

## LAMPIRAN

- a. Perhitungan kadar H<sub>2</sub>O yang teruapkan dan laju pengeringan kacang hijau pada variabel suhu

| No. | Suhu (°C) | Massa masuk (gram) | Massa keluar (gram) | Waktu pengeringan (jam) | Massa H <sub>2</sub> O Teruapkan (gram) | % H <sub>2</sub> O Teruapkan | Laju Pengeringan (lb/ft <sup>2</sup> jam) |
|-----|-----------|--------------------|---------------------|-------------------------|---|------------------------------|---|
| 1.  | 50        | 250                | 222,58              | 0,227                   | 27,42                                   | 10,968                       | 0,046                                     |
| 2.  | 55        | 250                | 220,17              | 0,222                   | 29,83                                   | 11,932                       | 0,048                                     |
| 3.  | 60        | 250                | 218,84              | 0,219                   | 31,16                                   | 12,464                       | 0,049                                     |
| 4.  | 65        | 250                | 216,13              | 0,213                   | 33,87                                   | 13,548                       | 0,051                                     |
| 5.  | 70        | 250                | 212,03              | 0,209                   | 37,97                                   | 15,188                       | 0,055                                     |

Laju pengeringan : 
$$N = \frac{-S_s \, dX}{A \, d\theta}$$

Dimana  $\frac{Dx}{Dt}$  dicari dengan : 
$$\frac{-Dx}{Dt} = \left(\frac{\pi}{2}\right)^2 \times \left(\frac{D'v}{s^2}\right) \times X$$

Menghitung luas penampang

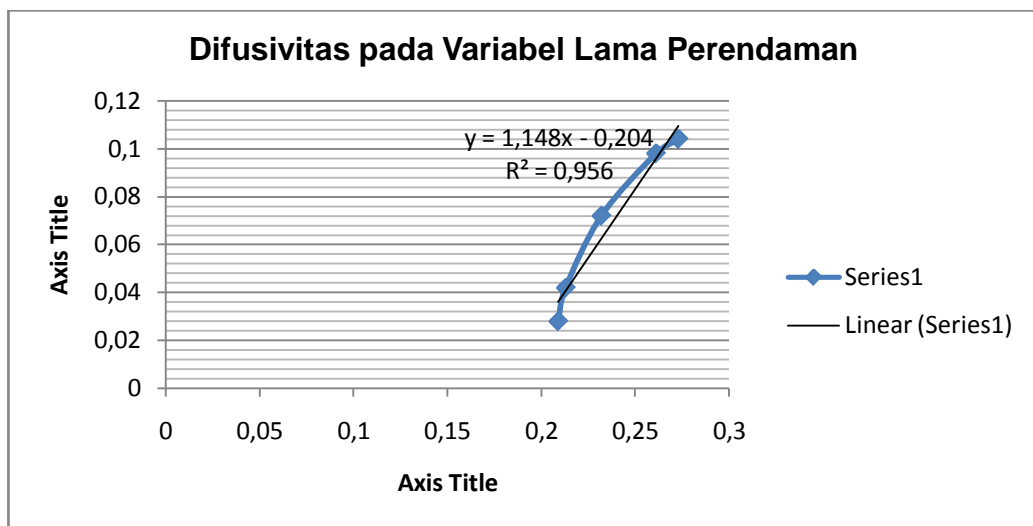
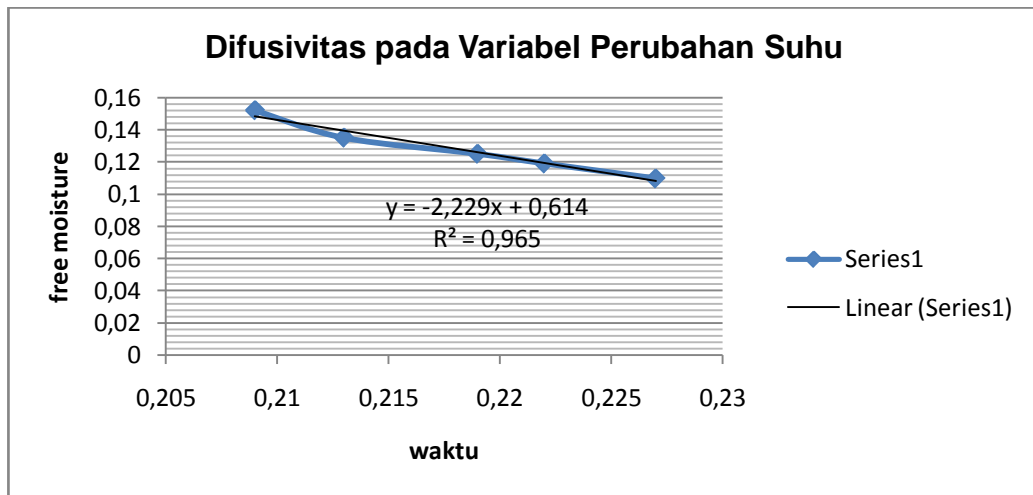
Diketahui :

