

1. Uraian perhitungan

1.1 Data pengamatan

Bioinhibitor	: Ekstrak biji alpukat
Temperatur	: 31° C
Warna	: Coklat muda - jernih
pH	: 3,46
volume	: 5 mL
Media	: Pelat baja karbon
Panjang pelat	: 4 cm
Lebar pelat	: 2,6 cm
Tebal pelat	: 0,24 cm
Larutan korosif	: HCl (1M, 2M, 3M, 4M, dan 5M)
Volume	: 100 mL
Temperatur	: 28° C

1.2 Perhitungan

1.2.1 Pembuatan larutan media perendaman

Diketahui :

$$\rho_{HCl} : 1,159 \text{ gr/mL}$$

$$BM : 36,5 \text{ gr/mol}$$

$$\% : 32$$

Penyelesaian :

Konsentrasi HCl 32%

$$M = \frac{\rho \times \% \times 1000 \text{ mL}}{BM}$$

$$= \frac{1,159 \frac{\text{gr}}{\text{mL}} \times 0,32 \times 1000 \text{ mL}}{36,5 \text{ gr}}$$

$$M = 10,161$$

Konsentrasi HCl 1M

$$V_1 M_1 = V_2 M_2$$

$$V_1 \times 10,161 \text{ M} = 100 \text{ mL} \times 1 \text{ M}$$

$$V_1 = \frac{100 \text{ mL} \times 1 \text{ M}}{10,161 \text{ M}}$$

$$V_1 = 9,8415 \text{ mL}$$

Konsentrasi HCl 2M

$$V_1 M_1 = V_2 M_2$$

$$V_1 \times 10,161 \text{ M} = 100 \text{ mL} \times 2 \text{ M}$$

$$V_1 = \frac{100 \text{ mL} \times 2 \text{ M}}{10,161 \text{ M}} = 19,6831 \text{ mL}$$

Konsentrasi HCl 3M

$$V_1 M_1 = V_2 M_2$$

$$V_1 \times 10,161 \text{ M} = 100 \text{ mL} \times 3 \text{ M}$$

$$V_1 = \frac{100 \text{ mL} \times 3 \text{ M}}{10,161 \text{ M}}$$

$$V_1 = 29,5246 \text{ mL}$$

Konsentrasi HCl 4M

$$V_1 M_1 = V_2 M_2$$

$$V_1 \times 10,161 \text{ M} = 100 \text{ mL} \times 4 \text{ M}$$

$$V_1 = \frac{100 \text{ mL} \times 4 \text{ M}}{10,161 \text{ M}}$$

$$V_1 = 39,3662 \text{ mL}$$

Konsentrasi HCl 5M

$$V_1 M_1 = V_2 M_2$$

$$V_1 \times 10,161 \text{ M} = 100 \text{ mL} \times 5 \text{ M}$$

$$V_1 = \frac{100 \text{ mL} \times 5 \text{ M}}{10,161 \text{ M}}$$

$$V_1 = 49,2077 \text{ mL}$$

1.2.2 Perhitungan analisa kadar *tannin*

Diketahui :

Massa kristal asam oksalat	: 630 mg
Volume titran KMnO_4 (standarisasi)	: 27,3 mL
BM asam oksalat	: 126 g/mol
A (Volume titrasi titran KMnO_4)	: 14,7666 mL
B (Volume titrasi blanko)	: 14,3 mL
Massa sampel	: 1,5 gram

Penyelesaian :

$$\begin{aligned}
 N \text{ KMnO}_4 &= \frac{\frac{w}{BM} \times 2 \times \frac{25}{100}}{\text{Volume titran}} \\
 &= \frac{\frac{630 \text{ mg}}{126 \text{ mg/mmol}} \times 2 \times \frac{25}{100}}{27,3 \text{ mL}} = 0,09157
 \end{aligned}$$

Kadar *tannin* pada ekstrak biji alpukat

$$\begin{aligned}
 \% \text{ tannin} &= \frac{10 (A-B) \times N \times 0,00416}{\text{massa sampel (gr)}} \times 100\% \\
 &= \frac{10 (14,7666 \text{ mL} - 14,3 \text{ mL}) \times 0,09157 \times 0,00416}{1,5 \text{ gram}} \times 100\% \\
 &= 0,203008 \%
 \end{aligned}$$

1.2.3 Perhitungan laju korosi dengan penambahan bioinhibitor

1. Konsentrasi HCl 1M

1.1 Waktu perendaman 1 minggu (168 jam)

1.1.1 Massa pelat

Berat awal : 16,1645 gr

Berat akhir : 15,8654 gr

Massa = Berat awal – berat akhir

= 16,1645 gr - 15,8654 gr

= 0,2991 gr

1.1.2 Konstanta : $3,45 \times 10^6$ mpy

1.1.3 Luas permukaan (A)

panjang : 4 cm

lebar : 2,6 cm

tebal : 0,24 cm

$$\begin{aligned} A &= 2 ((p \times l) + (l \times t) + (p \times t)) \\ &= 2 ((4 \text{ cm} \times 2,6 \text{ cm}) + (2,6 \text{ cm} \times 0,24 \text{ cm}) + (4 \text{ cm} \times 0,24 \text{ cm})) \\ &= 23,968 \text{ cm}^2 \end{aligned}$$

