

## DAFTAR PUSTAKA

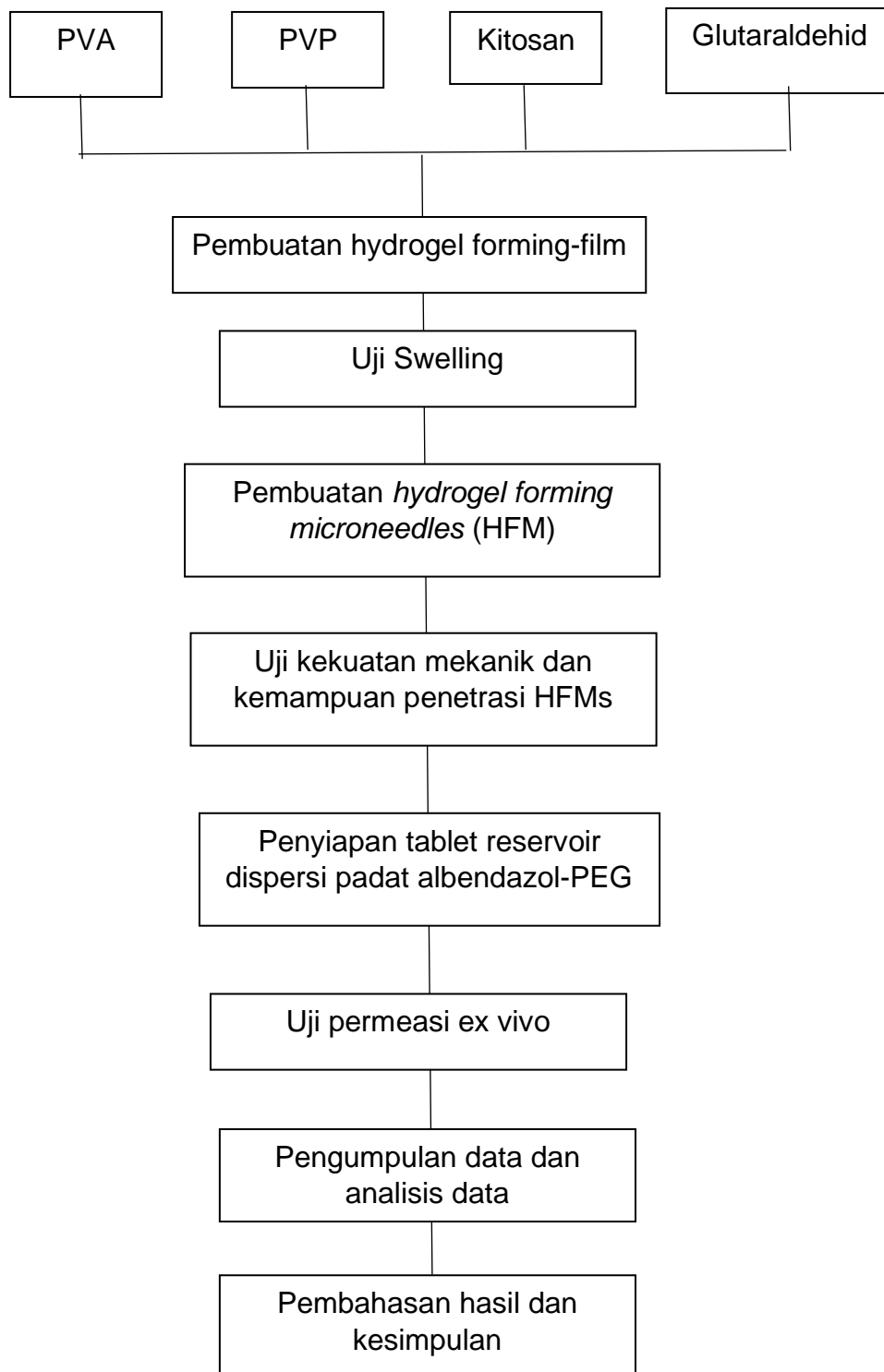
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## LAMPIRAN

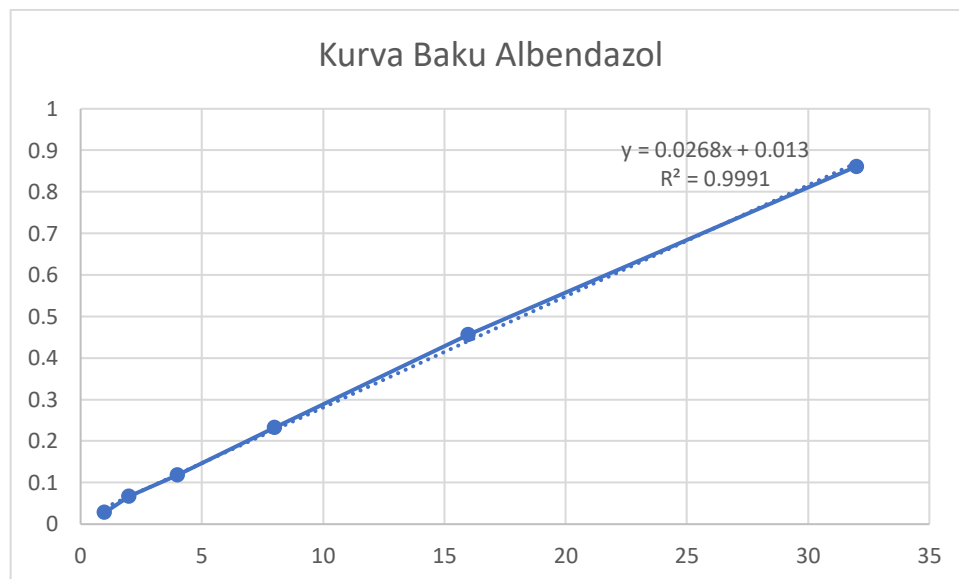
### Lampiran 1. Skema Kerja



## Lampiran 2. Kurva Baku Albendazol

Tabel 6. Kurva Baku Albendazol

| Konsentrasi | y1    | y2    | y3    | y avg    |
|-------------|-------|-------|-------|----------|
| 32          | 0.822 | 0.882 | 0.88  | 0.861333 |
| 16          | 0.46  | 0.463 | 0.445 | 0.456    |
| 8           | 0.241 | 0.238 | 0.22  | 0.233    |
| 4           | 0.126 | 0.121 | 0.109 | 0.118667 |
| 2           | 0.069 | 0.077 | 0.057 | 0.067667 |
| 1           | 0.031 | 0.03  | 0.023 | 0.028    |



