9.07687	16.82953
			Kaldness 40%	-16.70420	9.20220

*. The mean difference is significant at the 0.05 level.

Homogeneous Subsets

BOD

	Reaktor Uji	N	Subset for alpha = 0.05 1
Tukey HSD[a]	Kaldness 60%	3	6.46667
	Kaldness 20%	3	8.10000
	Kaldness 40%	3	14.08000
	Sig.		.151
Duncan[a]	Kaldness 60%	3	6.46667
	Kaldness 20%	3	8.10000
	Kaldness 40%	3	14.08000
			.079

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Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 3.000.

pH

	Reaktor Uji	N	Subset for alpha = 0.05 1	2
Tukey HSD[a]	Kaldness 60%	3	7.44333	
	Kaldness 40%	3		7.58000
	Kaldness 20%	3		7.63667
	Sig.		1.000	.362
Duncan[a]	Kaldness 60%	3	7.44333	
	Kaldness 40%	3		7.58000
	Kaldness 20%	3		7.63667
	Sig.		1.000	.188

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 3.000.

COD

	Reaktor Uji	N	Subset for alpha = 0.05 1
Tukey HSD[a]	Kaldness 40%	3	188.33333
	ess 20%	3	201.66667

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	Kaldness 60%	3	221.66667
	Sig.		.952
Duncan[a]	Kaldness 40%	3	188.33333
	Kaldness 20%	3	201.66667
	Kaldness 60%	3	221.66667
	Sig.		.781

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 3.000.

Amoniak

			Subset for alpha = 0.05
	Reaktor Uji	N	1
Tukey HSD[a]	Kaldness 20%	3	.21100
	Kaldness 40%	3	.21133
	Kaldness 60%	3	1.70933
	Sig.		.119
Duncan[a]	Kaldness 20%	3	.21100
	Kaldness 40%	3	.21133
	Kaldness 60%	3	1.70933
	Sig.		.061

Means for groups in homogeneous subsets are displayed.

n Sample Size = 3.000.

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TSS

			Subset for alpha = 0.05
	Reaktor Uji	N	1
Tukey HSD[a]	Kaldness 20%	3	19.28900
	Kaldness 60%	3	23.16533
	Kaldness 40%	3	26.91633
	Sig.		.246
Duncan[a]	Kaldness 20%	3	19.28900
	Kaldness 60%	3	23.16533
	Kaldness 40%	3	26.91633
	Sig.		.132

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 3.000.

```
ONEWAY BOD pH COD Amoniak TSS BY Waktu
  /STATISTICS DESCRIPTIVES HOMOGENEITY
  /MISSING ANALYSIS
  /POSTHOC=TUKEY DUNCAN ALPHA(0.05).
```

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Lampiran 6. Pengaruh Waktu Pengamatan Terhadap Penyisihan Parameter Air Limbah

Descriptives

						95% Confidence Interval for Mean
		N	Mean	Std. Deviation	Std. Error	Lower Bound
BOD	6 Jam	3	13.88333	1.575130	.909402	9.97049
	12 Jam	3	8.26333	5.518807	3.186285	-5.44614
	24 Jam	3	6.50000	4.998310	2.885775	-5.91649
	Total	9	9.54889	5.062733	1.687578	5.65733
pH	6 Jam	3	7.52333	.090738	.052387	7.29793
	12 Jam	3	7.56333	.125831	.072648	7.25075
	24 Jam	3	7.57333	.100167	.057831	7.32451
	Total	9	7.55333	.095131	.031710	7.48021
COD	6 Jam	3	289.66667	21.501938	12.414150	236.25289
	12 Jam	3	274.66667	14.742230	8.511430	238.04494
	24 Jam	3	47.33333	18.009257	10.397649	2.59586
	Total	9	203.88889	118.658591	39.552864	112.67982
Amoniak	6 Jam	3	1.24100	1.714730	.990000	-3.01863
	12 Jam	3	.55400	.556865	.321506	-.82933
	24 Jam	3	.33667	.323341	.186681	-.46656
	Total	9	.71056	1.002928	.334309	-.06036
TSS	6 Jam	3	27.09433	5.535775	3.196081	13.34271
	12 Jam	3	24.15967	5.194334	2.998950	11.25622
	24 Jam	3	18.11667	1.829365	1.056184	13.57227
	Total	9	23.12356	5.564099	1.854700	18.84661