1.1.4 Densitas pelat

massa awal : 16,1645 gr

A : 23,968 cm²

$$\begin{aligned} \rho &= \frac{\text{massa awal}}{A} \\ &= \frac{16,1645 \text{ gr}}{23,968 \text{ cm}^2} \\ &= 6,4761 \frac{\text{gr}}{\text{cm}^2} \end{aligned}$$

1.1.5 Laju korosi

Konstanta (K) = $3,45 \times 10^6$ mpy

Massa (w) = 0,2991 gr

A = 23,968 cm²

Densitas (ρ) = $6,4761 \frac{\text{gr}}{\text{cm}^2}$

Waktu (T) = 168 jam

$$\begin{aligned} \text{Laju korosi} &= \frac{K \times w}{A \times T \times \rho} \\ &= \frac{3,45 \times 10^6 \text{ mpy} \times 0,2991 \text{ gr}}{23,968 \text{ cm}^2 \times 168 \text{ jam} \times 6,4761 \frac{\text{gr}}{\text{cm}^2}} \\ &= 39,57097 \text{ mpy} \end{aligned}$$

Konversi :

$$\begin{aligned}
 \text{Laju korosi} &= 39,57097 \text{ mpy} \times \frac{0,547 \frac{\text{gr}}{\text{m}^2 \text{hari}}}{1 \text{ mpy}} \\
 &= 21,6453 \frac{\text{gr}}{\text{m}^2 \text{hari}} \\
 &= 21,6453 \frac{\text{gr}}{\text{m}^2 \text{hari}} \times \frac{7 \text{ hari}}{1 \text{ minggu}} \\
 &= 151,5172 \frac{\text{gr}}{\text{m}^2 \text{minggu}}
 \end{aligned}$$

1.2 Waktu perendaman 2 minggu (336 jam)

1.2.1 Massa pelat

Berat awal : 16,1645 gr

Berat akhir : 15,4377 gr

$$\begin{aligned}
 \text{Massa} &= \text{Berat awal} - \text{berat akhir} \\
 &= 16,1645 \text{ gr} - 15,4377 \text{ gr} \\
 &= 0,7268 \text{ gr}
 \end{aligned}$$

1.2.2 Konstanta : $3,45 \times 10^6$ mpy

1.2.3 Luas permukaan (A)

panjang : 4 cm

lebar : 2,6 cm

tebal : 0,24 cm

$$\begin{aligned}
 A &= 2 ((p \times l) + (l \times t) + (p \times t)) \\
 &= 2 ((4 \text{ cm} \times 2,6 \text{ cm}) + (2,6 \text{ cm} \times 0,24 \text{ cm}) + (4 \text{ cm} \times 0,24 \text{ cm})) \\
 &= 23,968 \text{ cm}^2
 \end{aligned}$$

1.2.4 Densitas pelat

massa awal : 16,1645 gr

A : 23,968 cm²

$$\begin{aligned}
 \rho &= \frac{\text{massa awal}}{A} \\
 &= \frac{16,1645 \text{ gr}}{23,968 \text{ cm}^2} = 6,4761 \frac{\text{gr}}{\text{cm}^2}
 \end{aligned}$$

1.2.5 Laju korosi

$$\text{Konstanta (K)} = 3,45 \times 10^6 \text{ mpy}$$

$$\text{Massa (w)} = 0,7268 \text{ gr}$$

$$A = 23,968 \text{ cm}^2$$

$$\text{Densitas } (\rho) = 6,4761 \frac{\text{gr}}{\text{cm}^2}$$

$$\text{Waktu (T)} = 336 \text{ jam}$$

$$\begin{aligned} \text{Laju korosi} &= \frac{K \times w}{A \times T \times \rho} \\ &= \frac{3,45 \times 10^6 \text{ mpy} \times 0,7268 \text{ gr}}{23,968 \text{ cm}^2 \times 336 \text{ jam} \times 6,4761 \frac{\text{gr}}{\text{cm}^2}} \\ &= 48,0778 \text{ mpy} \end{aligned}$$

Konversi :

$$\begin{aligned} \text{Laju korosi} &= 48,0778 \text{ mpy} \times \frac{0,547 \frac{\text{gr}}{\text{m}^2 \text{hari}}}{1 \text{ mpy}} \\ &= 26,2985 \frac{\text{gr}}{\text{m}^2 \text{hari}} \\ &= 26,2985 \frac{\text{gr}}{\text{m}^2 \text{hari}} \times \frac{7 \text{ hari}}{1 \text{ minggu}} \\ &= 184,0901 \frac{\text{gr}}{\text{m}^2 \text{minggu}} \end{aligned}$$

