Lampiran 3 : Uji Toksisitas

Hasil Aklimatisasi

Proses Aklimatisasi

Data Aklimatisasi

Pengulangan	Suhu	pH	DO	Kematian
1	26	7.1	7.6	6
2	26	7	7.8	3
3	26	7.2	8	5
Rerata	26	7.1	7.8	14

Hasil Uji Pendahluaun

Proses Uji Pendahuluan

Data Uji Pendahuluan (Mix / 0 jam)

Konsentrasi	Suhu	pH	DO	Kematian
0.00%	26	8.15	7.15	0
6.25%	26.05	7.75	7.5	0
12.50%	26.1	7.35	6.5	0
25.00%	26.15	6.9	6.8	0
50.00%	26.1	6.45	6.95	5
100.00%	26	6.1	6.8	5

Data Uji Pendahuluan (Mix / 24 jam)

Konsentrasi	Suhu	pH	DO	Kematian
0.00%	26	8.25	5.85	0
6.25%	25.1	8.2	4.3	3.5
12.50%	25.6	8.1	4	5
25.00%	25.05	7.9	2.6	5
50.00%	25.35	7.55	3.1	0
100.00%	25.9	6.8	4.75	0

Data Uji Pendahuluan (Effluent / 0 jam)

Konsentrasi	Suhu	pH	DO	Kematian
0.00%	26	8.15	5.25	0
6.25%	26.1	8.55	4.85	0
12.50%	26.15	8.65	5.05	0
25.00%	26.05	8.75	4.95	0
50.00%	26	8.8	5	0
100.00%	26.3	8.75	5.05	5

Data Uji Pendahuluan (Effluent / 24 jam)

Konsentrasi	Suhu	pH	DO	Kematian
0.00%	25.05	8.3	6.45	0
6.25%	25	8.5	6.2	0
12.50%	25.5	8.55	6.35	1.5
25.00%	25.1	8.8	5.6	1
50.00%	25.05	8.9	5.75	5
100.00%	25	9	5.4	0

Hasil Uji Toksisitas

Proses Uji Toksisitas

Data Uji Toksisitas (Mix / 0 jam)

Konsentrasi	Suhu	pH	DO	Kematian
0.00%	26	8.1	5.6	0
0.39%	25	8.2	4.95	0
0.78%	25	7.55	4.9	0
1.56%	25	7.55	4.7	0
3.13%	25	7.7	4.55	0
6.25%	25	7.5	4.45	0

Data Uji Toksisitas (Mix / 24 jam)

Konsentrasi	Suhu	pH	DO	Kematian
0.00%	26.75	8.4	5.3	0
0.39%	26	8.35	5.45	1
0.78%	26.25	8.3	5.25	0
1.56%	26	8.2	5.2	2
3.13%	26	8.2	5.15	1
6.25%	25.75	8.15	4.7	2

Data Uji Toksisitas (Mix / 48 jam)

Konsentrasi	Suhu	pH	DO	Kematian
0.00%	25.5	8.65	6.65	0
0.39%	26.5	8.5	6.95	1
0.78%	26.5	8.4	6.9	1
1.56%	26.5	8.4	7	0
3.13%	26.75	8.4	7.05	1
6.25%	27	8.4	7.15	2

Data Uji Toksisitas (Mix / 72 jam)

Konsentrasi	Suhu	pH	DO	Kematian
0.00%	27	8.6	6.65	0
0.39%	27	8.5	6.95	0
0.78%	26.5	8.35	6.9	2
1.56%	26.5	8.3	7	1
3.13%	26.25	8.2	7.05	2
6.25%	26	8.2	7.15	2

Data Uji Toksisitas (Mix / 96 jam)

Konsentrasi	Suhu	pH	DO	Kematian
0.00%	26.25	8.6	5.8	0
0.39%	26.5	8.6	6.05	1
0.78%	26	8.5	6.45	1
1.56%	26	8.35	6.45	1
3.13%	25.75	8.3	6.65	2
6.25%	25.75	8.2	7.05	2

