

## LAMPIRAN B PERHITUNGAN

### A. Perhitungan Desain Alat *Prototype Biodiesel Processors*

#### 1. Tangki Umpan Berkapasitas 20 L

#### 2. Tangki Filtrasi

$$\begin{aligned} \text{Diketahui : Diameter (d)} &= 10 \text{ cm} \\ \text{Jari-jari (r)} &= 5 \text{ cm} \\ \text{Tinggi (t)} &= 30 \text{ cm} \end{aligned}$$

$$\begin{aligned} \text{Volume} &= \pi r^2 t \\ &= 3.14 \times (5 \text{ cm})^2 \times 30 \text{ cm} \\ &= 2,355 \text{ cm}^3 \quad \left| \begin{array}{c} 1 \text{ dm}^3 \\ \hline 1000 \text{ cm}^3 \end{array} \right| \quad \left| \begin{array}{c} 1 \text{ L} \\ \hline 1 \text{ dm}^3 \end{array} \right| \\ &= 2.355 \text{ L} \end{aligned}$$

#### 3. Tangki Pemurnian

##### 3.1 Volume Silinder

$$\begin{aligned} \text{Diketahui : Diameter (d)} &= 20 \text{ cm} \\ \text{Jari-jari (r)} &= 10 \text{ cm} \\ \text{Tinggi (t)} &= 40 \text{ cm} \end{aligned}$$

$$\begin{aligned} \text{Volume} &= \pi r^2 t \\ &= 3.14 \times (10 \text{ cm})^2 \times 40 \text{ cm} \\ &= 12,560 \text{ cm}^3 \quad \left| \begin{array}{c} 1 \text{ dm}^3 \\ \hline 1000 \text{ cm}^3 \end{array} \right| \quad \left| \begin{array}{c} 1 \text{ L} \\ \hline 1 \text{ dm}^3 \end{array} \right| \\ &= 12.56 \text{ L} \end{aligned}$$

##### 3.2 Volume Kerucut

$$\begin{aligned} \text{Diketahui : Diameter (d)} &= 20 \text{ cm} \\ \text{Jari-jari (r)} &= 10 \text{ cm} \\ \text{Tinggi (t)} &= 15 \text{ cm} \end{aligned}$$

$$\begin{aligned} \text{Volume} &= \frac{1}{3} \pi r^2 t \\ &= \frac{1}{3} \times 3.14 \times (10 \text{ cm})^2 \times 15 \text{ cm} \\ &= 1,570 \text{ cm}^3 \quad \left| \begin{array}{c} 1 \text{ dm}^3 \\ \hline 1000 \text{ cm}^3 \end{array} \right| \quad \left| \begin{array}{c} 1 \text{ L} \\ \hline 1 \text{ dm}^3 \end{array} \right| \\ &= 1.57 \text{ L} \end{aligned}$$

$$\begin{aligned} \text{Total Kapasitas} &= \text{Volume silinder} + \text{Volume kerucut} \\ &= 12.56 \text{ L} + 1.57 \text{ L} \\ &= 14.13 \text{ L} \end{aligned}$$

$$\begin{aligned} \text{Faktor Keamanan 20\%} &= 20\% \times 14.13 \text{ L} \\ &= 2.826 \text{ L} \end{aligned}$$

$$\begin{aligned} \text{Kapasitas Operasi} &= 14.13 \text{ L} - 2.826 \text{ L} \\ &= 11.304 \text{ L} \end{aligned}$$

#### 4. Tangki Reaktor

##### 4.1 Volume Silinder

$$\begin{aligned} \text{Diketahui : Diameter (d)} &= 30 \text{ cm} \\ \text{Jari-jari (r)} &= 15 \text{ cm} \\ \text{Tinggi (t)} &= 30 \text{ cm} \end{aligned}$$

$$\begin{aligned} \text{Volume} &= \pi r^2 t \\ &= 3.14 \times (15 \text{ cm})^2 \times 30 \text{ cm} \\ &= 21,195 \text{ cm}^3 \quad \left| \begin{array}{c|c} 1 \text{ dm}^3 & 1 \text{ L} \\ \hline 1000 \text{ cm}^3 & 1 \text{ dm}^3 \end{array} \right| \\ &= 21.195 \text{ L} \end{aligned}$$