1.3 Waktu perendaman 3 minggu (504 jam)

1.3.1 Massa pelat

$$\text{Berat awal} : 16,1645 \text{ gr}$$

$$\text{Berat akhir} : 15,3653 \text{ gr}$$

$$\begin{aligned} \text{Massa} &= \text{Berat awal} - \text{berat akhir} \\ &= 16,1645 \text{ gr} - 15,3653 \text{ gr} \\ &= 0,7992 \text{ gr} \end{aligned}$$

1.3.2 Konstanta : $3,45 \times 10^6$ mpy

1.3.3 Luas permukaan (A)

panjang : 4 cm

lebar : 2,6 cm

tebal : 0,24 cm

$$\begin{aligned} A &= 2 ((p \times l) + (l \times t) + (p \times t)) \\ &= 2 ((4 \text{ cm} \times 2,6 \text{ cm}) + (2,6 \text{ cm} \times 0,24 \text{ cm}) + (4 \text{ cm} \times 0,24 \text{ cm})) \\ &= 23,968 \text{ cm}^2 \end{aligned}$$

1.3.4 Densitas pelat

massa awal : 16,1645 gr

A : 23,968 cm²

$$\begin{aligned} \rho &= \frac{\text{massa awal}}{A} \\ &= \frac{16,1645 \text{ gr}}{23,968 \text{ cm}^2} \\ &= 6,4761 \frac{\text{gr}}{\text{cm}^2} \end{aligned}$$

1.3.5 Laju korosi

Konstanta (K) = 3,45 x 10⁶ mpy

Massa (w) = 0,7992 gr

A = 23,968 cm²

Densitas (ρ) = 6,4761 $\frac{\text{gr}}{\text{cm}^2}$

Waktu (T) = 504 jam

$$\begin{aligned} \text{Laju korosi} &= \frac{K \times w}{A \times T \times \rho} \\ &= \frac{3,45 \times 10^6 \text{ mpy} \times 0,7992 \text{ gr}}{23,968 \text{ cm}^2 \times 504 \text{ jam} \times 6,4761 \frac{\text{gr}}{\text{cm}^2}} \\ &= 35,2447 \text{ mpy} \end{aligned}$$

Konversi :

$$\begin{aligned}
 \text{Laju korosi} &= 35,2447 \text{ mpy} \times \frac{0,547 \frac{\text{gr}}{\text{m}^2 \text{hari}}}{1 \text{ mpy}} \\
 &= 19,2788 \frac{\text{gr}}{\text{m}^2 \text{hari}} \\
 &= 19,2788 \frac{\text{gr}}{\text{m}^2 \text{hari}} \times \frac{7 \text{ hari}}{1 \text{ minggu}} \\
 &= 134,9521 \frac{\text{gr}}{\text{m}^2 \text{minggu}}
 \end{aligned}$$

1.4 Waktu perendaman 4 minggu (672 jam)

1.4.1 Massa pelat

Berat awal : 16,1645 gr

Berat akhir : 13,3837 gr

Massa = Berat awal – berat akhir

$$= 16,1645 \text{ gr} - 13,3837 \text{ gr}$$

$$= 2,7808 \text{ gr}$$

1.4.2 Konstanta : $3,45 \times 10^6$ mpy

1.4.3 Luas permukaan (A)

panjang : 4 cm

lebar : 2,6 cm

tebal : 0,24 cm

$$A = 2 ((p \times l) + (l \times t) + (p \times t))$$

$$= 2 ((4 \text{ cm} \times 2,6 \text{ cm}) + (2,6 \text{ cm} \times 0,24 \text{ cm}) + (4 \text{ cm} \times 0,24 \text{ cm}))$$

$$= 23,968 \text{ cm}^2$$

1.4.4 Densitas pelat

massa awal : 16,1645 gr

A : 23,968 cm²

$$\rho = \frac{\text{massa awal}}{A}$$

$$= \frac{16,1645 \text{ gr}}{23,968 \text{ cm}^2} = 6,4761 \frac{\text{gr}}{\text{cm}^2}$$

1.4.5 Laju korosi

$$\text{Konstanta (K)} = 3,45 \times 10^6 \text{ mpy}$$

$$\text{Massa (w)} = 2,7808 \text{ gr}$$

$$A = 23,968 \text{ cm}^2$$

$$\text{Densitas } (\rho) = 6,4761 \frac{\text{gr}}{\text{cm}^2}$$

$$\text{Waktu (T)} = 672 \text{ jam}$$

$$\begin{aligned} \text{Laju korosi} &= \frac{k \times w}{A \times T \times \rho} \\ &= \frac{3,45 \times 10^6 \text{ mpy} \times 2,7808 \text{ gr}}{23,968 \text{ cm}^2 \times 672 \text{ jam} \times 6,4761 \frac{\text{gr}}{\text{cm}^2}} \\ &= 91,9750 \text{ mpy} \end{aligned}$$