Gambar 12. Grafik Kurva Baku Albendazol

### Lampiran 3. Hasil Uji *Hydrogel Forming Microneedle*

#### Lampiran 3.1 Hasil Uji *Swelling Hydrogel Film*

Tabel 7. Bobot *hydrogel film* setiap interval waktu.

| Formula | Bobot (g) |      |      |      |      |      |      |      |      |      |      |      |
|---------|-----------|------|------|------|------|------|------|------|------|------|------|------|
|         | 0 m       | 15 m | 30 m | 1 j  | 2 j  | 3 j  | 4 j  | 5 j  | 6 j  | 7 j  | 8 j  | 24 j |
| F1      | 0.41      | 1.04 | 1.57 | 2.39 | 3.47 | 4.10 | 4.46 | 4.46 | 4.45 | 4.39 | 4.46 | 4.08 |
|         | 0.41      | 1.04 | 1.55 | 2.37 | 3.40 | 3.91 | 4.44 | 4.43 | 4.38 | 4.33 | 4.40 | 4.03 |
|         | 0.41      | 1.03 | 1.56 | 2.35 | 3.25 | 3.88 | 4.39 | 4.42 | 4.36 | 4.32 | 4.39 | 4.02 |
| F2      | 0.42      | 1.27 | 2,00 | 2.85 | 3.5  | 3.83 | 4.09 | 3.97 | 3.86 | 3.75 | 3.78 | 3.33 |
|         | 0.42      | 1.26 | 1.99 | 2.80 | 3.43 | 3.75 | 4.05 | 3.96 | 3.86 | 3.74 | 3.77 | 3.32 |
|         | 0.42      | 1.28 | 1.98 | 2.77 | 3.40 | 3.73 | 4.02 | 3.96 | 3.85 | 3.74 | 3.77 | 3.22 |
| F3      | 0.41      | 0.89 | 1.26 | 1.95 | 2.89 | 3.62 | 4.33 | 4.51 | 4.55 | 4.60 | 4.60 | 4.27 |
|         | 0.41      | 0.89 | 1.28 | 1.95 | 2.87 | 3.60 | 4.34 | 4.50 | 4.54 | 4.59 | 4.60 | 4.27 |
|         | 0.42      | 0.88 | 1.27 | 1.94 | 2.85 | 3.59 | 4.31 | 4.5  | 4.26 | 4.58 | 4.60 | 4.27 |

#### Contoh Perhitungan persentase *swelling hydrogel film*

Diketahui F1 replikasi pertama pada jam ke-0 bobot *hydrogel* 0.41 gram dan jam ke-24 bobot *hydrogel* 4.08 gram, maka :

$$\begin{aligned}
 \%Swelling &= \frac{\text{Bobot pada interval waktu tertentu} - \text{Bobot awal}}{\text{Bobot awal}} \times 100\% \\
 &= \frac{4.08 \text{ gram} - 0.41 \text{ gram}}{0.41 \text{ gram}} \times 100\% \\
 &= 895.12\%
 \end{aligned}$$

**Lampiran 3.2 Hasil Uji Kekuatan Mekanik dan Kemampuan Penetrasi**  
***Hydrogel Forming Microneedle***

**Tabel 8. Uji Kekuatan Mekanik**

| <b>Formula</b> | <b>Sebelum Uji<br/>Kekuatan Mekanik<br/>(<math>\mu\text{m}</math>)</b> | <b>Setelah Uji<br/>Kekuatan Mekanik<br/>(<math>\mu\text{m}</math>)</b> | <b>Persentase<br/>Kekuatan<br/>Mekanik (%)</b> |
|----------------|--|--|--|
|                | 708  | 639  | 9,74   |
| F1             | 728  | 641  | 11,95  |
|                | 719  | 637  | 11,40  |
|                | 722  | 703  | 2,63   |
| F2             | 718  | 689  | 4,04   |
|                | 711  | 698  | 1,83   |
|                | 723  | 677  | 6,36   |
| F3             | 721  | 701  | 2,77   |
|                | 712  | 688  | 3,37   |

Tabel 9. Uji Kemampuan Penetrasi

| Lapisan ke- | Formula |     |     |             |     |     |     |             |     |     |     |             |
|-------------|---------|-----|-----|-------------|-----|-----|-----|-------------|-----|-----|-----|-------------|
|             | F1      |     |     | % Penetrasi | F2  |     |     | % Penetrasi | F3  |     |     | % Penetrasi |
| 1           | 100     | 100 | 100 | 100         | 100 | 100 | 100 | 100         | 100 | 100 | 100 | 100         |
| 2           | 100     | 100 | 100 | 100         | 100 | 100 | 100 | 100         | 100 | 100 | 100 | 100         |
| 3           | 75      | 88  | 81  | 81.33       | 91  | 98  | 93  | 94          | 100 | 100 | 100 | 100         |
| 4           | 0       | 0   | 0   | 0           | 29  | 31  | 22  | 27.33       | 87  | 77  | 71  | 78.33       |
| 5           | 0       | 0   | 0   | 0           | 0   | 0   | 0   | 0           | 11  | 18  | 22  | 17          |
| 6           | 0       | 0   | 0   | 0           | 0   | 0   | 0   | 0           | 0   | 0   | 0   | 0           |
| 7           | 0       | 0   | 0   | 0           | 0   | 0   | 0   | 0           | 0   | 0   | 0   | 0           |
| 8           | 0       | 0   | 0   | 0           | 0   | 0   | 0   | 0           | 0   | 0   | 0   | 0           |