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Descriptives

		95% Confidence Interval for Mean		
		Upper Bound	Minimum	Maximum
BOD	6 Jam	17.79617	12.740	15.680
	12 Jam	21.97281	4.510	14.600
	24 Jam	18.91649	2.150	11.960
	Total	13.44045	2.150	15.680
pH	6 Jam	7.74874	7.440	7.620
	12 Jam	7.87591	7.430	7.680
	24 Jam	7.82216	7.460	7.650
	Total	7.62646	7.430	7.680
COD	6 Jam	343.08044	268.000	311.000
	12 Jam	311.28840	258.000	286.000
	24 Jam	92.07081	35.000	68.000
	Total	295.09796	35.000	311.000
Amoniak	6 Jam	5.50063	.251	3.221
	12 Jam	1.93733	.229	1.197
	24 Jam	1.13989	.146	.710
	Total	1.48147	.146	3.221
TSS	6 Jam	40.84596	20.797	31.193
	12 Jam	37.06311	19.149	29.520
	24 Jam	22.66106	16.393	20.036
	Total	27.40050	16.393	31.193

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Test of Homogeneity of Variances

		Levene Statistic	df1	df2	Sig.
BOD	Based on Mean	2.542	2	6	.159
	Based on Median	.456	2	6	.654
	Based on Median and with adjusted df	.456	2	3.854	.664
	Based on trimmed mean	2.269	2	6	.185
pH	Based on Mean	.181	2	6	.839
	Based on Median	.096	2	6	.910
	Based on Median and with adjusted df	.096	2	5.597	.910
	Based on trimmed mean	.174	2	6	.845
COD	Based on Mean	.127	2	6	.883
	Based on Median	.110	2	6	.898
	Based on Median and with adjusted df	.110	2	5.546	.898
	Based on trimmed mean	.125	2	6	.885
Amoniak	Based on Mean	7.943	2	6	.021
	Based on Median	.496	2	6	.632
	Based on Median and with adjusted df	.496	2	2.562	.658
	Based on trimmed mean	6.258	2	6	.034
TSS	Based on Mean	1.645	2	6	.269
	Based on Median	.500	2	6	.630
	Based on Median and with adjusted df	.500	2	3.812	.642
	trimmed mean	1.540	2	6	.289

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ANOVA (Waktu Pengolahan terhadap Penyisihan Bahan Pencemar)

		Sum of Squares	df	Mean Square	F	Sig.
BOD	Between Groups	89.207	2	44.604	2.310	.180
	Within Groups	115.843	6	19.307		
	Total	205.050	8			
pH	Between Groups	.004	2	.002	.185	.836
	Within Groups	.068	6	.011		
	Total	.072	8			
COD	Between Groups	110630.889	2	55315.444	165.285	.000
	Within Groups	2008.000	6	334.667		
	Total	112638.889	8			
Amoniak	Between Groups	1.337	2	.669	.598	.580
	Within Groups	6.710	6	1.118		
	Total	8.047	8			
TSS	Between Groups	125.729	2	62.864	3.093	.119
	Within Groups	121.945	6	20.324		
	Total	247.674	8			

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Post Hoc Tests

Multiple Comparisons

Dependent Variable		(I) Waktu Pengamatan	(J) Waktu Pengamatan	Mean Difference (I-J)	Std. Error
BOD	Tukey HSD	6 Jam	12 Jam	5.620000	3.587675
			24 Jam	7.383333	3.587675
		12 Jam	6 Jam	-5.620000	3.587675
			24 Jam	1.763333	3.587675
		24 Jam	6 Jam	-7.383333	3.587675
			12 Jam	-1.763333	3.587675
pH	Tukey HSD	6 Jam	12 Jam	-.040000	.087050
			24 Jam	-.050000	.087050
		12 Jam	6 Jam	.040000	.087050
			24 Jam	-.010000	.087050
		24 Jam	6 Jam	.050000	.087050
			12 Jam	.010000	.087050
COD	Tukey HSD	6 Jam	12 Jam	15.000000	14.936904
			24 Jam	242.333333*	14.936904
		12 Jam	6 Jam	-15.000000	14.936904
			24 Jam	227.333333*	14.936904
		24 Jam	6 Jam	-242.333333*	14.936904
			12 Jam	-227.333333*	14.936904
Amoniak	Tukey HSD	6 Jam	12 Jam	.687000	.863449
			24 Jam	.904333	.863449
		12 Jam	6 Jam	-.687000	.863449

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			24 Jam	.217333	.863449
		24 Jam	6 Jam	-.904333	.863449
			12 Jam	-.217333	.863449
TSS	Tukey HSD	6 Jam	12 Jam	2.934667	3.680957
			24 Jam	8.977667	3.680957
		12 Jam	6 Jam	-2.934667	3.680957
			24 Jam	6.043000	3.680957
		24 Jam	6 Jam	-8.977667	3.680957
			12 Jam	-6.043000	3.680957