Konversi :

$$\begin{aligned} \text{Laju korosi} &= 91,970 \text{ mpy} \times \frac{0,547 \frac{\text{gr}}{\text{m}^2 \text{hari}}}{1 \text{ mpy}} \\ &= 50,3103 \frac{\text{gr}}{\text{m}^2 \text{hari}} \\ &= 50,3103 \frac{\text{gr}}{\text{m}^2 \text{hari}} \times \frac{7 \text{ hari}}{1 \text{ minggu}} \\ &= 352,1725 \frac{\text{gr}}{\text{m}^2 \text{minggu}} \end{aligned}$$

1.5 Waktu perendaman 5 minggu (840 jam)

1.5.1 Massa pelat

$$\text{Berat awal} : 16,1645 \text{ gr}$$

$$\text{Berat akhir} : 13,3615 \text{ gr}$$

$$\text{Massa} = \text{Berat awal} - \text{berat akhir}$$

$$= 16,1645 \text{ gr} - 13,3615 \text{ gr}$$

$$= 2,803 \text{ gr}$$

1.5.2 Konstanta : $3,45 \times 10^6$ mpy

1.5.3 Luas permukaan (A)

panjang : 4 cm

lebar : 2,6 cm

tebal : 0,24 cm

$$\begin{aligned}
 A &= 2 ((p \times l) + (l \times t) + (p \times t)) \\
 &= 2 ((4 \text{ cm} \times 2,6 \text{ cm}) + (2,6 \text{ cm} \times 0,24 \text{ cm}) + (4 \text{ cm} \times 0,24 \text{ cm})) \\
 &= 23,968 \text{ cm}^2
 \end{aligned}$$

1.5.4 Densitas pelat

massa awal : 16,1645 gr

A : 23,968 cm²

$$\begin{aligned}
 \rho &= \frac{\text{massa awal}}{A} \\
 &= \frac{16,1645 \text{ gr}}{23,968 \text{ cm}^2} \\
 &= 6,4761 \frac{\text{gr}}{\text{cm}^2}
 \end{aligned}$$

1.5.5 Laju korosi

Konstanta (K) = 3,45 x 10⁶ mpy

Massa (w) = 2,803 gr

A = 23,968 cm²Densitas (ρ) = 6,4761 $\frac{\text{gr}}{\text{cm}^2}$

Waktu (T) = 840 jam

$$\begin{aligned}
 \text{Laju korosi} &= \frac{K \times w}{A \times T \times \rho} \\
 &= \frac{3,45 \times 10^6 \text{ mpy} \times 2,803 \text{ gr}}{23,968 \text{ cm}^2 \times 840 \text{ jam} \times 6,4761 \frac{\text{gr}}{\text{cm}^2}} \\
 &= 74,1674 \text{ mpy}
 \end{aligned}$$

Konversi :

$$\begin{aligned}
 \text{Laju korosi} &= 74,1674 \text{ mpy} \times \frac{0,547 \frac{\text{gr}}{\text{m}^2 \text{hari}}}{1 \text{ mpy}} \\
 &= 40,5696 \frac{\text{gr}}{\text{m}^2 \text{hari}} = 283,9872 \frac{\text{gr}}{\text{m}^2 \text{minggu}}
 \end{aligned}$$

Dengan cara perhitungan yang sama, hasil perhitungan laju korosi yang terdapat pada konsentrasi HCl 2M, 3M, 4M, dan 5M (dengan penambahan bioinhibitor).

Dapat dilihat pada tabel berikut :

Tabel 1. Hasil perhitungan (Dengan bioinhibitor)

Konsentrasi HCl (M)	waktu (minggu)	w (gram)	Densitas (ρ)	Laju korosi		
				(mpy)	$\text{g/m}^2\text{hari}$	$\text{g/m}^2\text{minggu}$
1	1	0,2991	6,4761	39,5709	21,6453	151,5172
	2	0,7268		48,0778	26,2985	184,0901
	3	0,7992		35,2447	19,2788	134,9521
	4	2,7808		91,9750	50,3103	352,1725
	5	2,803		74,1674	40,5696	283,9872
2	1	0,2101	7,3690	24,4283	13,3622	93,5360
	2	1,4449		83,9992	45,9475	321,6331
	3	1,4827		57,4645	31,4330	220,0316
	4	1,9943		57,9693	31,7092	221,9645
	5	5,0062		116,4141	63,6785	445,7498
3	1	0,675	7,1606	80,7660	44,1790	309,2532
	2	3,0828		184,4337	100,8852	706,1969
	3	3,2968		131,4911	71,9256	503,4795
	4	7,4129		221,7447	121,2943	849,0605
	5	7,7135		184,5893	100,9703	706,7925
4	1	0,6771	7,1449	81,1949	44,4136	310,8955
	2	4,4598		267,4001	146,2678	1023,8752
	3	4,8256		192,8885	105,5100	738,5700
	4	5,724		171,5994	93,8649	657,0543
	5	5,974		143,2753	78,3716	548,6013
5	1	2,2544	7,4082	260,7298	142,6192	998,3347
	2	5,9754		345,5388	189,0097	1323,0681
	3	8,1183		312,9707	171,1949	1198,3648
	4	11,109		321,2110	175,7024	1229,9170
	5	11,207		259,2425	141,8056	992,6398

