

### Hasil Perhitungan Pengujian Alat

#### % Rendemen Minyak Biji Kemiri (rpm 0 & suhu 50°C, 60°C, 70°C)

$$\% \text{ Rendemen} = \frac{\text{massa minyak yang terekstrak (gr)}}{\text{massa sampel (gr)}} \times 100\%$$

$$\text{Variabel 1a} = \frac{149,8 \text{ gr}}{300 \text{ gr}} \times 100\% = 49,93 \%$$

$$\text{Variabel 1b} = \frac{149,3 \text{ gr}}{300 \text{ gr}} \times 100\% = 49,77 \%$$

$$\text{Variabel 1c} = \frac{149,1 \text{ gr}}{300 \text{ gr}} \times 100\% = 49,70 \%$$

$$\begin{aligned} \text{Rata-rata} &= \frac{(\text{variabel 1a} + \text{variabel 1b} + \text{variabel 1c})}{3} \\ &= \frac{(49,93 + 49,77 + 49,70)\%}{3} \\ &= 49,8 \%$$

$$\text{Variabel 2a} = \frac{154,7 \text{ gr}}{300 \text{ gr}} \times 100\% = 51,57 \%$$

$$\text{Variabel 2b} = \frac{151,64 \text{ gr}}{300 \text{ gr}} \times 100\% = 50,55 \%$$

$$\text{Variabel 2c} = \frac{151,4 \text{ gr}}{300 \text{ gr}} \times 100\% = 50,40 \%$$

$$\begin{aligned} \text{Rata-rata} &= \frac{(51,57 + 50,55 + 50,40)\%}{3} \\ &= 50,84 \%$$

$$\text{Variabel 3a} = \frac{149,8 \text{ gr}}{300 \text{ gr}} \times 100\% = 49,93 \%$$

$$\text{Variabel 3b} = \frac{149,6 \text{ gr}}{300 \text{ gr}} \times 100\% = 49,87 \%$$

$$\text{Variabel 3c} = \frac{149,2 \text{ gr}}{300 \text{ gr}} \times 100\% = 49,73 \%$$

$$\begin{aligned} \text{Rata-rata} &= \frac{(49,93 + 49,87 + 49,73)\%}{3} \\ &= 49,84 \%$$

#### % Rendemen Minyak Biji Kemiri (rpm 175 & suhu 50°C, 60°C, 70°C)

$$\text{Variabel 1} = \frac{35,05 \text{ gr}}{200 \text{ gr}} \times 100\% = 17,53 \%$$

$$\text{Variabel 2} = \frac{61,77 \text{ gr}}{200 \text{ gr}} \times 100\% = 30,89 \%$$

$$\text{Variabel 3} = \frac{87,20 \text{ gr}}{200 \text{ gr}} \times 100\% = 43,60 \%$$

#### **% Rendemen Minyak Biji Kemiri ( rpm 200 & suhu 50°C, 60 °C, 70°C)**

$$\text{Variabel 1} = \frac{37,90 \text{ gr}}{200 \text{ gr}} \times 100\% = 18,95 \%$$

$$\text{Variabel 2} = \frac{80,75 \text{ gr}}{200 \text{ gr}} \times 100\% = 40,38 \%$$

$$\text{Variabel 3} = \frac{89,65 \text{ gr}}{200 \text{ gr}} \times 100\% = 44,83 \%$$

#### **Densitas Minyak Biji Kemiri (rpm 0 & suhu 50°C, 60 °C, 70°C)**

$$\rho = \frac{(\text{massa pikno isi minyak} - \text{mass pikno kosong}) \text{ gr}}{\text{volume pikno yang digunakan (ml)}}$$

$$\text{Variabel 1a} = \frac{(48,52-25,37)\text{gr}}{25 \text{ ml}} = 0,926 \text{ gr/ml}$$

$$\text{Variabel 1b} = \frac{(48,51-25,37)\text{gr}}{25 \text{ ml}} = 0,926 \text{ gr/ml}$$