##### 4.2 Volume Kerucut

$$\begin{aligned} \text{Diketahui : Diameter (d)} &= 30 \text{ cm} \\ \text{Jari-jari (r)} &= 15 \text{ cm} \\ \text{Tinggi (t)} &= 15 \text{ cm} \end{aligned}$$

$$\begin{aligned} \text{Volume} &= \frac{1}{3} \pi r^2 t \\ &= \frac{1}{3} \times 3.14 \times (15 \text{ cm})^2 \times 15 \text{ cm} \\ &= 3,533 \text{ cm}^3 \quad \left| \begin{array}{c|c} 1 \text{ dm}^3 & 1 \text{ L} \\ \hline 1000 \text{ cm}^3 & 1 \text{ dm}^3 \end{array} \right| \\ &= 3.533 \text{ L} \end{aligned}$$

$$\begin{aligned} \text{Total Kapasitas} &= \text{Volume silinder} + \text{Volume kerucut} \\ &= 21.195 \text{ L} + 3.533 \text{ L} \\ &= 24.728 \text{ L} \end{aligned}$$

$$\begin{aligned} \text{Faktor Keamanan 20\%} &= 20\% \times 24.728 \text{ L} \\ &= 4.946 \text{ L} \end{aligned}$$

$$\begin{aligned} \text{Kapasitas Operasi} &= 24.7275 \text{ L} - 4.946 \text{ L} \\ &= 19.782 \text{ L} \end{aligned}$$

#### 5. Tangki Katalis

##### 5.1 Volume Silinder

$$\begin{aligned} \text{Diketahui : Diameter (d)} &= 25 \text{ cm} \\ \text{Jari-jari (r)} &= 12.5 \text{ cm} \\ \text{Tinggi (t)} &= 20 \text{ cm} \end{aligned}$$

$$\begin{aligned}
\text{Volume} &= \pi r^2 t \\
&= 3.14 \times (12.5 \text{ cm})^2 \times 20 \text{ cm} \\
&= 9,813 \text{ cm}^3 \quad \left| \begin{array}{c|c} 1 \text{ dm}^3 & 1 \text{ L} \\ \hline 1000 \text{ cm}^3 & 1 \text{ dm}^3 \end{array} \right| \\
&= 9.8125 \text{ L}
\end{aligned}$$

## 5.2 Volume Kerucut

$$\begin{aligned}
\text{Diketahui : Diameter (d)} &= 25 \text{ cm} \\
\text{Jari-jari (r)} &= 12.5 \text{ cm} \\
\text{Tinggi (t)} &= 15 \text{ cm}
\end{aligned}$$

$$\begin{aligned}
\text{Volume} &= \frac{1}{3} \pi r^2 t \\
&= \frac{1}{3} \times 3.14 \times (12.5 \text{ cm})^2 \times 15 \text{ cm} \\
&= 2,453 \text{ cm}^3 \quad \left| \begin{array}{c|c} 1 \text{ dm}^3 & 1 \text{ L} \\ \hline 1000 \text{ cm}^3 & 1 \text{ dm}^3 \end{array} \right| \\
&= 2.453 \text{ L}
\end{aligned}$$

$$\begin{aligned}
\text{Total Kapasitas} &= \text{Volume silinder} + \text{Volume kerucut} \\
&= 9.8125 \text{ L} + 2.453 \text{ L} \\
&= 12.266 \text{ L}
\end{aligned}$$

$$\begin{aligned}
\text{Faktor Keamanan 20\%} &= 20\% \times 12.266 \text{ L} \\
&= 2.453 \text{ L}
\end{aligned}$$

$$\begin{aligned}
\text{Kapasitas Operasi} &= 12.2656 \text{ L} - 2.453 \text{ L} \\
&= 9.813 \text{ L}
\end{aligned}$$

## 6. Tangki Separator

### 6.1 Volume Silinder

$$\begin{aligned}
\text{Diketahui : Diameter (d)} &= 25 \text{ cm} \\
\text{Jari-jari (r)} &= 12.5 \text{ cm} \\
\text{Tinggi (t)} &= 45 \text{ cm}
\end{aligned}$$

$$\begin{aligned}
\text{Volume} &= \pi r^2 t \\
&= 3.14 \times (12.5 \text{ cm})^2 \times 45 \text{ cm} \\
&= 22,078 \text{ cm}^3 \quad \left| \begin{array}{c|c} 1 \text{ dm}^3 & 1 \text{ L} \\ \hline 1000 \text{ cm}^3 & 1 \text{ dm}^3 \end{array} \right| \\
&= 22.078125 \text{ L}
\end{aligned}$$