1.2.4 Perhitungan laju korosi tanpa penambahan bioinhibitor

1. Konsentrasi HCl 1M

1.1 Waktu perendaman 1 minggu (168 jam)

1.1.1 Massa pelat

Berat awal : 15,1751 gr

Berat akhir : 13,3814 gr

$$\begin{aligned} \text{Massa} &= \text{Berat awal} - \text{berat akhir} \\ &= 15,1751 \text{ gr} - 13,3814 \text{ gr} \\ &= 1,7937 \text{ gr} \end{aligned}$$

1.1.2 Konstanta : $3,45 \times 10^6$ mpy

1.1.3 Luas permukaan (A)

panjang : 4 cm

lebar : 2,6 cm

tebal : 0,24 cm

$$\begin{aligned} A &= 2 ((p \times l) + (l \times t) + (p \times t)) \\ &= 2 ((4 \text{ cm} \times 2,6 \text{ cm}) + (2,6 \text{ cm} \times 0,24 \text{ cm}) + (4 \text{ cm} \times 0,24 \text{ cm})) \\ &= 23,968 \text{ cm}^2 \end{aligned}$$

1.1.4 Densitas pelat

massa awal : 15,1751 gr

A : 23,968 cm²

$$\begin{aligned} \rho &= \frac{\text{massa awal}}{A} \\ &= \frac{15,1751 \text{ gr}}{23,968 \text{ cm}^2} \\ &= 6,0797 \frac{\text{gr}}{\text{cm}^2} \end{aligned}$$

1.1.5 Laju korosi

$$\text{Konstanta (K)} = 3,45 \times 10^6 \text{ mpy}$$

$$\text{Massa (w)} = 1,7937 \text{ gr}$$

$$A = 23,968 \text{ cm}^2$$

$$\text{Densitas } (\rho) = 6,0797 \frac{\text{gr}}{\text{cm}^2}$$

$$\text{Waktu (T)} = 168 \text{ jam}$$

$$\begin{aligned} \text{Laju korosi} &= \frac{K \times w}{A \times T \times \rho} \\ &= \frac{3,45 \times 10^6 \text{ mpy} \times 1,7937 \text{ gr}}{23,968 \text{ cm}^2 \times 168 \text{ jam} \times 6,0797 \frac{\text{gr}}{\text{cm}^2}} \\ &= 252,7789 \text{ mpy} \end{aligned}$$

Konversi :

$$\begin{aligned} \text{Laju korosi} &= 252,7789 \text{ mpy} \times \frac{0,547 \frac{\text{gr}}{\text{m}^2 \text{hari}}}{1 \text{ mpy}} \\ &= 138,2700 \frac{\text{gr}}{\text{m}^2 \text{hari}} \\ &= 138,2700 \frac{\text{gr}}{\text{m}^2 \text{hari}} \times \frac{7 \text{ hari}}{1 \text{ minggu}} \\ &= 967,8904 \frac{\text{gr}}{\text{m}^2 \text{minggu}} \end{aligned}$$

1.2 Waktu perendaman 2 minggu (336 jam)

1.2.1 Massa pelat

$$\text{Berat awal} : 15,1751 \text{ gr}$$

$$\text{Berat akhir} : 12,7819 \text{ gr}$$

$$\text{Massa} = \text{Berat awal} - \text{berat akhir}$$

$$= 15,1751 \text{ gr} - 12,7819 \text{ gr}$$

$$= 2,3932 \text{ gr}$$

1.2.2 Konstanta : $3,45 \times 10^6$ mpy

1.2.3 Luas permukaan (A)

panjang : 4 cm

lebar : 2,6 cm

tebal : 0,24 cm

$$\begin{aligned}
 A &= 2 ((p \times l) + (l \times t) + (p \times t)) \\
 &= 2 ((4 \text{ cm} \times 2,6 \text{ cm}) + (2,6 \text{ cm} \times 0,24 \text{ cm}) + (4 \text{ cm} \times 0,24 \text{ cm})) \\
 &= 23,968 \text{ cm}^2
 \end{aligned}$$

1.2.4 Densitas pelat

massa awal : 15,1751 gr

A : 23,968 cm²

$$\begin{aligned}
 \rho &= \frac{\text{massa awal}}{A} \\
 &= \frac{15,1751 \text{ gr}}{23,968 \text{ cm}^2} = 6,0797 \frac{\text{gr}}{\text{cm}^2}
 \end{aligned}$$