Data Uji Toksisitas (Effluent / 0 jam)

Konsentrasi	Suhu	pH	DO	Kematian
0.00%	25	8.1	5.6	0
1.56%	25	8.25	4.75	0
3.13%	25	8.35	4.85	0
6.25%	25	8.5	4.75	0
12.50%	25	8.55	4.95	0
25.00%	25	8.25	5.1	0

Data Uji Toksisitas (Effluent / 24 jam)

Konsentrasi	Suhu	pH	DO	Kematian
0.00%	26.5	8.2	7.6	0
1.56%	26	8.45	7.5	0
3.13%	26	8.5	5.4	1
6.25%	26	8.6	5.3	0
12.50%	26	8.75	5.15	0
25.00%	26	8.8	4.9	1

Data Uji Toksisitas (Effluent / 48 jam)

Konsentrasi	Suhu	pH	DO	Kematian
0.00%	27	8.35	7.15	0
1.56%	27	8.4	7.05	1
3.13%	27	8.4	7	2
6.25%	27	8.5	6.8	3
12.50%	27	8.7	6.85	2
25.00%	27.5	8.75	6.85	3

Data Uji Toksisitas (Effluent / 72 jam)

Konsentrasi	Suhu	pH	DO	Kematian
0.00%	26	8	6.35	0
1.56%	26	8.2	6.7	1
3.13%	26	8.35	6.55	1
6.25%	26	8.5	6.35	2
12.50%	26.5	8.8	6.45	2
25.00%	26.5	8.8	6.45	2

Data Uji Toksisitas (Effluent / 96 jam)

Konsentrasi	Suhu	pH	DO	Kematian
0.00%	27	8	6.15	0
1.56%	26.5	8	6.4	0
3.13%	26.25	8.3	6.3	1
6.25%	26.1	8.35	6.25	1
12.50%	26.25	8.6	6.5	2
25.00%	26	8.75	6.45	2

Data Rekapitulasi Kematian Hewan Uji (Mix / 0 – 96 jam)

Konsentrasi	Kematian					Jumlah Kematian
	0 jam	24 jam	48 jam	72 jam	96 jam	
0.00%	0	0	0	0	0	0
0.39%	0	1	1	0	1	3
0.78%	0	0	1	2	1	4
1.56%	0	2	0	1	1	4
3.13%	0	1	1	2	2	6
6.25%	0	2	2	2	2	8

Data Rekapitulasi Kematian Hewan Uji (Effluent / 0 – 96 jam)

Konsentrasi	Kematian					Jumlah Kematian
	0 jam	24 jam	48 jam	72 jam	96 jam	
0.00%	0	0	0	0	0	0
1.56%	0	0	1	1	0	2
3.13%	0	1	2	1	1	5
6.25%	0	0	3	2	1	6
12.50%	0	0	2	2	2	6
25.00%	0	1	3	2	2	8

Lethal Concentration 50 **(LC50)**

Tabel Mencari Nilai Probit

Table 3.2 Transformation of percentages to probits

%	0	1	2	3	4	5	6	7	8	9
0	—	2.67	2.95	3.12	3.25	3.36	3.45	3.52	3.59	3.66
10	3.72	3.77	3.82	3.87	3.92	3.96	4.01	4.05	4.08	4.12
20	4.16	4.19	4.23	4.26	4.29	4.33	4.36	4.39	4.42	4.45
30	4.48	4.50	4.53	4.56	4.59	4.61	4.64	4.67	4.69	4.72
40	4.75	4.77	4.80	4.82	4.85	4.87	4.90	4.92	4.95	4.97
50	5.00	5.03	5.05	5.08	5.10	5.13	5.15	5.18	5.20	5.23
60	5.25	5.28	5.31	5.33	5.36	5.39	5.41	5.44	5.47	5.50
70	5.52	5.55	5.58	5.61	5.64	5.67	5.71	5.74	5.77	5.81
80	5.84	5.88	5.92	5.95	5.99	6.04	6.08	6.13	6.18	6.23
90	6.28	6.34	6.41	6.48	6.55	6.64	6.75	6.88	7.05	7.33
—	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
99	7.33	7.37	7.41	7.46	7.51	7.58	7.65	7.75	7.88	8.09