### 6.2 Volume Kerucut

$$\begin{aligned}
\text{Diketahui : Diameter (d)} &= 25 \text{ cm} \\
\text{Jari-jari (r)} &= 12.5 \text{ cm} \\
\text{Tinggi (t)} &= 15 \text{ cm}
\end{aligned}$$

$$\begin{aligned}
\text{Volume} &= \frac{1}{3}\pi r^2 t \\
&= \frac{1}{3} \times 3.14 \times (12.5 \text{ cm})^2 \times 15 \text{ cm} \\
&= 2,453 \text{ cm}^3 \quad \left| \begin{array}{c} 1 \text{ dm}^3 \\ 1000 \text{ cm}^3 \end{array} \right| \quad \left| \begin{array}{c} 1 \text{ L} \\ 1 \text{ dm}^3 \end{array} \right| \\
&= 2.453 \text{ L}
\end{aligned}$$

$$\begin{aligned}
\text{Total Kapasitas} &= \text{Volume silinder} + \text{Volume kerucut} \\
&= 22.0781 \text{ L} + 2.453 \text{ L} \\
&= 24.531 \text{ L}
\end{aligned}$$

$$\begin{aligned}
\text{Faktor Keamanan 20\%} &= 20\% \times 24.531 \text{ L} \\
&= 4.906 \text{ L}
\end{aligned}$$

$$\begin{aligned}
\text{Kapasitas Operasi} &= 24.5313 \text{ L} - 4.906 \text{ L} \\
&= 19.625 \text{ L}
\end{aligned}$$

## 7. Tangki Penampung Setelah Filtrasi

### 7.1 Volume Silinder

$$\begin{aligned}
\text{Diketahui : Diameter (d)} &= 30 \text{ cm} \\
\text{Jari-jari (r)} &= 15 \text{ cm} \\
\text{Tinggi (t)} &= 30 \text{ cm}
\end{aligned}$$

$$\begin{aligned}
\text{Volume} &= \pi r^2 t \\
&= 3.14 \times (15 \text{ cm})^2 \times 30 \text{ cm} \\
&= 21,195 \text{ cm}^3 \quad \left| \begin{array}{c} 1 \text{ dm}^3 \\ 1000 \text{ cm}^3 \end{array} \right| \quad \left| \begin{array}{c} 1 \text{ L} \\ 1 \text{ dm}^3 \end{array} \right| \\
&= 21.195 \text{ L}
\end{aligned}$$

### 7.2 Volume Kerucut

$$\begin{aligned}
\text{Diketahui : Diameter (d)} &= 30 \text{ cm} \\
\text{Jari-jari (r)} &= 15 \text{ cm} \\
\text{Tinggi (t)} &= 15 \text{ cm}
\end{aligned}$$

$$\begin{aligned}
\text{Volume} &= \frac{1}{3}\pi r^2 t \\
&= \frac{1}{3} \times 3.14 \times (15 \text{ cm})^2 \times 15 \text{ cm} \\
&= 3,533 \text{ cm}^3 \quad \left| \begin{array}{c} 1 \text{ dm}^3 \\ 1000 \text{ cm}^3 \end{array} \right| \quad \left| \begin{array}{c} 1 \text{ L} \\ 1 \text{ dm}^3 \end{array} \right| \\
&= 3.533 \text{ L}
\end{aligned}$$

$$\begin{aligned}
\text{Total Kapasitas} &= \text{Volume silinder} + \text{Volume kerucut} \\
&= 21.195 \text{ L} + 3.533 \text{ L} \\
&= 24.728 \text{ L}
\end{aligned}$$

$$\begin{aligned} \text{Faktor Keamanan 20\%} &= 20\% \times 24.728 \text{ L} \\ &= 4.946 \text{ L} \end{aligned}$$

$$\begin{aligned} \text{Kapasitas Operasi} &= 24.7275 \text{ L} - 4.946 \text{ L} \\ &= 19.782 \text{ L} \end{aligned}$$