$$\text{Variabel 1c} = \frac{(48,51-25,37)\text{gr}}{25 \text{ ml}} = 0,926 \text{ gr/ml}$$

$$\begin{aligned} \text{Rata-rata} &= \frac{(0,926+0,926+0,926)\text{gr/ml}}{3} \\ &= 0,926 \text{ gr/ml} \end{aligned}$$

$$\text{Variabel 2a} = \frac{(48,50-25,37)\text{gr}}{25 \text{ ml}} = 0,925 \text{ gr/ml}$$

$$\text{Variabel 2b} = \frac{(48,50-25,37)\text{gr}}{25 \text{ ml}} = 0,925 \text{ gr/ml}$$

$$\text{Variabel 2c} = \frac{(48,50-25,37)\text{gr}}{25 \text{ ml}} = 0,925 \text{ gr/ml}$$

$$\begin{aligned} \text{Rata-rata} &= \frac{(0,925+0,925+0,925)\text{gr/ml}}{3} \\ &= 0,925 \text{ gr/ml} \end{aligned}$$

$$\text{Variabel 3a} = \frac{(48,49-25,37)\text{gr}}{25 \text{ ml}} = 0,925 \text{ gr/ml}$$

$$\text{Variabel 3b} = \frac{(48,48-25,37)\text{gr}}{25 \text{ ml}} = 0,924 \text{ gr/ml}$$

$$\text{Variabel 3c} = \frac{(48,48-25,37)gr}{25 ml} = 0,924 \text{ gr/ml}$$

$$\begin{aligned} \text{Rata-rata} &= \frac{(0,925+0,924+0,924)gr/ml}{3} \\ &= 0,924 \text{ gr/ml} \end{aligned}$$

#### Densitas Minyak Biji Kemiri (rpm 175 & suhu 50°C, 60°C, 70°C)

$$\text{Variabel 1} = \frac{(38,43-15,28)gr}{25 ml} = 0,926 \text{ gr/ml}$$

$$\text{Variabel 2} = \frac{(38,41-15,28)gr}{25 ml} = 0,925 \text{ gr/ml}$$

$$\text{Variabel 3} = \frac{(38,38-15,28)gr}{25 ml} = 0,924 \text{ gr/ml}$$

#### Densitas Minyak Biji Kemiri (rpm 200 & suhu 50°C, 60°C, 70°C)

$$\text{Variabel 1} = \frac{(38,43-15,28)gr}{25 ml} = 0,926 \text{ gr/ml}$$

$$\text{Variabel 2} = \frac{(38,42-15,28)gr}{25 ml} = 0,926 \text{ gr/ml}$$

$$\text{Variabel 3} = \frac{(38,39-15,28)gr}{25 ml} = 0,924 \text{ gr/ml}$$

#### Viskositas Minyak Biji Kemiri (rpm 0 & suhu 50°C, 60°C, 70°C)

$$i_x = \frac{t_x d_x}{t_0 d_0} \cdot i_0$$

$$\text{Variabel 1a} = \frac{23,2 s \times 0,924 \text{ gr/ml}}{2,94 s \times 1 \text{ gr/ml}} \cdot 1,004 \text{ cP} = 7,26 \text{ cp}$$

$$\text{Variabel 1b} = \frac{23,2 s \times 0,926 \text{ gr/ml}}{2,94 s \times 1 \text{ gr/ml}} \cdot 1,004 \text{ cP} = 7,34 \text{ cp}$$

$$\text{Variabel 1c} = \frac{22,8 s \times 0,925 \text{ gr/ml}}{2,94 s \times 1 \text{ gr/ml}} \cdot 1,004 \text{ cP} = 7,20 \text{ cp}$$

$$\begin{aligned} \text{Rata-rata} &= \frac{(7,26+7,34+7,20)cp}{3} \\ &= 7,26 \text{ cp} \end{aligned}$$

$$\text{Variabel 2a} = \frac{23,2 \text{ s} \times 0,924 \text{ gr/ml}}{2,94 \text{ s} \times 1 \text{ gr/ml}} \cdot 1,004 \text{ cP} = 7,32 \text{ cp}$$