1.2.5 Laju korosi

Konstanta (K) = 3,45 x 10⁶ mpy

Massa (w) = 2,3932 gr

A = 23,968 cm²Densitas (ρ) = 6,0797 $\frac{\text{gr}}{\text{cm}^2}$

Waktu (T) = 336 jam

$$\begin{aligned}
 \text{Laju korosi} &= \frac{K \times w}{A \times T \times \rho} \\
 &= \frac{3,45 \times 10^6 \text{ mpy} \times 2,3932 \text{ gr}}{23,968 \text{ cm}^2 \times 336 \text{ jam} \times 6,0797 \frac{\text{gr}}{\text{cm}^2}} \\
 &= 168,6320 \text{ mpy}
 \end{aligned}$$

Konversi :

$$\begin{aligned}
 \text{Laju korosi} &= 168,6320 \text{ mpy} \times \frac{0,547 \frac{\text{gr}}{\text{m}^2 \text{hari}}}{1 \text{ mpy}} \\
 &= 92,2417 \frac{\text{gr}}{\text{m}^2 \text{hari}} \\
 &= 645,6919 \frac{\text{gr}}{\text{m}^2 \text{minggu}}
 \end{aligned}$$

1.3 Waktu perendaman 3 minggu (504 jam)

1.3.1 Massa pelat

Berat awal : 15,1751 gr

Berat akhir : 12,2904 gr

$$\begin{aligned} \text{Massa} &= \text{Berat awal} - \text{berat akhir} \\ &= 15,1751 \text{ gr} - 12,2904 \text{ gr} \\ &= 2,8847 \text{ gr} \end{aligned}$$

1.3.2 Konstanta : $3,45 \times 10^6$ mpy

1.3.3 Luas permukaan (A)

panjang : 4 cm

lebar : 2,6 cm

tebal : 0,24 cm

$$\begin{aligned} A &= 2 ((p \times l) + (l \times t) + (p \times t)) \\ &= 2 ((4 \text{ cm} \times 2,6 \text{ cm}) + (2,6 \text{ cm} \times 0,24 \text{ cm}) + (4 \text{ cm} \times 0,24 \text{ cm})) \\ &= 23,968 \text{ cm}^2 \end{aligned}$$

1.3.4 Densitas pelat

massa awal : 15,1751 gr

A : 23,968 cm²

$$\begin{aligned} \rho &= \frac{\text{massa awal}}{A} \\ &= \frac{15,1751 \text{ gr}}{23,968 \text{ cm}^2} \\ &= 6,0797 \frac{\text{gr}}{\text{cm}^2} \end{aligned}$$

1.3.5 Laju korosi

Konstanta (K) = $3,45 \times 10^6$ mpy

Massa (w) = 2,8847 gr

A = 23,968 cm²

Densitas (ρ) = $6,0797 \frac{\text{gr}}{\text{cm}^2}$

$$\text{Waktu (T)} = 504 \text{ jam}$$

$$\begin{aligned} \text{Laju korosi} &= \frac{K \times w}{A \times T \times \rho} \\ &= \frac{3,45 \times 10^6 \text{ mpy} \times 2,8847 \text{ gr}}{23,968 \text{ cm}^2 \times 504 \text{ jam} \times 6,0797 \frac{\text{gr}}{\text{cm}^2}} \\ &= 135,5097 \text{ mpy} \end{aligned}$$

Konversi :

$$\begin{aligned} \text{Laju korosi} &= 135,5097 \text{ mpy} \times \frac{0,547 \frac{\text{gr}}{\text{m}^2 \text{hari}}}{1 \text{ mpy}} \\ &= 74,1238 \frac{\text{gr}}{\text{m}^2 \text{hari}} \\ &= 74,1238 \frac{\text{gr}}{\text{m}^2 \text{hari}} \times \frac{7 \text{ hari}}{1 \text{ minggu}} \\ &= 518,8667 \frac{\text{gr}}{\text{m}^2 \text{minggu}} \end{aligned}$$

1.4 Waktu perendaman 4 minggu (672 jam)

1.4.1 Massa pelat

Berat awal : 15,1751 gr

Berat akhir : 12,2773 gr

$$\begin{aligned} \text{Massa} &= \text{Berat awal} - \text{berat akhir} \\ &= 15,1751 \text{ gr} - 12,2773 \text{ gr} \\ &= 2,8978 \text{ gr} \end{aligned}$$

1.4.2 Konstanta : $3,45 \times 10^6$ mpy

1.4.3 Luas permukaan (A)

panjang : 4 cm

lebar : 2,6 cm

tebal : 0,24 cm

$$\begin{aligned} A &= 2 ((p \times l) + (l \times t) + (p \times t)) \\ &= 2 ((4 \text{ cm} \times 2,6 \text{ cm}) + (2,6 \text{ cm} \times 0,24 \text{ cm}) + (4 \text{ cm} \times 0,24 \text{ cm})) \\ &= 23,968 \text{ cm}^2 \end{aligned}$$

1.4.4 Densitas pelat

massa awal : 15,1751 gr

A : 23,968 cm²

$$\rho = \frac{\text{massa awal}}{A}$$

$$= \frac{15,1751 \text{ gr}}{23,968 \text{ cm}^2} = 6,0797 \frac{\text{gr}}{\text{cm}^2}$$