#### Contoh Perhitungan persentase penurunan tinggi *needle*

Diketahui F1 replikasi pertama sebelum dilakukan pengujian kekuatan mekanik, tinggi microneedle berukuran 708  $\mu\text{m}$  dan setelah dilakukan pengujian tingginya menjadi 639  $\mu\text{m}$ , maka :

$$\begin{aligned}
 \% \text{Kekuatan Mekanik} &= \frac{\text{Tinggi sebelum uji} - \text{Tinggi setelah uji}}{\text{Tinggi Sebelum uji}} \times 100\% \\
 &= \frac{708 \mu\text{m} - 639 \mu\text{m}}{708 \mu\text{m}} \times 100\% \\
 &= 9,74\%
 \end{aligned}$$

#### Contoh Perhitungan persentase penetrasi lapisan ke-n

Diketahui F1 replikasi pertama sebelum dilakukan pengujian kekuatan mekanik, tinggi microneedle berukuran 708  $\mu\text{m}$  dan setelah dilakukan pengujian tingginya menjadi 639  $\mu\text{m}$ , maka :

$$\begin{aligned}
 \% \text{Kekuatan Mekanik} &= \frac{\text{Tinggi sebelum uji} - \text{Tinggi setelah uji}}{\text{Tinggi Sebelum uji}} \times 100\% \\
 &= \frac{708 \mu\text{m} - 639 \mu\text{m}}{708 \mu\text{m}} \times 100\% \\
 &= 9,74\%
 \end{aligned}$$



### Lampiran 3.3 Hasil Uji Permeasi Ex Vivo

Tabel 10. Persentase permeasi F1

| Waktu (jam) | Abs   | Concentration ( $\mu\text{g/ml}$ ) | 0.5 ml ( $\mu\text{g}$ ) | Dilution factor | 8 ml (mg) | Correction factor | ABZ permeated (mg) | % permeasi | Average (mg) $\pm$ SD |
|-------------|-------|------------------------------------|--------------------------|-----------------|-----------|-------------------|--------------------|------------|-----------------------|
| 0.25        | 0.101 | 3.22                               | 3.22                     | 1               | 0.03      | 0                 | 0.03               | 0.02       | 0.03 $\pm$ 0.00       |
|             | 0.089 | 2.76                               | 2.76                     | 1               | 0.02      | 0                 | 0.02               | 0.02       |                       |
|             | 0.118 | 3.88                               | 3.88                     | 1               | 0.03      | 0                 | 0.03               | 0.03       |                       |
| 0.5         | 0.131 | 4.38                               | 4.38                     | 1               | 0.04      | 0.003             | 0.04               | 0.03       | 0.04 $\pm$ 0.00       |
|             | 0.151 | 5.15                               | 5.15                     | 1               | 0.04      | 0.003             | 0.04               | 0.04       |                       |
|             | 0.149 | 5.07                               | 5.07                     | 1               | 0.04      | 0.004             | 0.04               | 0.04       |                       |
| 0.75        | 0.198 | 6.95                               | 6.95                     | 1               | 0.06      | 0.008             | 0.06               | 0.05       | 0.06 $\pm$ 0.01       |
|             | 0.166 | 5.72                               | 5.72                     | 1               | 0.05      | 0.008             | 0.05               | 0.04       |                       |
|             | 0.201 | 7.07                               | 7.07                     | 1               | 0.06      | 0.009             | 0.07               | 0.05       |                       |
| 1           | 0.276 | 9.95                               | 9.95                     | 1               | 0.08      | 0.015             | 0.09               | 0.08       | 0.09 $\pm$ 0.01       |
|             | 0.233 | 8.30                               | 8.30                     | 1               | 0.07      | 0.014             | 0.08               | 0.06       |                       |
|             | 0.281 | 10.15                              | 10.15                    | 1               | 0.08      | 0.016             | 0.10               | 0.08       |                       |
| 2           | 0.41  | 15.11                              | 15.11                    | 1               | 0.12      | 0.025             | 0.15               | 0.12       | 0.16 $\pm$ 0.01       |
|             | 0.456 | 16.88                              | 16.88                    | 1               | 0.14      | 0.022             | 0.16               | 0.13       |                       |
|             | 0.482 | 17.88                              | 17.88                    | 1               | 0.14      | 0.026             | 0.17               | 0.14       |                       |
| 3           | 0.701 | 26.30                              | 26.30                    | 1               | 0.21      | 0.040             | 0.25               | 0.20       | 0.25 $\pm$ 0.001      |
|             | 0.667 | 24.99                              | 24.99                    | 1               | 0.20      | 0.039             | 0.24               | 0.19       |                       |
|             | 0.691 | 25.92                              | 25.92                    | 1               | 0.21      | 0.044             | 0.25               | 0.20       |                       |