1 ft = 30,48 cm

panjang = 300 cm = 9,843 ft

jari-jari = 15 cm = 0,492 ft

luas =  $(2 \times 3,14 \times 0,492^2) \text{ ft}^2 + (3,14 \times 0,492 \times 9,843) = 16,76 \text{ ft}^2$



D'v dicari dari gradien grafik free moisture dengan waktu, dan didapatkan :

D'v (Variabel perubahan suhu) : 2,229 cm<sup>2</sup>/jam

D'v (Variabel Lama perendaman) : 1,148 cm<sup>2</sup>/jam

### Perhitungan

#### 1. Variabel 1 suhu 50 °C

$$\text{Massa masuk} : 250 \text{ gr} = \frac{250 \text{ gr}}{453,5924 \frac{\text{gr}}{\text{lb}}} = 0,551 \text{ lb}$$

$$\text{Massa keluar} : 222,58 \text{ gr} = \frac{222,58 \text{ gr}}{453,5924 \frac{\text{gr}}{\text{lb}}} = 0,491 \text{ lb}$$

$$\text{Massa H}_2\text{O teruapkan} : 27,42 \text{ gr} = \frac{27,42 \text{ gr}}{453,5924 \frac{\text{gr}}{\text{lb}}} = 0,06 \text{ lb}$$

$$\begin{aligned} \% \text{ H}_2\text{O teruapkan} &= \frac{\text{Berat awal} - \text{Berat akhir}}{\text{Berat awal}} \times 100\% \\ &= \frac{250 - 222,58}{250} \times 100\% \\ &= 10,968 \% \end{aligned}$$

$$\begin{aligned} \text{Laju pengeringan} &= \frac{0,491 \text{ lb} \times 1,559 \frac{\text{lbH } 20}{\text{lbhankering} \times \text{jam}}}{16,76 \text{ ft}^2} \\ &= 0,046 \text{ Lb H}_2\text{O yang diuapkan / jam ft}^2 \end{aligned}$$

## 2. Variabel 2 suhu 55 °C

$$\text{Massa masuk} : 250 \text{ gr} = \frac{250 \text{ gr}}{453,5924 \frac{\text{gr}}{\text{lb}}} = 0,551 \text{ lb}$$

$$\text{Massa keluar} : 220,17 \text{ gr} = \frac{220,17 \text{ gr}}{453,5924 \frac{\text{gr}}{\text{lb}}} = 0,485 \text{ lb}$$

$$\text{Massa H}_2\text{O teruapkan} : 29,83 \text{ gr} = \frac{29,83 \text{ gr}}{453,5924 \frac{\text{gr}}{\text{lb}}} = 0,066 \text{ lb}$$

$$\begin{aligned} \% \text{ H}_2\text{O teruapkan} &= \frac{\text{Berat awal} - \text{Berat akhir}}{\text{Berat awal}} \times 100\% \\ &= \frac{250 - 220,17}{250} \times 100\% \\ &= 11,932 \% \end{aligned}$$

$$\begin{aligned} \text{Laju pengeringan} &= \frac{0,485 \text{ lb} \times 1,66 \frac{\text{lbH } 20}{\text{lbhankering} \times \text{jam}}}{16,76 \text{ ft}^2} \\ &= 0,048 \text{ Lb H}_2\text{O yang diuapkan / jam ft}^2 \end{aligned}$$