1.4.5 Laju korosi

Konstanta (K) = 3,45 x 10⁶ mpy

Massa (w) = 2,8978 gr

A = 23,968 cm²

Densitas (ρ) = 6,0797 $\frac{\text{gr}}{\text{cm}^2}$

Waktu (T) = 672 jam

$$\text{Laju korosi} = \frac{K \times w}{A \times T \times \rho}$$

$$= \frac{3,45 \times 10^6 \text{ mpy} \times 2,8978 \text{ gr}}{23,968 \text{ cm}^2 \times 672 \text{ jam} \times 6,0797 \frac{\text{gr}}{\text{cm}^2}}$$

$$= 102,0938 \text{ mpy}$$

Konversi :

$$\text{Laju korosi} = 102,0938 \text{ mpy} \times \frac{0,547 \frac{\text{gr}}{\text{m}^2 \text{hari}}}{1 \text{ mpy}}$$

$$= 55,8453 \frac{\text{gr}}{\text{m}^2 \text{hari}}$$

$$= 390,9172 \frac{\text{gr}}{\text{m}^2 \text{minggu}}$$

1.5 Waktu perendaman 5 minggu (840 jam)

1.5.1 Massa pelat

Berat awal : 15,1751 gr

Berat akhir : 12,2769 gr

$$\text{Massa} = \text{Berat awal} - \text{berat akhir}$$

$$= 15,1751 \text{ gr} - 12,2769 \text{ gr}$$

$$= 2,8982 \text{ gr}$$

1.5.2 Konstanta : $3,45 \times 10^6$ mpy

1.5.3 Luas permukaan (A)

panjang : 4 cm

lebar : 2,6 cm

tebal : 0,24 cm

$$\begin{aligned} A &= 2 ((p \times l) + (l \times t) + (p \times t)) \\ &= 2 ((4 \text{ cm} \times 2,6 \text{ cm}) + (2,6 \text{ cm} \times 0,24 \text{ cm}) + (4 \text{ cm} \times 0,24 \text{ cm})) \\ &= 23,968 \text{ cm}^2 \end{aligned}$$

1.5.4 Densitas pelat

massa awal : 15,1751 gr

A : 23,968 cm²

$$\begin{aligned} \rho &= \frac{\text{massa awal}}{A} \\ &= \frac{15,1751 \text{ gr}}{23,968 \text{ cm}^2} \\ &= 6,0797 \frac{\text{gr}}{\text{cm}^2} \end{aligned}$$

1.5.5 Laju korosi

Konstanta (K) = $3,45 \times 10^6$ mpy

Massa (w) = 2,8982 gr

A = 23,968 cm²

Densitas (ρ) = $6,0797 \frac{\text{gr}}{\text{cm}^2}$

Waktu (T) = 840 jam

$$\begin{aligned} \text{Laju korosi} &= \frac{K \times w}{A \times T \times \rho} \\ &= \frac{3,45 \times 10^6 \text{ mpy} \times 2,8982 \text{ gr}}{23,968 \text{ cm}^2 \times 840 \text{ jam} \times 6,0797 \frac{\text{gr}}{\text{cm}^2}} \\ &= 81,6863 \text{ mpy} \end{aligned}$$

Konversi :

$$\begin{aligned} \text{Laju korosi} &= 81,6863 \text{ mpy} \times \frac{0,547 \frac{\text{gr}}{\text{m}^2 \text{hari}}}{1 \text{ mpy}} \\ &= 44,6824 \frac{\text{gr}}{\text{m}^2 \text{hari}} = 312,7769 \frac{\text{gr}}{\text{m}^2 \text{minggu}} \end{aligned}$$

Dengan cara perhitungan yang sama, hasil perhitungan laju korosi yang terdapat pada konsentrasi HCl 2M, 3M, 4M, dan 5M (tanpa menggunakan bioinhibitor).

Dapat dilihat pada tabel berikut :

Tabel 1. Hasil perhitungan (Tanpa bioinhibitor)

Konsentrasi HCl (M)	waktu (minggu)	w (gram)	Densitas (ρ)	Laju korosi		
				(mpy)	$\text{g/m}^2 \text{hari}$	$\text{g/m}^2 \text{minggu}$
1	1	1,7937	6,0797	252,7789	138,2700	967,8904
	2	2,3932		168,6320	92,2417	645,6919
	3	2,8847		135,5097	74,1238	518,8667
	4	2,8978		102,0938	55,8453	390,9172
	5	2,8982		81,6863	44,6824	312,7769
2	1	3,7081	6,9701	455,8135	249,3299	1745,3099
	2	7,7097		473,8525	259,1973	1814,3814
	3	8,0922		331,5744	181,3712	1269,5987
	4	8,1374		250,0699	136,7882	957,5176
	5	8,2062		201,7473	110,3558	772,4906
3	1	3,5423	6,6361	457,3492	250,1700	1751,1902
	2	8,5684		553,1365	302,5656	2117,9598
	3	9,4967		408,7088	223,5637	1564,9463
	4	9,7448		314,5397	172,0532	1204,3727
	5	10,4675		270,2934	147,8505	1034,9537
4	1	5,2519	6,6556	676,0892	369,8208	2588,7458
	2	8,5295		549,0111	300,3091	2102,1637
	3	9,0312		387,5357	211,9820	1483,8745
	4	9,2777		298,5849	163,3259	1143,2818
	5	9,412		242,3257	132,5521	927,8651
5	1	6,2194	7,1312	747,2454	408,7432	2861,2028
	2	10,0645		604,6123	330,7229	2315,0606
	3	10,9795		439,7198	240,5267	1683,6874
	4	12,1035		363,5513	198,8625	1392,0381
	5	12,2056		293,2945	160,4320	1123,0246