| Waktu (jam) | Abs   | Concentration (µg/ml) | 0.5 ml (µg) | Dilution factor | 8 ml (mg) | Correction factor | ABZ permeated (mg) | % permeasi | Average (mg)±SD |
|-------------|-------|-----------------------|-------------|-----------------|-----------|-------------------|--------------------|------------|-----------------|
| 4           | 0.819 | 30.84                 | 30.84       | 2               | 0.49      | 0.066             | 0.56               | 0.45       | 0.54±0.01       |
|             | 0.782 | 29.42                 | 29.42       | 2               | 0.47      | 0.064             | 0.53               | 0.43       |                 |
|             | 0.779 | 29.30                 | 29.30       | 2               | 0.47      | 0.070             | 0.54               | 0.43       |                 |
| 5           | 0.711 | 26.68                 | 26.68       | 4               | 0.85      | 0.097             | 0.95               | 0.76       | 0.94±0.01       |
|             | 0.698 | 26.18                 | 26.18       | 4               | 0.84      | 0.093             | 0.93               | 0.75       |                 |
|             | 0.702 | 26.34                 | 26.34       | 4               | 0.84      | 0.099             | 0.94               | 0.75       |                 |
| 6           | 0.532 | 19.80                 | 19.80       | 6               | 0.95      | 0.123             | 1.07               | 0.86       | 1.20±0.11       |
|             | 0.611 | 22.84                 | 22.84       | 6               | 1.10      | 0.119             | 1.22               | 0.97       |                 |
|             | 0.653 | 24.45                 | 24.45       | 6               | 1.17      | 0.126             | 1.30               | 1.04       |                 |
| 7           | 0.811 | 30.53                 | 30.53       | 6               | 1.47      | 0.143             | 1.61               | 1.29       | 1.61±0.03       |
|             | 0.798 | 30.03                 | 30.03       | 6               | 1.44      | 0.142             | 1.58               | 1.27       |                 |
|             | 0.822 | 30.95                 | 30.95       | 6               | 1.49      | 0.150             | 1.64               | 1.31       |                 |
| 8           | 0.618 | 23.11                 | 23.11       | 10              | 1.85      | 0.174             | 2.02               | 1.63       | 1.95±0.01       |
|             | 0.561 | 20.92                 | 20.92       | 10              | 1.67      | 0.172             | 1.85               | 1.48       |                 |
|             | 0.598 | 22.34                 | 22.34       | 10              | 1.79      | 0.181             | 1.97               | 1.57       |                 |
| 24          | 0.819 | 30.84                 | 30.84       | 15              | 3.70      | 0.197             | 3.90               | 3.119      | 3.87±0.06       |
|             | 0.798 | 30.03                 | 30.03       | 15              | 3.60      | 0.193             | 3.80               | 3.04       |                 |
|             | 0.821 | 30.92                 | 30.92       | 15              | 3.71      | 0.203             | 3.91               | 3.13       |                 |

### Contoh Perhitungan persentase permeasi F1

Diketahui jam ke- 0,25 replikasi pertama jumlah albendazol yang terpermeasi adalah 0,03 mg dengan jumlah obat dalam sediaan 125 mg, maka :

$$\begin{aligned}\% \text{Permease} &= \frac{\text{Jumlah terpermeasi}}{\text{Jumlah Obat dalam Sediaan}} \times 100\% \\ &= \frac{0,03 \text{ mg}}{125 \text{ mg}} \times 100\% \\ &= 0,02\%\end{aligned}$$

$$\begin{aligned}\text{Jumlah obat dalam sediaan} &= 50\% \times 250 \text{ mg} \\ &= 125 \text{ mg}\end{aligned}$$

**Tabel 11. Persentase permeasi F2**

| Waktu (jam) | Abs   | Concentration (µg/ml) | 0.5 ml (µg) | Dilution factor | 8 ml (mg) | Correction factor | ABZ permeated (mg) | % permeasi | Average (mg)±SD |
|-------------|-------|-----------------------|-------------|-----------------|-----------|-------------------|--------------------|------------|-----------------|
| 0.25        | 0.069 | 1.99                  | 1.99        | 1               | 0.02      | 0                 | 0.02               | 0.01       | 0.02±0.00       |
|             | 0.072 | 2.11                  | 2.11        | 1               | 0.02      | 0                 | 0.02               | 0.01       |                 |
|             | 0.066 | 1.88                  | 1.88        | 1               | 0.02      | 0                 | 0.02               | 0.01       |                 |
| 0.5         | 0.092 | 2.88                  | 2.88        | 1               | 0.02      | 0.002             | 0.03               | 0.02       | 0.03±0.002      |
|             | 0.101 | 3.22                  | 3.22        | 1               | 0.03      | 0.002             | 0.03               | 0.02       |                 |
|             | 0.088 | 2.72                  | 2.72        | 1               | 0.02      | 0.002             | 0.02               | 0.02       |                 |
| 0.75        | 0.132 | 4.42                  | 4.42        | 1               | 0.04      | 0.005             | 0.04               | 0.03       | 0.04±0.00       |
|             | 0.144 | 4.88                  | 4.88        | 1               | 0.04      | 0.005             | 0.04               | 0.04       |                 |
|             | 0.123 | 4.07                  | 4.07        | 1               | 0.03      | 0.005             | 0.04               | 0.03       |                 |
| 1           | 0.202 | 7.11                  | 7.11        | 1               | 0.06      | 0.009             | 0.07               | 0.05       | 0.07±0.00       |
|             | 0.198 | 6.95                  | 6.95        | 1               | 0.06      | 0.010             | 0.07               | 0.05       |                 |
|             | 0.181 | 6.30                  | 6.30        | 1               | 0.05      | 0.009             | 0.06               | 0.05       |                 |
| 2           | 0.362 | 13.26                 | 13.26       | 1               | 0.11      | 0.016             | 0.12               | 0.10       | 0.13±0.01       |
|             | 0.398 | 14.65                 | 14.65       | 1               | 0.12      | 0.017             | 0.13               | 0.11       |                 |
|             | 0.382 | 14.03                 | 14.03       | 1               | 0.11      | 0.015             | 0.13               | 0.10       |                 |
| 3           | 0.518 | 19.26                 | 19.26       | 1               | 0.15      | 0.030             | 0.18               | 0.15       | 0.20±0.02       |
|             | 0.609 | 22.76                 | 22.76       | 1               | 0.18      | 0.032             | 0.21               | 0.17       |                 |
|             | 0.619 | 23.15                 | 23.15       | 1               | 0.19      | 0.029             | 0.21               | 0.17       |                 |
| 4           | 0.511 | 18.99                 | 18.99       | 2               | 0.30      | 0.049             | 0.35               | 0.28       | 0.33±0.03       |
|             | 0.401 | 14.76                 | 14.76       | 2               | 0.24      | 0.055             | 0.29               | 0.23       |                 |
|             | 0.498 | 18.49                 | 18.49       | 2               | 0.30      | 0.052             | 0.35               | 0.28       |                 |