Data Nilai Probit (Mix)

Konsentrasi	Log10 Konsentrasi	Jumlah Hewan Uji	Jumkah Hewan Mati	%Mortalitas	%Mortalitas Terkoreksi	Nilai Probit
0	0	10	0	0	0	0
0.33	-0.48148606	10	3	30	30	4.48
0.78	-0.107905397	10	4	40	40	4.75
1.56	0.193124598	10	4	40	40	4.75
3.13	0.495544338	10	6	60	60	5.25
6.25	0.795880017	10	8	80	80	5.84

Contoh Perhitungan Nilai Probit Mix (6.25%)

Log10 Konsentrasi = Log (Konsentrasi)
= Log (6.25)
= 0.795880017

%Mortalitas $= \frac{\text{Jumlah Hewan Mati}}{\text{Jumlah Hewan Uji}}$ x 100
$= \frac{8}{10}$ x 100
= 80

%Mortalitas Terkoreksi $= \frac{(\text{\%Mortalitas Perlakuan} - \text{\%Mortalitas Kontrol})}{(100 - \text{\%Mortalitas Kontrol})}$ x 100
$= \frac{(80-0)}{(100-0)}$ x 100
= 80

Menentukan Nilai Probit dilihat dari hasil %Mortalitas Terkoreksi dengan melihat acuan Tabel Nilai Probit. Contoh : %Mortalitas Terkoreksi untuk konsentrasi 6.25% yaitu 80, maka Nilai Probit yang didapatkan adalah 5.84

Data Nilai Probit (Effluent)

Konsentrasi	Log10 Konsentrasi	Jumlah Hewan Uji	Jumkah Hewan Mati	%Mortalitas	%Mortalitas Terkoreksi	Nilai Probit
0	0	10	0	0	0	0
1.56	0.193124598	10	2	20	20	4.16
3.13	0.495544338	10	5	50	50	5
6.25	0.795880017	10	6	60	60	5.25
12.5	1.096910013	10	6	60	60	5.25

Konsentrasi	Log10 Konsentrasi	Jumlah Hewan Uji	Jumkah Hewan Mati	%Mortalitas	%Mortalitas Terkoreksi	Nilai Probit
25	1.397940009	10	8	80	80	5.84

Contoh Perhitungan Nilai Probit Effluent (25%)

Log10 Konsentrasi = Log (Konsentrasi)
= Log (25)
= 1.397840009

%Mortalitas $= \frac{\text{Jumlah Hewan Mati}}{\text{Jumlah Hewan Uji}}$ x 100
$= \frac{8}{10}$ x 100
= 80

%Mortalitas Terkoreksi $= \frac{(\%\text{Mortalitas Perlakuan} - \%\text{Mortalitas Kontrol})}{(100 - \%\text{Mortalitas Kontrol})}$ x 100
$= \frac{(80-0)}{(100-0)}$ x 100
= 80

Menentukan Nilai Probit dilihat dari hasil %Mortalitas Terkoreksi dengan melihat acuan Tabel Nilai Probit. Contoh : %Mortalitas Terkoreksi untuk konsentrasi 25% yaitu 80, maka Nilai Probit yang didapatkan adalah 5.84

***Toxicity Unit Acute* (TUa)**

Data Nilai LC50 dan *Toxicity Unit Acute* (TUa) (Mix)

Konsentrasi (x)	Jumlah Hewan Mati (y)	x2	x.y
0	0	0	0
0.33	3	0.1089	0.99
0.78	4	0.6084	3.12
1.56	4	2.4336	6.24
3.13	6	9.7969	18.78
6.25	8	39.0625	50
12.05	**25**	**52.0103**	**79.13**