$$\text{Variabel 2b} = \frac{23,3 \text{ s} \times 0,924 \text{ gr/ml}}{2,94 \text{ s} \times 1 \text{ gr/ml}} \cdot 1,004 \text{ cP} = 7,35 \text{ cp}$$

$$\text{Variabel 2c} = \frac{23,3 \text{ s} \times 0,925 \text{ gr/ml}}{2,94 \text{ s} \times 1 \text{ gr/ml}} \cdot 1,004 \text{ cP} = 7,36 \text{ cp}$$

$$\text{Rata-rata} = \frac{(7,32+7,35+7,36)\text{cp}}{3} \\ = 7,34 \text{ cp}$$

$$\text{Variabel 3a} = \frac{23,6 \text{ s} \times 0,926 \text{ gr/ml}}{2,94 \text{ s} \times 1 \text{ gr/ml}} \cdot 1,004 \text{ cP} = 7,46 \text{ cp}$$

$$\text{Variabel 3b} = \frac{23,8 \text{ s} \times 0,926 \text{ gr/ml}}{2,94 \text{ s} \times 1 \text{ gr/ml}} \cdot 1,004 \text{ cP} = 7,53 \text{ cp}$$

$$\text{Variabel 3c} = \frac{24 \text{ s} \times 0,925 \text{ gr/ml}}{2,94 \text{ s} \times 1 \text{ gr/ml}} \cdot 1,004 \text{ cP} = 7,58 \text{ cp}$$

$$\text{Rata-rata} = \frac{(7,46+7,53+7,58)\text{cp}}{3} \\ = 7,52 \text{ cp}$$

#### **Viskositas Minyak Biji Kemiri (rpm 175 & suhu 50°C, 60°C, 70°C)**

$$\text{Variabel 1} = \frac{23,3 \text{ s} \times 0,926 \text{ gr/ml}}{2,94 \text{ s} \times 1 \text{ gr/ml}} \cdot 1,004 \text{ cP} = 7,36 \text{ cp}$$

$$\text{Variabel 2} = \frac{23,8 \text{ s} \times 0,926 \text{ gr/ml}}{2,94 \text{ s} \times 1 \text{ gr/ml}} \cdot 1,004 \text{ cP} = 7,52 \text{ cp}$$

$$\text{Variabel 3} = \frac{24,6 \text{ s} \times 0,924 \text{ gr/ml}}{2,94 \text{ s} \times 1 \text{ gr/ml}} \cdot 1,004 \text{ cP} = 7,76 \text{ cp}$$

#### **Viskositas Minyak Biji Kemiri (rpm 200 & suhu 50°C, 60°C, 70°C)**

$$\text{Variabel 1} = \frac{23,5 \text{ s} \times 0,926 \text{ gr/ml}}{2,94 \text{ s} \times 1 \text{ gr/ml}} \cdot 1,004 \text{ cP} = 7,43 \text{ cp}$$

$$\text{Variabel 2} = \frac{23,9 \text{ s} \times 0,925 \text{ gr/ml}}{2,94 \text{ s} \times 1 \text{ gr/ml}} \cdot 1,004 \text{ cP} = 7,54 \text{ cp}$$

$$\text{Variabel 3} = \frac{24,8 \text{ s} \times 0,924 \text{ gr/ml}}{2,94 \text{ s} \times 1 \text{ gr/ml}} \cdot 1,004 \text{ cP} = 7,82 \text{ cp}$$