| Waktu (jam) | Abs   | Concentration (µg/ml) | 0.5 ml (µg) | Dilution factor | 8 ml (mg) | Correction factor | ABZ permeated (mg) | % permeasi | Average (mg)±SD |
|-------------|-------|-----------------------|-------------|-----------------|-----------|-------------------|--------------------|------------|-----------------|
| 5           | 0.502 | 18.65                 | 18.65       | 2               | 0.30      | 0.068             | 0.37               | 0.29       | 0.41±0.03       |
|             | 0.618 | 23.11                 | 23.11       | 2               | 0.37      | 0.069             | 0.44               | 0.35       |                 |
|             | 0.598 | 22.34                 | 22.34       | 2               | 0.36      | 0.071             | 0.43               | 0.34       |                 |
| 6           | 0.718 | 26.95                 | 26.95       | 4               | 0.86      | 0.087             | 0.95               | 0.76       | 1.01±0.05       |
|             | 0.801 | 30.15                 | 30.15       | 4               | 0.97      | 0.092             | 1.06               | 0.85       |                 |
|             | 0.762 | 28.65                 | 28.65       | 4               | 0.92      | 0.093             | 1.01               | 0.81       |                 |
| 7           | 0.671 | 25.15                 | 25.15       | 6               | 1.21      | 0.114             | 1.32               | 1.06       | 1.34±0.02       |
|             | 0.666 | 24.95                 | 24.95       | 6               | 1.20      | 0.123             | 1.32               | 1.06       |                 |
|             | 0.691 | 25.92                 | 25.92       | 6               | 1.24      | 0.122             | 1.37               | 1.09       |                 |
| 8           | 0.761 | 28.61                 | 28.61       | 6               | 1.37      | 0.139             | 1.51               | 1.21       | 1.58±0.06       |
|             | 0.818 | 30.80                 | 30.80       | 6               | 1.48      | 0.148             | 1.63               | 1.30       |                 |
|             | 0.798 | 30.03                 | 30.03       | 6               | 1.44      | 0.148             | 1.59               | 1.27       |                 |
| 24          | 0.672 | 25.18                 | 25.18       | 15              | 3.02      | 0.167             | 3.19               | 2.55       | 3.11±0.25       |
|             | 0.592 | 22.11                 | 22.11       | 15              | 2.65      | 0.178             | 2.83               | 2.27       |                 |
|             | 0.698 | 26.18                 | 26.18       | 15              | 3.14      | 0.178             | 3.32               | 2.66       |                 |

### Contoh Perhitungan persentase permeasi F2

Diketahui jam ke- 0,25 replikasi pertama jumlah albendazol yang terpermeasi adalah 0,02 mg dengan jumlah obat dalam sediaan 125 mg, maka :

$$\begin{aligned}\% \text{Permease} &= \frac{\text{Jumlah terpermeasi}}{\text{Jumlah Obat dalam Sediaan}} \times 100\% \\ &= \frac{0,02 \text{ mg}}{125 \text{ mg}} \times 100\% \\ &= 0,01\%\end{aligned}$$

$$\begin{aligned}\text{Jumlah obat dalam sediaan} &= 50\% \times 250 \text{ mg} \\ &= 125 \text{ mg}\end{aligned}$$

**Tabel 12. Persentase permeasi F3**

| Waktu (jam) | Abs   | Concentration (µg/ml) | 0.5 ml (µg) | Dilution factor | 8 ml (mg) | Correction factor | ABZ permeated (mg) | % permeasi | Average (mg)±SD |
|-------------|-------|-----------------------|-------------|-----------------|-----------|-------------------|--------------------|------------|-----------------|
| 0.25        | 0.045 | 1.07                  | 1.07        | 1               | 0.01      | 0                 | 0.01               | 0.01       | 0.01±0.00       |
|             | 0.028 | 0.42                  | 0.42        | 1               | 0.00      | 0                 | 0.00               | 0.00       |                 |
|             | 0.033 | 0.61                  | 0.61        | 1               | 0.01      | 0                 | 0.01               | 0.00       |                 |
| 0.5         | 0.089 | 2.76                  | 2.76        | 1               | 0.02      | 0.001             | 0.02               | 0.02       | 0.02±0.004      |
|             | 0.063 | 1.76                  | 1.76        | 1               | 0.01      | 0.000             | 0.02               | 0.01       |                 |
|             | 0.077 | 2.30                  | 2.30        | 1               | 0.02      | 0.001             | 0.02               | 0.02       |                 |
| 0.75        | 0.091 | 2.84                  | 2.84        | 1               | 0.02      | 0.004             | 0.03               | 0.02       | 0.03±0.00       |
|             | 0.112 | 3.65                  | 3.65        | 1               | 0.03      | 0.002             | 0.03               | 0.03       |                 |
|             | 0.098 | 3.11                  | 3.11        | 1               | 0.03      | 0.003             | 0.03               | 0.02       |                 |
| 1           | 0.138 | 4.65                  | 4.65        | 1               | 0.04      | 0.007             | 0.04               | 0.04       | 0.04±0.00       |
|             | 0.142 | 4.80                  | 4.80        | 1               | 0.04      | 0.006             | 0.04               | 0.04       |                 |
|             | 0.119 | 3.92                  | 3.92        | 1               | 0.03      | 0.006             | 0.04               | 0.03       |                 |
| 2           | 0.276 | 9.95                  | 9.95        | 1               | 0.08      | 0.011             | 0.09               | 0.07       | 0.09±0.01       |
|             | 0.298 | 10.80                 | 10.80       | 1               | 0.09      | 0.011             | 0.10               | 0.08       |                 |
|             | 0.251 | 8.99                  | 8.99        | 1               | 0.07      | 0.010             | 0.08               | 0.07       |                 |
| 3           | 0.487 | 18.07                 | 18.07       | 1               | 0.15      | 0.021             | 0.17               | 0.13       | 0.16±0.011      |
|             | 0.418 | 15.42                 | 15.42       | 1               | 0.12      | 0.021             | 0.15               | 0.12       |                 |
|             | 0.466 | 17.26                 | 17.26       | 1               | 0.14      | 0.019             | 0.16               | 0.13       |                 |
| 4           | 0.818 | 30.80                 | 30.80       | 1               | 0.25      | 0.039             | 0.29               | 0.23       | 0.28±0.01       |
|             | 0.782 | 29.42                 | 29.42       | 1               | 0.24      | 0.037             | 0.27               | 0.22       |                 |
|             | 0.821 | 30.92                 | 30.92       | 1               | 0.25      | 0.036             | 0.28               | 0.23       |                 |