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Multiple Comparisons

Dependent Variable		(I) Waktu Pengamatan	(J) Waktu Pengamatan	Sig.	95% Confidence Interval Lower Bound
BOD	Tukey HSD	6 Jam	12 Jam	.329	-5.38797
			24 Jam	.179	-3.62464
		12 Jam	6 Jam	.329	-16.62797
			24 Jam	.878	-9.24464
		24 Jam	6 Jam	.179	-18.39131
			12 Jam	.878	-12.77131
pH	Tukey HSD	6 Jam	12 Jam	.892	-.30709
			24 Jam	.838	-.31709
		12 Jam	6 Jam	.892	-.22709
			24 Jam	.993	-.27709
		24 Jam	6 Jam	.838	-.21709
			12 Jam	.993	-.25709
COD	Tukey HSD	6 Jam	12 Jam	.601	-30.83052
			24 Jam	.000	196.50281
		12 Jam	6 Jam	.601	-60.83052
			24 Jam	.000	181.50281
		24 Jam	6 Jam	.000	-288.16386
			12 Jam	.000	-273.16386
Amoniak	Tukey HSD	6 Jam	12 Jam	.719	-1.96230
			24 Jam	.577	-1.74497
		12 Jam	6 Jam	.719	-3.33630
			24 Jam	.966	-2.43197

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		24 Jam	6 Jam	.577	-3.55363
			12 Jam	.966	-2.86663
TSS	Tukey HSD	6 Jam	12 Jam	.718	-8.35952
			24 Jam	.110	-2.31652
		12 Jam	6 Jam	.718	-14.22885
			24 Jam	.301	-5.25119
		24 Jam	6 Jam	.110	-20.27185
			12 Jam	.301	-17.33719

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Multiple Comparisons

Dependent Variable		(I) Waktu Pengamatan	(J) Waktu Pengamatan	95% Confidence Interval
				Upper Bound
BOD	Tukey HSD	6 Jam	12 Jam	16.62797
			24 Jam	18.39131
		12 Jam	6 Jam	5.38797
			24 Jam	12.77131
		24 Jam	6 Jam	3.62464
			12 Jam	9.24464
pH	Tukey HSD	6 Jam	12 Jam	.22709
			24 Jam	.21709
		12 Jam	6 Jam	.30709
			24 Jam	.25709
		24 Jam	6 Jam	.31709
			12 Jam	.27709
COD	Tukey HSD	6 Jam	12 Jam	60.83052
			24 Jam	288.16386
		12 Jam	6 Jam	30.83052
			24 Jam	273.16386
		24 Jam	6 Jam	-196.50281
			12 Jam	-181.50281
Amoniak	Tukey HSD	6 Jam	12 Jam	3.33630
			24 Jam	3.55363
		12 Jam	6 Jam	1.96230
			24 Jam	2.86663

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		24 Jam	6 Jam	1.74497
			12 Jam	2.43197
TSS	Tukey HSD	6 Jam	12 Jam	14.22885
			24 Jam	20.27185
		12 Jam	6 Jam	8.35952
			24 Jam	17.33719
		24 Jam	6 Jam	2.31652
			12 Jam	5.25119

*. The mean difference is significant at the 0.05 level.

Homogeneous Subsets

BOD

	Waktu Pengamatan	N	Subset for alpha = 0.05
			1
Tukey HSD[a]	24 Jam	3	6.50000
	12 Jam	3	8.26333
	6 Jam	3	13.88333
	Sig.		.179
Duncan[a]	24 Jam	3	6.50000
	12 Jam	3	8.26333
	6 Jam	3	13.88333
	Sig.		.094

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pH

	Waktu Pengamatan	N	Subset for alpha = 0.05 1
Tukey HSD[a]	6 Jam	3	7.52333
	12 Jam	3	7.56333
	24 Jam	3	7.57333
	Sig.		.838
Duncan[a]	6 Jam	3	7.52333
	12 Jam	3	7.56333
	24 Jam	3	7.57333
	Sig.		.598

COD

			Subset for alpha = 0.05	
	Waktu Pengamatan	N	1	2
Tukey HSD[a]	24 Jam	3	47.33333	
	12 Jam	3		274.66667
	6 Jam	3		289.66667
	Sig.		1.000	.601
Duncan[a]	24 Jam	3	47.33333	
	12 Jam	3		274.66667
	6 Jam	3		289.66667
	Sig.		1.000	.354

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Amoniak

	Waktu Pengamatan	N	Subset for alpha = 0.05 1
Tukey HSD[a]	24 Jam	3	.33667
	12 Jam	3	.55400
	6 Jam	3	1.24100
	Sig.		.577
Duncan[a]	24 Jam	3	.33667
	12 Jam	3	.55400
	6 Jam	3	1.24100
	Sig.		.350

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 3.000.

TSS

	Waktu Pengamatan	N	Subset for alpha = 0.05 1
Tukey HSD[a]	24 Jam	3	18.11667
	12 Jam	3	24.15967
	6 Jam	3	27.09433
	Sig.		.110
Duncan[a]	24 Jam	3	18.11667
	12 Jam	3	24.15967
	6 Jam	3	27.09433
	Sig.		.057

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