**Kadar Air pada Minyak Biji Kemiri (rpm 0 & suhu 50°C, 60°C, 70°C)**

$$\text{Rumus} = \frac{\text{massa minyak awal (gr)} - \text{massa minyak setelah dipanaskan (gr)}}{\text{massa minyak awal (gr)}}$$

$$\text{Variabel 1a} = \frac{10 \text{ gr} - 9,5 \text{ gr}}{10 \text{ gr}} \times 100\% = 5 \%$$

$$\text{Variabel 1b} = \frac{10 \text{ gr} - 9,6 \text{ gr}}{10 \text{ gr}} \times 100\% = 4 \%$$

$$\text{Variabel 1c} = \frac{10 \text{ gr} - 9,5 \text{ gr}}{10 \text{ gr}} \times 100\% = 5 \%$$

$$\begin{aligned} \text{Rata-rata} &= \frac{(5 + 4 + 5)\%}{3} \\ &= 4,67 \% \end{aligned}$$

$$\text{Variabel 2a} = \frac{10 \text{ gr} - 9,7 \text{ gr}}{10 \text{ gr}} \times 100\% = 3 \%$$

$$\text{Variabel 2b} = \frac{10 \text{ gr} - 9,7 \text{ gr}}{10 \text{ gr}} \times 100\% = 3 \%$$

$$\text{Variabel 2c} = \frac{10 \text{ gr} - 9,8 \text{ gr}}{10 \text{ gr}} \times 100\% = 2 \%$$

$$\begin{aligned} \text{Rata-rata} &= \frac{(3 + 3 + 2)\%}{3} \\ &= 2,67 \% \end{aligned}$$

$$\text{Variabel 3a} = \frac{10 \text{ gr} - 9,8 \text{ gr}}{10 \text{ gr}} \times 100\% = 2 \%$$

$$\text{Variabel 3b} = \frac{10 \text{ gr} - 9,9 \text{ gr}}{10 \text{ gr}} \times 100\% = 1 \%$$

$$\text{Variabel 3c} = \frac{10 \text{ gr} - 9,9 \text{ gr}}{10 \text{ gr}} \times 100\% = 1 \%$$

$$\begin{aligned} \text{Rata-rata} &= \frac{(2 + 1 + 1)\%}{3} \\ &= 1,33 \% \end{aligned}$$

**Kadar Air pada Minyak Biji Kemiri (rpm 175 & suhu 50°C, 60°C, 70°C)**

$$\text{Variabel 1} = \frac{10 \text{ gr} - 9,78 \text{ gr}}{10 \text{ gr}} \times 100\% = 2,2 \%$$

$$\text{Variabel 2} = \frac{10 \text{ gr} - 9,83 \text{ gr}}{10 \text{ gr}} \times 100\% = 1,7 \%$$

$$\text{Variabel 3} = \frac{10 \text{ gr} - 9,92 \text{ gr}}{10 \text{ gr}} \times 100\% = 0,8 \%$$

### **Kadar Air pada Minyak Biji Kemiri (rpm 200 & suhu 50°C, 60°C, 70°C)**

$$\text{Variabel 1} = \frac{10 \text{ gr} - 9,79 \text{ gr}}{10 \text{ gr}} \times 100\% = 2,1 \%$$

$$\text{Variabel 2} = \frac{10 \text{ gr} - 9,83 \text{ gr}}{10 \text{ gr}} \times 100\% = 1,7 \%$$

$$\text{Variabel 3} = \frac{10 \text{ gr} - 9,93 \text{ gr}}{10 \text{ gr}} \times 100\% = 0,7 \%$$

### **Bilangan Asam Minyak Biji Kemiri (rpm 0 & suhu 50°C, 60°C, 70°C)**

$$\text{Rumus} = \frac{56,1 \times \text{ml KOH yang dibutuhkan} \times \text{normalitas KOH}}{\text{massa sampel (gr)}}$$

$$\text{Variabel 1a} = \frac{56,1 \times 1,3 \text{ ml} \times 0,1 \text{ N}}{5,614 \text{ gr}} = 1,30 \text{ g KOH/g sampel}$$

$$\text{Variabel 1b} = \frac{56,1 \times 1,3 \text{ ml} \times 0,1 \text{ N}}{5,614 \text{ gr}} = 1,30 \text{ g KOH/g sampel}$$

$$\text{Variabel 1c} = \frac{56,1 \times 1,25 \text{ ml} \times 0,1 \text{ N}}{5,614 \text{ gr}} = 1,25 \text{ g KOH/g sampel}$$