| Waktu (jam) | Abs   | Concentration (µg/ml) | 0.5 ml (µg) | Dilution factor | 8 ml (mg) | Correction factor | ABZ permeated (mg) | % permeasi | Average (mg)±SD |
|-------------|-------|-----------------------|-------------|-----------------|-----------|-------------------|--------------------|------------|-----------------|
| 5           | 0.376 | 13.80                 | 13.80       | 2               | 0.22      | 0.070             | 0.29               | 0.23       | 0.30±0.01       |
|             | 0.416 | 15.34                 | 15.34       | 2               | 0.25      | 0.066             | 0.31               | 0.25       |                 |
|             | 0.391 | 14.38                 | 14.38       | 2               | 0.23      | 0.067             | 0.30               | 0.24       |                 |
| 6           | 0.618 | 23.11                 | 23.11       | 2               | 0.37      | 0.084             | 0.45               | 0.36       | 0.44±0.02       |
|             | 0.561 | 20.92                 | 20.92       | 2               | 0.34      | 0.082             | 0.42               | 0.33       |                 |
|             | 0.622 | 23.26                 | 23.26       | 2               | 0.37      | 0.081             | 0.45               | 0.36       |                 |
| 7           | 0.517 | 19.22                 | 19.22       | 4               | 0.62      | 0.107             | 0.72               | 0.58       | 0.76±0.05       |
|             | 0.601 | 22.45                 | 22.45       | 4               | 0.72      | 0.103             | 0.82               | 0.66       |                 |
|             | 0.538 | 20.03                 | 20.03       | 4               | 0.64      | 0.105             | 0.75               | 0.60       |                 |
| 8           | 0.719 | 26.99                 | 26.99       | 5               | 1.08      | 0.126             | 1.21               | 0.97       | 1.16±0.04       |
|             | 0.687 | 25.76                 | 25.76       | 5               | 1.03      | 0.125             | 1.16               | 0.92       |                 |
|             | 0.663 | 24.84                 | 24.84       | 5               | 0.99      | 0.125             | 1.12               | 0.90       |                 |
| 24          | 0.817 | 30.76                 | 30.76       | 10              | 2.46      | 0.153             | 2.61               | 2.09       | 2.45±0.24       |
|             | 0.798 | 30.03                 | 30.03       | 10              | 2.40      | 0.151             | 2.55               | 2.04       |                 |
|             | 0.673 | 25.22                 | 25.22       | 10              | 2.03      | 0.150             | 2.17               | 1.73       |                 |



### Contoh Perhitungan persentase permeasi F3

Diketahui jam ke- 0,25 replikasi pertama jumlah albendazol yang terpermeasi adalah 0,01 mg dengan jumlah obat dalam sediaan 125 mg, maka :

$$\begin{aligned}\% \text{Permease} &= \frac{\text{Jumlah terpermeasi}}{\text{Jumlah Obat dalam Sediaan}} \times 100\% \\ &= \frac{0,01 \text{ mg}}{125 \text{ mg}} \times 100\% \\ &= 0,01\%\end{aligned}$$

$$\begin{aligned}\text{Jumlah obat dalam sediaan} &= 50\% \times 250 \text{ mg} \\ &= 125 \text{ mg}\end{aligned}$$

## Lampiran 4. Data Hasil Analisis Statistika

### Lampiran 4.1 Uji Swelling *Hydrogel Forming Film*

#### Tests of Normality

|          | formula | Kolmogorov-Smirnov <sup>a</sup> |    |      | Shapiro-Wilk |    |      |
|----------|---------|---------------------------------|----|------|--------------|----|------|
|          |         | Statistic                       | df | Sig. | Statistic    | df | Sig. |
| swelling | F1      | .337                            | 3  | .    | .855         | 3  | .253 |
|          | F2      | .347                            | 3  | .    | .836         | 3  | .203 |
|          | F3      | .245                            | 3  | .    | .971         | 3  | .672 |

a. Lilliefors Significance Correction

#### ANOVA

| swelling       |                |    |             |         |      |  |
|----------------|----------------|----|-------------|---------|------|--|
|                | Sum of Squares | df | Mean Square | F       | Sig. |  |
| Between Groups | 100358.978     | 2  | 50179.489   | 614.620 | .000 |  |
| Within Groups  | 489.858        | 6  | 81.643      |         |      |  |
| Total          | 100848.836     | 8  |             |         |      |  |