## 3. Variabel 3 suhu 60 °C

$$\text{Massa masuk} : 250 \text{ gr} = \frac{250 \text{ gr}}{453,5924 \frac{\text{gr}}{\text{lb}}} = 0,551 \text{ lb}$$

$$\text{Massa keluar} : 218,84 \text{ gr} = \frac{218,84 \text{ gr}}{453,5924 \frac{\text{gr}}{\text{lb}}} = 0,482 \text{ lb}$$

$$\text{Massa H}_2\text{O teruapkan} : 31,16 \text{ gr} = \frac{31,16 \text{ gr}}{453,5924 \frac{\text{gr}}{\text{lb}}} = 0,069 \text{ lb}$$

$$\begin{aligned} \% \text{ H}_2\text{O teruapkan} &= \frac{\text{Berat awal} - \text{Berat akhir}}{\text{Berat awal}} \times 100\% \\ &= \frac{250 - 218,84}{250} \times 100\% \end{aligned}$$

$$= 12,464 \%$$

$$\begin{aligned} \text{Laju pengeringan} &= \frac{0,482 \text{ lb} \times 1,715 \frac{\text{lbH } 20}{\text{lbhankering} \times \text{jam}}}{16,76 \text{ ft}^2} \\ &= 0,049 \text{ Lb H}_2\text{O yang diuapkan / jam ft}^2 \end{aligned}$$

#### 4. Variabel 4 suhu 65 °C

$$\text{Massa m3suk} : 250 \text{ gr} = \frac{250 \text{ gr}}{453,5924 \frac{\text{gr}}{\text{lb}}} = 0,551 \text{ lb}$$

$$\text{Massa keluar} : 216,13 \text{ gr} = \frac{216,13 \text{ gr}}{453,5924 \frac{\text{gr}}{\text{lb}}} = 0,476 \text{ lb}$$

$$\text{Massa H}_2\text{O teruapkan} : 33,87 \text{ gr} = \frac{33,87 \text{ gr}}{453,5924 \frac{\text{gr}}{\text{lb}}} = 0,075 \text{ lb}$$

$$\begin{aligned} \% \text{ H}_2\text{O teruapkan} &= \frac{\text{Berat awal} - \text{Berat akhir}}{\text{Berat awal}} \times 100\% \\ &= \frac{250 - 216,13}{250} \times 100\% \end{aligned}$$

$$= 13,548 \%$$

$$\begin{aligned} \text{Laju pengeringan} &= \frac{0,476 \text{ lb} \times 1,813 \frac{\text{lbH } 20}{\text{lbhankering} \times \text{jam}}}{16,76 \text{ ft}^2} \\ &= 0,051 \text{ Lb H}_2\text{O yang diuapkan / jam ft}^2 \end{aligned}$$

#### 5. Variabel 5 suhu 70 °C

$$\text{Massa m3suk} : 250 \text{ gr} = \frac{250 \text{ gr}}{453,5924 \frac{\text{gr}}{\text{lb}}} = 0,551 \text{ lb}$$

$$\text{Massa keluar} : 212,30 \text{ gr} = \frac{212,30 \text{ gr}}{453,5924 \frac{\text{gr}}{\text{lb}}} = 0,467 \text{ lb}$$

$$\text{Massa H}_2\text{O teruapkan} : 37,97 \text{ gr} = \frac{37,97 \text{ gr}}{453,5924 \frac{\text{gr}}{\text{lb}}} = 0,084 \text{ lb}$$

$$\begin{aligned} \% \text{ H}_2\text{O teruapkan} &= \frac{\text{Berat awal} - \text{Berat akhir}}{\text{Berat awal}} \times 100\% \\ &= \frac{250 - 212,03}{250} \times 100\% \end{aligned}$$

$$\begin{aligned} \text{Laju pengeringan} &= \frac{0,467 \text{ lb} \times 1,993 \frac{\text{lbH}_2\text{O}}{\text{lb bahan kering} \times \text{jam}}}{16,76 \text{ ft}^2} \\ &= 0,055 \text{ Lb H}_2\text{O yang diuapkan / jam ft}^2 \end{aligned}$$