1.2.5 Perhitungan efisiensi bioinhibitor

1. Efisiensi bioinhibitor pada HCl 1M

1.1 Minggu 1

$$X_a : 252,7789 \text{ mpy}$$

$$X_b : 39,5709 \text{ mpy}$$

$$\begin{aligned} \text{Efisiensi bioinhibitor} &= \frac{x_a - x_b}{x_a} \times 100\% \\ &= \frac{252,7789 \text{ mpy} - 39,5709 \text{ mpy}}{252,7789 \text{ mpy}} \times 100\% \\ &= 84,3456 \% \end{aligned}$$

1.2 Minggu 2

$$X_a : 168,6320 \text{ mpy}$$

$$X_b : 48,0778 \text{ mpy}$$

$$\begin{aligned} \text{Efisiensi bioinhibitor} &= \frac{x_a - x_b}{x_a} \times 100\% \\ &= \frac{168,6320 \text{ mpy} - 48,0778 \text{ mpy}}{168,6320 \text{ mpy}} \times 100\% \\ &= 71,4894 \% \end{aligned}$$

1.3 Minggu 3

$$X_a : 135,5097 \text{ mpy}$$

$$X_b : 35,2447 \text{ mpy}$$

$$\begin{aligned} \text{Efisiensi bioinhibitor} &= \frac{x_a - x_b}{x_a} \times 100\% \\ &= \frac{135,5097 \text{ mpy} - 35,2447 \text{ mpy}}{135,5097 \text{ mpy}} \times 100\% \\ &= 73,9909 \% \end{aligned}$$

1.4 Minggu 4

$$X_a : 102,0938 \text{ mpy}$$

$$X_b : 91,9750 \text{ mpy}$$

$$\begin{aligned} \text{Efisiensi bioinhibitor} &= \frac{x_a - x_b}{x_a} \times 100\% \\ &= \frac{102,0938 \text{ mpy} - 91,9750 \text{ mpy}}{102,0938 \text{ mpy}} \times 100\% \\ &= 9,9112 \% \end{aligned}$$

1.5 Minggu 5

$$X_a : 81,6863 \text{ mpy}$$

$$X_b : 74,1674 \text{ mpy}$$

$$\begin{aligned} \text{Efisiensi bioinhibitor} &= \frac{x_a - x_b}{x_a} \times 100\% \\ &= \frac{81,6863 \text{ mpy} - 74,1674 \text{ mpy}}{81,6863 \text{ mpy}} \times 100\% \\ &= 9,2045 \% \end{aligned}$$

Dengan cara perhitungan yang sama, hasil perhitungan efisiensi bioinhibitor yang terdapat pada konsentrasi HCl 2M, 3M, 4M, dan 5M. Dapat dilihat pada tabel berikut :

Konsentrasi HCl (M)	Waktu (Minggu)	Laju korosi		Efisiensi bioinhibitor (%)
		Tanpa bioinhibitor (X_a)	Dengan bioinhibitor (X_b)	
1	1	252,7789	39,5709	84,3456
	2	168,6320	48,0778	71,4894
	3	135,5097	35,2447	73,9909
	4	102,0938	91,9750	9,9112
	5	81,6863	74,1674	9,2045
2	1	455,8135	24,4283	94,6407
	2	473,8525	83,9992	82,2731
	3	331,5744	57,4645	82,6692
	4	250,0699	57,9693	76,8187
	5	201,7473	116,4141	42,2970
3	1	457,3492	80,7660	82,3403
	2	553,1365	184,4337	66,6567
	3	408,7088	131,4911	67,8276
	4	314,5397	221,7447	29,5018
	5	270,2934	184,5893	31,7078
4	1	676,0892	81,1949	87,9904
	2	549,0111	267,4001	51,2942
	3	387,5357	192,8885	50,2269
	4	298,5849	171,5994	42,5291
	5	242,3257	143,2753	40,8748
5	1	747,2454	260,7298	65,1078
	2	604,6123	345,5388	42,8495
	3	439,7198	312,9707	28,8249
	4	363,5513	321,2110	11,6463
	5	293,2945	259,2425	11,6101