#### Multiple Comparisons

Dependent Variable: swelling

|              | (I) formula | (J) formula | Mean Difference |            | Sig. | 95% Confidence Interval |             |
|--------------|-------------|-------------|-----------------|------------|------|-------------------------|-------------|
|              |             |             | (I-J)           | Std. Error |      | Lower Bound             | Upper Bound |
| Tukey HSD    | f1          | f2          | 196.76571*      | 7.37758    | .000 | 174.1293                | 219.4022    |
|              |             | f3          | -47.01979*      | 7.37758    | .002 | -69.6562                | -24.3833    |
|              | f2          | f1          | -196.76571*     | 7.37758    | .000 | -219.4022               | -174.1293   |
|              |             | f3          | -243.78550*     | 7.37758    | .000 | -266.4219               | -221.1491   |
|              | f3          | f1          | 47.01979*       | 7.37758    | .002 | 24.3833                 | 69.6562     |
|              |             | f2          | 243.78550*      | 7.37758    | .000 | 221.1491                | 266.4219    |
| Games-Howell | f1          | f2          | 196.76571*      | 8.08758    | .002 | 154.5725                | 238.9590    |
|              |             | f3          | -47.01979*      | 4.49689    | .004 | -66.1224                | -27.9171    |
|              | f2          | f1          | -196.76571*     | 8.08758    | .002 | -238.9590               | -154.5725   |
|              |             | f3          | -243.78550*     | 8.81222    | .000 | -280.7046               | -206.8664   |
|              | f3          | f1          | 47.01979*       | 4.49689    | .004 | 27.9171                 | 66.1224     |
|              |             | f2          | 243.78550*      | 8.81222    | .000 | 206.8664                | 280.7046    |

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

## Lampiran 4.2 Uji Kekuatan Mekanik *Hydrogel Forming Microneedle*

### Tests of Normality

|                  | formula | Kolmogorov-Smirnov <sup>a</sup> |    |      | Shapiro-Wilk |    |      |
|------------------|---------|---------------------------------|----|------|--------------|----|------|
|                  |         | Statistic                       | df | Sig. | Statistic    | df | Sig. |
| kekuatan_mekanik | f1      | .292                            | 3  | .    | .923         | 3  | .462 |
|                  | f2      | .239                            | 3  | .    | .975         | 3  | .698 |
|                  | f3      | .327                            | 3  | .    | .871         | 3  | .299 |

a. Lilliefors Significance Correction

### ANOVA

| kekuatan_mekanik |                |    |             |        |      |  |
|------------------|----------------|----|-------------|--------|------|--|
|                  | Sum of Squares | df | Mean Square | F      | Sig. |  |
| Between Groups   | 116.126        | 2  | 58.063      | 27.798 | .001 |  |
| Within Groups    | 12.533         | 6  | 2.089       |        |      |  |
| Total            | 128.659        | 8  |             |        |      |  |

### Multiple Comparisons

Dependent Variable: kekuatan\_mekanik

|              | (I) formula | (J) formula | Mean Difference |            | Sig. | 95% Confidence Interval |             |
|--------------|-------------|-------------|-----------------|------------|------|-------------------------|-------------|
|              |             |             | (I-J)           | Std. Error |      | Lower Bound             | Upper Bound |
| Tukey HSD    | f1          | f2          | 8.19859*        | 1.18005    | .001 | 4.5779                  | 11.8193     |
|              |             | f3          | 6.86525*        | 1.18005    | .003 | 3.2445                  | 10.4860     |
|              | f2          | f1          | -8.19859*       | 1.18005    | .001 | -11.8193                | -4.5779     |
|              |             | f3          | -1.33333        | 1.18005    | .532 | -4.9541                 | 2.2874      |
|              | f3          | f1          | -6.86525*       | 1.18005    | .003 | -10.4860                | -3.2445     |
|              |             | f2          | 1.33333         | 1.18005    | .532 | -2.2874                 | 4.9541      |
| Games-Howell | f1          | f2          | 8.19859*        | .92526     | .002 | 4.9000                  | 11.4972     |
|              |             | f3          | 6.86525*        | 1.29284    | .022 | 1.7386                  | 11.9919     |
|              | f2          | f1          | -8.19859*       | .92526     | .002 | -11.4972                | -4.9000     |
|              |             | f3          | -1.33333        | 1.28453    | .604 | -6.4728                 | 3.8062      |
|              | f3          | f1          | -6.86525*       | 1.29284    | .022 | -11.9919                | -1.7386     |
|              |             | f2          | 1.33333         | 1.28453    | .604 | -3.8062                 | 6.4728      |

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

### Lampiran 4.3 Uji Kemampuan Penetrasi Hydrogel Forming Microneedle

#### Tests of Normality

|           | formula | Kolmogorov-Smirnov <sup>a</sup> |    |      | Shapiro-Wilk |    |      |
|-----------|---------|---------------------------------|----|------|--------------|----|------|
|           |         | Statistic                       | df | Sig. | Statistic    | df | Sig. |
| penetrasi | f1      | .187                            | 3  | .    | .998         | 3  | .915 |
|           | f2      | .276                            | 3  | .    | .942         | 3  | .537 |
|           | f3      | .                               | 3  | .    | .            | 3  | .    |

a. Lilliefors Significance Correction

#### ANOVA

| penetrasi      |                |    |             |        |      |  |
|----------------|----------------|----|-------------|--------|------|--|
|                | Sum of Squares | df | Mean Square | F      | Sig. |  |
| Between Groups | 544.889        | 2  | 272.444     | 14.771 | .005 |  |
| Within Groups  | 110.667        | 6  | 18.444      |        |      |  |
| Total          | 655.556        | 8  |             |        |      |  |