- b. Perhitungan kadar H<sub>2</sub>O yang teruapkan dan laju pengeringan kacang hijau pada variabel waktu perendaman

| No. | Waktu perendaman (jam) | Berat awal (gram) | Berat akhir (gram) | Waktu pengeringan (jam) | Massa H <sub>2</sub> O Teruapkan (gram) | % H <sub>2</sub> O Teruapkan | Laju Pengeringan (lb/ft <sup>2</sup> jam) |
|-----|------------------------|-------------------|--------------------|-------------------------|---|------------------------------|---|
| 1.  | 40                     | 498,76            | 446,76             | 0,273                   | 52,00                                   | 10,426                       | 0,107                                     |
| 2.  | 36                     | 488,13            | 440,51             | 0,261                   | 47,67                                   | 9,756                        | 0,093                                     |
| 3.  | 32                     | 453,99            | 421,19             | 0,232                   | 32,80                                   | 7,225                        | 0,054                                     |
| 4.  | 28                     | 418,59            | 400,89             | 0,213                   | 17,70                                   | 4,228                        | 0,026                                     |
| 5.  | 24                     | 411,83            | 400,12             | 0,209                   | 11,71                                   | 2,843                        | 0,017                                     |

### Perhitungan

#### 1. Variabel 1 waktu perendaman 40 jam

$$\text{Massa masuk} : 498,76 \text{ gr} = \frac{498,76 \text{ gr}}{453,5924 \frac{\text{gr}}{\text{lb}}} = 1,099 \text{ lb}$$

$$\text{Massa keluar} : 446,76 \text{ gr} = \frac{446,76 \text{ gr}}{453,5924 \frac{\text{gr}}{\text{lb}}} = 0,985 \text{ lb}$$

$$\text{Massa H}_2\text{O teruapkan} : 52 \text{ gr} = \frac{52 \text{ gr}}{453,5924 \frac{\text{gr}}{\text{lb}}} = 0,115 \text{ lb}$$

$$\% \text{ H}_2\text{O teruapkan} = \frac{\text{Berat awal} - \text{Berat akhir}}{\text{Berat awal}} \times 100\%$$

$$= \frac{498,76 - 446,76}{498,76} \times 100\%$$

$$= 10,426 \%$$

$$\text{Laju pengeringan} = \frac{0,985 \text{ lb} \times 1,836 \frac{\text{lbH}_2\text{O}}{\text{lb bahan kering} \times \text{jam}}}{16,76 \text{ ft}^2}$$

$$= 0,107 \text{ Lb H}_2\text{O yang diuapkan / jam ft}^2$$

## 2. Variabel 2 waktu perendaman 36 jam

$$\text{Massa masuk} : 488,13 \text{ gr} = \frac{488,13 \text{ gr}}{453,5924 \frac{\text{gr}}{\text{lb}}} = 1,076 \text{ lb}$$

$$\text{Massa keluar} : 440,51 \text{ gr} = \frac{440,51 \text{ gr}}{453,5924 \frac{\text{gr}}{\text{lb}}} = 0,971 \text{ lb}$$

$$\text{Massa H}_2\text{O teruapkan} : 47,67 \text{ gr} = \frac{47,67 \text{ gr}}{453,5924 \frac{\text{gr}}{\text{lb}}} = 0,105 \text{ lb}$$

$$\begin{aligned} \% \text{ H}_2\text{O teruapka} &= \frac{\text{Berat awal} - \text{Berat akhir}}{\text{Berat awal}} \times 100\% \\ &= \frac{488,13 - 440,51}{488,13} \times 100\% \end{aligned}$$

$$= 9,756 \%$$

$$\begin{aligned} \text{Laju pengeringan} &= \frac{0,971 \text{ lb} \times 1,604 \frac{\text{lbH } 20}{\text{lb bahankering} \times \text{jam}}}{16,76 \text{ ft}^2} \\ &= 0,093 \text{ Lb H}_2\text{O yang diuapkan / jam ft}^2 \end{aligned}$$