Contoh Uji	LC50
Mixing	80.47

Contoh Uji	Tua
Mixing	1.24

Contoh Perhitungan Nilai LC50 dan TUa (Mix)

$$a = \frac{(\sum y)(\sum x^2) - (\sum x)(\sum xy)}{n(\sum x^2) - (\sum x)^2}$$

$$= \frac{(25)(52) - (12.05)(79.1)}{6(52) - (12.05)^2}$$

$$= 2.078$$

$$b = \frac{n(\sum xy) - (\sum x)(\sum y)}{n(\sum x^2) - (\sum x)^2}$$

$$= \frac{6(79.1) - (12.05)(25)}{6(52) - (12.05)^2}$$

$$= 1.04$$

$$x = \frac{(5-b)}{a}$$

$$= \frac{(5-1.04)}{2.078}$$

$$= 1.91$$

LC50 = antilog (x)

$= 10^x$

$= 10^{1.91}$

$= 80.47$

$$TUa = \frac{100}{LC50}$$

$$= \frac{100}{80.47}$$

$$= 1.24$$

Data Nilai LC50 dan *Toxicity Unit Acute* (TUa) (Effluent)

Konsentrasi (x)	Jumlah Hewan Mati (y)	x2	x.y
0	0	0	0
1.56	2	2.4336	3.12
3.13	5	9.7969	15.65
6.25	6	39.0625	37.5
12.5	6	156.25	75
25	8	625	200
48.44	**27**	**832.543**	**331.27**

Contoh Uji	LC50
Effluent	89.83

Contoh Uji	Tua
Effluent	1.11

Contoh Perhitungan Nilai LC50 dan TUa (Mix)

$$a = \frac{(\sum y)(\sum x^2) - (\sum x)\,(\sum xy)}{n\,(\sum x^2) - (\sum x)^2}$$

$$= \frac{(27)(833) - (48.44)\,(331)}{6(833) - (48.44)^2}$$

$$= 2.4282$$

$$b = \frac{n\,(\sum xy) - (\sum x)\,(\sum y)}{n\,(\sum x^2) - (\sum x)^2}$$

$$= \frac{6\,(331) - (48.44)\,(27)}{6\,(27) - (48.44)^2}$$

$$= 0.2566$$

$$x = \frac{(5-b)}{a}$$

$$= \frac{(5-0.2566)}{2.4282}$$

$$= 1.95$$

LC50 = antilog (x)

$= 10^x$

$= 10^{1.95}$

$= 89.83$

$$TUa = \frac{100}{LC50}$$

$$= \frac{100}{89.83}$$

$= 1.$

Lethal Concentration 50 (LC50) dengan Sofware EPA Probit 1.5

Contoh Perhitungan LC50 dengan Software EPA Probit 1.5 (Mix)

EPA PROBIT ANALYSIS PROGRAM
USED FOR CALCULATING LC/EC VALUES
Version 1.5

Mixing

Conc.	Number Exposed	Number Resp.	Observed Proportion Responding	Proportion Responding Adjusted for Controls	Predicted Proportion Responding
0.3300	10	3	0.3000	0.3000	0.2568
0.7600	10	4	0.4000	0.4000	0.3849
1.5600	10	4	0.4000	0.4000	0.5073
3.1300	10	6	0.6000	0.6000	0.6252
6.2500	10	8	0.8000	0.8000	0.7317

Chi - Square for Heterogeneity (calculated) = 0.832
Chi - Square for Heterogeneity
(tabular value at 0.05 level) = 7.815

Mu = 0.174854
Sigma = 1.004897

Parameter	Estimate	Std. Err.	95% Confidence Limits	
Intercept	4.825998	0.198567	(4.436806,	5.215190)
Slope	0.995127	0.420900	(0.170162,	1.820091)