#### Multiple Comparisons

Dependent Variable: penetrasi

|              | (I) formula | (J) formula | Mean Difference |            | Sig. | 95% Confidence Interval |             |
|--------------|-------------|-------------|-----------------|------------|------|-------------------------|-------------|
|              |             |             | (I-J)           | Std. Error |      | Lower Bound             | Upper Bound |
| Tukey HSD    | f1          | f2          | -12.66667*      | 3.50661    | .026 | -23.4259                | -1.9074     |
|              |             | f3          | -18.66667*      | 3.50661    | .004 | -29.4259                | -7.9074     |
|              | f2          | f1          | 12.66667*       | 3.50661    | .026 | 1.9074                  | 23.4259     |
|              |             | f3          | -6.00000        | 3.50661    | .276 | -16.7592                | 4.7592      |
|              | f3          | f1          | 18.66667*       | 3.50661    | .004 | 7.9074                  | 29.4259     |
|              |             | f2          | 6.00000         | 3.50661    | .276 | -4.7592                 | 16.7592     |
| Games-Howell | f1          | f2          | -12.66667       | 4.29470    | .113 | -30.1601                | 4.8268      |
|              |             | f3          | -18.66667       | 3.75648    | .069 | -40.7951                | 3.4618      |
|              | f2          | f1          | 12.66667        | 4.29470    | .113 | -4.8268                 | 30.1601     |
|              |             | f3          | -6.00000        | 2.08167    | .180 | -18.2626                | 6.2626      |
|              | f3          | f1          | 18.66667        | 3.75648    | .069 | -3.4618                 | 40.7951     |
|              |             | f2          | 6.00000         | 2.08167    | .180 | -6.2626                 | 18.2626     |

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

## Lampiran 4.4 Uji Permeasi ex vivo

### Tests of Normality

|          | formula | Kolmogorov-Smirnov <sup>a</sup> |    |      | Shapiro-Wilk |    |      |
|----------|---------|---------------------------------|----|------|--------------|----|------|
|          |         | Statistic                       | df | Sig. | Statistic    | df | Sig. |
| permeasi | f1      | .340                            | 3  | .    | .849         | 3  | .238 |
|          | f2      | .285                            | 3  | .    | .932         | 3  | .498 |
|          | f3      | .339                            | 3  | .    | .850         | 3  | .241 |

a. Lilliefors Significance Correction

### ANOVA

|                | Sum of Squares | df | Mean Square | F      | Sig. |
|----------------|----------------|----|-------------|--------|------|
| Between Groups | 3.047          | 2  | 1.523       | 36.085 | .000 |
| Within Groups  | .253           | 6  | .042        |        |      |
| Total          | 3.300          | 8  |             |        |      |

### Multiple Comparisons

Dependent Variable: permeasi

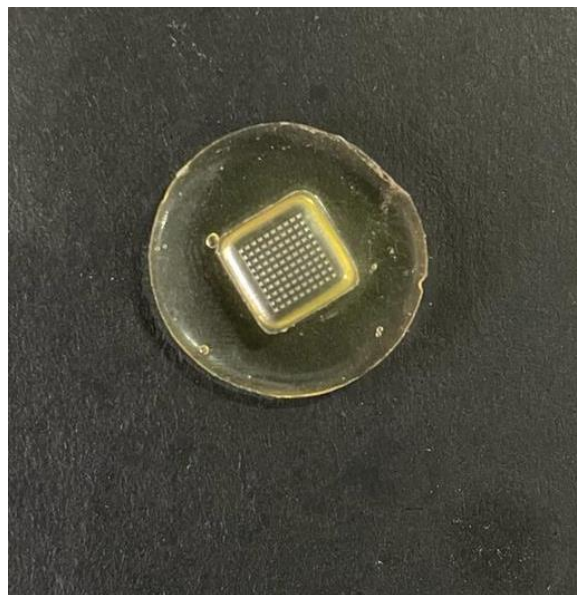
|              | (I) formula | (J) formula | Mean Difference |            | Sig. | 95% Confidence Interval |             |
|--------------|-------------|-------------|-----------------|------------|------|-------------------------|-------------|
|              |             |             | (I-J)           | Std. Error |      | Lower Bound             | Upper Bound |
| Tukey HSD    | f1          | f2          | .75572*         | .16775     | .010 | .2410                   | 1.2704      |
|              |             | f3          | 1.42424*        | .16775     | .000 | .9095                   | 1.9390      |
|              | f2          | f1          | -.75572*        | .16775     | .010 | -1.2704                 | -.2410      |
|              |             | f3          | .66853*         | .16775     | .017 | .1538                   | 1.1832      |
|              | f3          | f1          | -1.42424*       | .16775     | .000 | -1.9390                 | -.9095      |
|              |             | f2          | -.66853*        | .16775     | .017 | -1.1832                 | -.1538      |
| Games-Howell | f1          | f2          | .75572          | .15051     | .055 | -.0329                  | 1.5443      |
|              |             | f3          | 1.42424*        | .14453     | .012 | .6738                   | 2.1747      |
|              | f2          | f1          | -.75572         | .15051     | .055 | -1.5443                 | .0329       |
|              |             | f3          | .66853          | .20220     | .063 | -.0527                  | 1.3898      |
|              | f3          | f1          | -1.42424*       | .14453     | .012 | -2.1747                 | -.6738      |
|              |             | f2          | -.66853         | .20220     | .063 | -1.3898                 | .0527       |

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

## Lampiran 5. Dokumentasi



**Gambar 13. Uji *Swelling Hydrogel Film***



**Gambar 14. Pembuatan *Hydrogel Forming Microneedle (HFM)***



**Gambar 15. Uji Kekuatan Mekanik dan Kemampuan Penetrasi HFM**



**Gambar 16. Pembuatan Tablet Reservoir PEG**



**Gambar 17. Uji Permeasi ex vivo**