## 3. Variabel 3 waktu perendaman 32 jam

$$\text{Massa masuk} : 453,99 \text{ gr} = \frac{453,99 \text{ gr}}{453,5924 \frac{\text{gr}}{\text{lb}}} = 1,000 \text{ lb}$$

$$\text{Massa keluar} : 421,19 \text{ gr} = \frac{421,19 \text{ gr}}{453,5924 \frac{\text{gr}}{\text{lb}}} = 0,929 \text{ lb}$$

$$\text{Massa H}_2\text{O teruapkan} : 32,80 \text{ gr} = \frac{32,80 \text{ gr}}{453,5924 \frac{\text{gr}}{\text{lb}}} = 0,072 \text{ lb}$$

$$\begin{aligned} \% \text{ H}_2\text{O teruapkan} &= \frac{\text{Berat awal} - \text{Berat akhir}}{\text{Berat awal}} \times 100\% \\ &= \frac{453,99 - 421,19}{453,99} \times 100\% \end{aligned}$$

$$= 12,464 \%$$

$$\begin{aligned} \text{Laju pengeringan} &= \frac{0,929 \text{ lb} \times 0,977 \frac{\text{lbH } 20}{\text{lb bahankering} \times \text{jam}}}{16,76 \text{ ft}^2} \\ &= 0,054 \text{ Lb H}_2\text{O yang diuapkan / jam ft}^2 \end{aligned}$$

#### 4. Variabel 4 waktu perendaman 28 jam

$$\text{Massa masuk} : 418,59 \text{ gr} = \frac{418,59 \text{ gr}}{453,5924 \frac{\text{gr}}{\text{lb}}} = 0,922 \text{ lb}$$

$$\text{Massa keluar} : 400,89 \text{ gr} = \frac{400,89 \text{ gr}}{453,5924 \frac{\text{gr}}{\text{lb}}} = 0,884 \text{ lb}$$

$$\text{Massa H}_2\text{O teruapkan} : 17,70 \text{ gr} = \frac{17,70 \text{ gr}}{453,5924 \frac{\text{gr}}{\text{lb}}} = 0,039 \text{ lb}$$

$$\begin{aligned} \% \text{ H}_2\text{O teruapkan} &= \frac{\text{Berat awal} - \text{Berat akhir}}{\text{Berat awal}} \times 100\% \\ &= \frac{418,59 - 400,89}{418,59} \times 100\% \\ &= 4,228 \% \end{aligned}$$

$$\begin{aligned} \text{Laju pengeringan} &= \frac{0,884 \text{ lb} \times 0,486 \frac{\text{lbH } 20}{\text{lbhankering} \times \text{jam}}}{16,76 \text{ ft}^2} \\ &= 0,026 \text{ Lb H}_2\text{O yang diuapkan / jam ft}^2 \end{aligned}$$

#### 5. Variabel 5 waktu perendaman 24 jam

$$\text{Massa masuk} : 411,83 \text{ gr} = \frac{411,83 \text{ gr}}{453,5924 \frac{\text{gr}}{\text{lb}}} = 0,908 \text{ lb}$$

$$\text{Massa keluar} : 400,12 \text{ gr} = \frac{400,12 \text{ gr}}{453,5924 \frac{\text{gr}}{\text{lb}}} = 0,882 \text{ lb}$$

$$\text{Massa H}_2\text{O teruapkan} : 11,71 \text{ gr} = \frac{11,71 \text{ gr}}{453,5924 \frac{\text{gr}}{\text{lb}}} = 0,026 \text{ lb}$$

$$\begin{aligned} \% \text{ H}_2\text{O teruapkan} &= \frac{\text{Berat awal} - \text{Berat akhir}}{\text{Berat awal}} \times 100\% \\ &= \frac{411,83 - 400,12}{411,83} \times 100\% \\ &= 2,843 \% \end{aligned}$$

$$\begin{aligned} \text{Laju pengeringan} &= \frac{0,882 \text{ lb} \times 0,318 \frac{\text{lbH } 20}{\text{lbhankering} \times \text{jam}}}{16,76 \text{ ft}^2} \\ &= 0,017 \text{ Lb H}_2\text{O yang diuapkan / jam ft}^2 \end{aligned}$$