Theoretical Spontaneous Response Rate = 0.0000

Mixing

Estimated LC/EC Values and Confidence Limits

Point	Exposure Conc.	95% Confidence Limits Lower	Upper
LC/EC 1.00	0.007	0.000	0.086
LC/EC 5.00	0.033	0.000	0.209
LC/EC 10.00	0.077	0.000	0.341
LC/EC 15.00	0.136	0.000	0.481
LC/EC 50.00	1.496	0.330	6.485
LC/EC 85.00	16.456	4.691	2083444.125
LC/EC 90.00	29.022	6.608	55670672.000

```
LC/EC 95.00        67.268           10.790  7367336960.000
LC/EC 99.00       325.497           26.380  %72083644088320.000

Mixing

        PLOT OF ADJUSTED PROBITS AND PREDICTED REGRESSION LINE

Probit
   10+
     -
     -
     -
     -
    9+
     -
     -
     -
     -
    8+
     -
     -
     -
.
     -
    7+
.
     -
..
     -                                                          ..
     -                                                       ...
     -                                                    ....
    6+                                                ....
     -                                          o....
     -                                         ...
     -                                     ....
     -                                 ....o
    5+                              ...
     -                            o...o
     -                         ....
     -                      o..
     -                   ....
    4+               ....
     -            ....
     -         ...
     -       ..
     -     ..
    3+   .
     -
     -.
```

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     -
     -
    2+
     -
     -
     -
     -
    1+
     -
     -
     -
     -
    0+
      -+--------------+--------+---------+---------+--------+----
----------+-
      EC01            EC10     EC25      EC50      EC75     EC90
EC99
```

Contoh Perhitungan LC50 dengan Software EPA Probit 1.5 (Effluent)

EPA PROBIT ANALYSIS PROGRAM
USED FOR CALCULATING LC/EC VALUES
Version 1.5

Effluent

Conc.	Number Exposed	Number Resp.	Observed Proportion Responding	Proportion Responding Adjusted for Controls	Predicted Proportion Responding
1.5600	10	2	0.2000	0.2000	0.2761
3.1300	10	5	0.5000	0.5000	0.4049
6.2500	10	6	0.6000	0.6000	0.5440
12.5000	10	6	0.6000	0.6000	0.6782
25.0000	10	8	0.8000	0.8000	0.7924

Chi - Square for Heterogeneity (calculated) = 1.075
Chi - Square for Heterogeneity
(tabular value at 0.05 level) = 7.815

Mu = 0.701377
Sigma = 0.854820

Parameter	Estimate	Std. Err.	95% Confidence Limits	
Intercept	4.179504	0.397310	(3.400776,	4.958231)
Slope	1.169836	0.450594	(0.286671,	2.053001)

Theoretical Spontaneous Response Rate = 0.0000

Effluent

Estimated LC/EC Values and Confidence Limits

Point	Exposure Conc.	95% Confidence Limits Lower	Upper
LC/EC 1.00	0.052	0.000	0.429
LC/EC 5.00	0.197	0.000	0.948
LC/EC 10.00	0.403	0.000	1.461
LC/EC 15.00	0.654	0.001	1.974
LC/EC 50.00	5.028	1.271	12.341
LC/EC 85.00	38.665	14.544	14215.728
LC/EC 90.00	62.649	19.834	98355.102
LC/EC 95.00	128.077	30.798	1761818.625
LC/EC 99.00	489.718	68.360	405991264.000

Effluent

PLOT OF ADJUSTED PROBITS AND PREDICTED REGRESSION LINE

```
Probit
   10+
     -
     -
     -
     -
    9+
     -
     -
     -
     -
    8+
     -
     -
     -
.
     -
    7+
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     -
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     -                                                          ..
     -                                                       ...
     -                                                    ....
    6+                                                ....
     -                                            ..o.
```

```
     -                                          ...
     -                                       ....
     -                                  .o..  o
    5+                              o  ...
     -                              ....
     -                           ....
     -                        ...
     -                     ....o
    4+                  ....
     -                ....
     -            ...
     -          ..
     -       ..
    3+    .
     -
     -.
     -
     -
    2+
     -
     -
     -
     -
    1+
     -
     -
     -
     -
    0+
      -+--------------+--------+---------+---------+--------+----
----------+-
      EC01           EC10     EC25      EC50      EC75     EC90
EC99
```