$$\begin{aligned} \text{Rata-rata} &= \frac{(1,30 + 1,30 + 1,25)}{3} \\ &= 1,28 \text{ g KOH/g sampel} \end{aligned}$$

$$\text{Variabel 2a} = \frac{56,1 \times 1,1 \text{ ml} \times 0,1 \text{ N}}{5,593 \text{ gr}} = 1,10 \text{ g KOH/g sampel}$$

$$\text{Variabel 2b} = \frac{56,1 \times 1,0 \text{ ml} \times 0,1 \text{ N}}{5,593 \text{ gr}} = 1,00 \text{ g KOH/g sampel}$$

$$\text{Variabel 2c} = \frac{56,1 \times 1,0 \text{ ml} \times 0,1 \text{ N}}{5,593 \text{ gr}} = 1,00 \text{ g KOH/g sampel}$$

$$\begin{aligned} \text{Rata-rata} &= \frac{(1,10 + 1,00 + 1,00)}{3} \\ &= 1,03 \text{ g KOH/g sampel} \end{aligned}$$

$$\text{Variabel 3a} = \frac{56,1 \times 0,9 \text{ ml} \times 0,1 \text{ N}}{5,593 \text{ gr}} = 0,90 \text{ g KOH/g sampel}$$

$$\text{Variabel 3b} = \frac{56,1 \times 0,8 \text{ ml} \times 0,1 \text{ N}}{5,593 \text{ gr}} = 0,80 \text{ g KOH/g sampel}$$

$$\text{Variabel 3c} = \frac{56,1 \times 0,8 \text{ ml} \times 0,1 \text{ N}}{5,593 \text{ gr}} = 0,80 \text{ g KOH/g sampel}$$

$$\begin{aligned} \text{Rata-rata} &= \frac{(0,90 + 0,80 + 0,80)}{3} \\ &= 0,83 \text{ g KOH/g sampel} \end{aligned}$$

**Bilangan Asam Minyak Biji Kemiri (rpm 175 & suhu 50°C, 60 °C, 70°C)**

$$\text{Variabel 1} = \frac{56,1 \times 1,1 \text{ ml} \times 0,1 \text{ N}}{5,614 \text{ gr}} = 1,10 \text{ g KOH/g sampel}$$

$$\text{Variabel 2} = \frac{56,1 \times 1,4 \text{ ml} \times 0,1 \text{ N}}{5,6 \text{ gr}} = 1,00 \text{ g KOH/g sampel}$$

$$\text{Variabel 3} = \frac{56,1 \times 0,7 \text{ ml} \times 0,1 \text{ N}}{5,593 \text{ gr}} = 0,71 \text{ g KOH/g sampel}$$

**Bilangan Asam Minyak Biji Kemiri (rpm 200 & suhu 50°C, 60 °C, 70°C)**

$$\text{Variabel 1} = \frac{56,1 \times 1,1 \text{ ml} \times 0,1 \text{ N}}{5,607 \text{ gr}} = 1,10 \text{ g KOH/g sampel}$$

$$\text{Variabel 2} = \frac{56,1 \times 0,9 \text{ ml} \times 0,1 \text{ N}}{5,6 \text{ gr}} = 0,90 \text{ g KOH/g sampel}$$

$$\text{Variabel 3} = \frac{56,1 \times 0,7 \text{ ml} \times 0,1 \text{ N}}{5,586 \text{ gr}} = 0,70 \text{ g KOH/g sampel}$$

**Bilangan Penyabunan Minyak Kemiri (rpm 0 & suhu 50°C, 60 °C, 70°C)**

$$\text{Rumus} = \frac{(V \text{ blanko} - V \text{ titrasi sampel}) \text{ ml} \times \text{NHCl} \times 56,1}{\text{massa sampel (gr)}}$$

$$\text{Variabel 1a} = \frac{(25,3 - 18,2) \text{ ml} \times 0,5 \times 56,1}{1,06 \text{ gr}} = 187,88 \text{ mg KOH/g sampel}$$

$$\text{Variabel 1b} = \frac{(25,3 - 18,2) \text{ ml} \times 0,5 \times 56,1}{1,06 \text{ gr}} = 187,88 \text{ mg KOH/g sampel}$$

$$\text{Variabel 1c} = \frac{(25,3 - 18,3) \text{ ml} \times 0,5 \times 56,1}{1,06 \text{ gr}} = 185,24 \text{ mg KOH/g sampel}$$

$$\begin{aligned} \text{Rata-rata} &= \frac{(187,88 + 187,88 + 185,24)}{3} \\ &= 187,00 \text{ mg KOH/g sampel} \end{aligned}$$

$$\text{Variabel 2a} = \frac{(25,3 - 18,4) \text{ ml} \times 0,5 \times 56,1}{1,02 \text{ gr}} = 189,75 \text{ mg KOH/g sampel}$$

$$\text{Variabel 2b} = \frac{(25,3 - 18,3) \text{ ml} \times 0,5 \times 56,1}{1,02 \text{ gr}} = 192,50 \text{ mg KOH/g sampel}$$

$$\text{Variabel 2c} = \frac{(25,3 - 18,4) \text{ ml} \times 0,5 \times 56,1}{1,02 \text{ gr}} = 189,75 \text{ mg KOH/g sampel}$$

$$\begin{aligned} \text{Rata-rata} &= \frac{(189,75 + 192,50 + 189,75)}{3} \end{aligned}$$

$$= 190,67 \text{ mg KOH/g sampel}$$

$$\text{Variabel 3a} = \frac{(25,3-18,2) \text{ ml} \times 0,5 \times 56,1}{1,01 \text{ gr}} = 197,18 \text{ mg KOH/g sampel}$$

$$\text{Variabel 3b} = \frac{(25,3-18,3) \text{ ml} \times 0,5 \times 56,1}{1,01 \text{ gr}} = 194,41 \text{ mg KOH/g sampel}$$

$$\text{Variabel 3c} = \frac{(25,3-18,3) \text{ ml} \times 0,5 \times 56,1}{1,01 \text{ gr}} = 194,41 \text{ mg KOH/g sampel}$$

$$\begin{aligned} \text{Rata-rata} &= \frac{(197,18 + 194,41 + 194,41)}{3} \\ &= 195,33 \text{ mg/KOH/g sampel} \end{aligned}$$

#### **Bilangan Penyabunan Minyak Kemiri (rpm 175 & suhu 50°C, 60 °C, 70°C)**

$$\text{Variabel 1} = \frac{(25,2-18,2) \text{ ml} \times 0,5 \times 56,1}{1,05 \text{ gr}} = 187,00 \text{ mg KOH/g sampel}$$

$$\text{Variabel 2} = \frac{(25,2-18,3) \text{ ml} \times 0,5 \times 56,1}{1,01 \text{ gr}} = 191,63 \text{ mg KOH/g sampel}$$

$$\text{Variabel 3} = \frac{(25,2-18,2) \text{ ml} \times 0,5 \times 56,1}{1,02 \text{ gr}} = 192,50 \text{ mg KOH/g sampel}$$

#### **Bilangan Penyabunan Minyak Kemiri (rpm 200 & suhu 50°C, 60 °C, 70°C)**

$$\text{Variabel 1} = \frac{(25,2-18,1) \text{ ml} \times 0,5 \times 56,1}{1,06 \text{ gr}} = 187,88 \text{ mg KOH/g sampel}$$

$$\text{Variabel 2} = \frac{(25,2-18,3) \text{ ml} \times 0,5 \times 56,1}{1,02 \text{ gr}} = 189,75 \text{ mg KOH/g sampel}$$

$$\text{Variabel 3} = \frac{(25,2-18,1) \text{ ml} \times 0,5 \times 56,1}{1,02 \text{ gr}} = 195,25 \text{ mg KOH/g sampel}$$



**Gambar Hasil Minyak Kemiri****Kecepatan Putaran 0 rpm****Kecepatan Putaran 175 rpm**

**Kecepatan Putaran 200 rpm**