

LAMPIRAN II PERHITUNGAN

A. Perhitungan Desain

Produksi Bahan bakar cair per hari = 2,5 l

1. Menghitung Massa Bahan Bakar Cair Dalam Satu Kali *Running*

Diketahui :

$$\begin{aligned} \rho_{mp} &= 0,770 \text{ kg/l} && (\text{Sumber: Thahir Ramli, 2013}) \\ V_{mp} &= 2,5 \text{ l} \\ m_{mp} &= \rho_{mp} \times V_{mp} \\ &= 2,5 \text{ l} \times 0,770 \text{ jam} \\ &= 1,93 \text{ kg} \end{aligned}$$

2. Menghitung Kebutuhan Bahan Baku Sampah Plastik

Diketahui :

$$\% \text{ konversi} = 50 \% \quad (\text{sumber : thahir romli, 2013})$$

Sehingga bahan baku plastik yang diperlukan adalah :

$$\begin{aligned} m_{sp} &= \frac{100 \%}{\% \text{konversi}} \times m_{mp} \\ &= \frac{100 \%}{50 \%} \times 1,93 \text{ kg} \\ &= 3,85 \text{ kg} \end{aligned}$$

3. Menghitung Kapasitas Reaktor Pirolisis

a. Menentukan Volume reaktor (V_r)

Diketahui :

$$\rho_{sp} = 282,3 \text{ kg/m}^3 \quad (\text{Sumber: perhitungan aktual piknometer})$$

$$\text{faktor keamanan} = 20 \%$$

Sehingga,

$$V_r = \frac{(\% \text{ volume} + \% \text{ faktor keamanan})}{\rho_{sp}} \times m_{sp}$$

$$\begin{aligned}
 V_r &= \frac{100 \% + 20 \%}{282,3 \text{ kg/m}^3} \times 3,85 \text{ kg} \\
 &= 0,02 \text{ m}^3 \\
 &= 16365,6 \text{ cm}^3
 \end{aligned}$$

b. Menghitung Tinggi Reaktor

Diketahui :

$$D = 22 \text{ cm}$$

$$r = 11 \text{ cm}$$

$$V = 16365,6 \text{ cm}^3$$

Sehingga,

$$\begin{aligned}
 V &= \pi r^2 t \\
 16365,6 \text{ cm}^3 &= 3,14 \times (11 \text{ cm})^2 \times t \\
 t &= \frac{16365,6 \text{ cm}^3}{3,14 \times (11 \text{ cm})^2} \\
 t &= 43,074 \text{ cm}
 \end{aligned}$$

4. Menghitung Kebutuhan Panas untuk Konversi Sampah Plastik

Kebutuhan panas untuk konversi sampah plastik dibagi menjadi 2 yaitu :

1. Menentukan Kebutuhan Panas untuk Proses Pirolisis

Diketahui : Panas untuk konversi 1 kg sampah plastik

$$L = 29506,19 \text{ kkal/kg} \quad (\text{sumber : Feng Gao, 2010})$$

$$m_{sp} = 3,85 \text{ kg}$$

maka,

$$\begin{aligned}
 Q_{sp} &= m_{sp} \times L \\
 &= 3,85 \text{ kg} \times 29506,19 \text{ kkal/kg} \\
 &= 113598,83 \text{ kkal}
 \end{aligned}$$

5. Menghitung Kebutuhan Oli Bekas dan Solar

Diketahui :

$$Q_{\text{Oli Bekas}} = 10684,912 \text{ kkal/kg} \quad (\text{sumber : Wahyu, 2007})$$

$$Q_{\text{solar}} = \mathbf{11062,32 \text{ kkal/kg}} \quad (\text{sumber : Sitepu, 2009})$$

maka kalor campuran antara oli dan solar dengan perbandingan 7:3

$$\begin{aligned}
 Q_{\text{Oli Bekas}} &= 30 \% \times 10684,9 \text{ kkal/kg} = 3205,5 \text{ kkal/kg} \\
 Q_{\text{solar}} &= 70 \% \times 11062,3 \text{ kkal/kg} = \underline{7743,6 \text{ kkal/kg}} \\
 Q_{\text{Bahan Bakar}} &= 10949,09 \text{ kkal/kg} \\
 m_{\text{Bahan Bakar}} &= \frac{Q_{\text{SP}}}{Q_{\text{Bahan Bakar}}} = \frac{113598,83 \text{ kkal}}{10949,09 \text{ kkal/kg}} = 10,3752 \text{ kg}
 \end{aligned}$$

maka volume bahan bakar yang dibutuhkan

$$\begin{aligned}
 V_{\text{oli}} &= \frac{30 \% \times 10,38 \text{ kg}}{860,00 \text{ kg/m}^3} = \frac{0,00362 \text{ m}^3}{\text{m}^3} = 3,62 \text{ liter} \\
 V_{\text{solar}} &= \frac{70 \% \times 10,38 \text{ kg}}{850,00 \text{ kg/m}^3} = \frac{0,00854 \text{ m}^3}{\text{m}^3} = 8,54 \text{ liter}
 \end{aligned}$$

B. Menentukan Massa Jenis Produk

Diketahui :

$$v \text{ piknometer} = 100,4 \text{ ml}$$

$$\text{Berat piknometer kosong} = 60,49 \text{ gr}$$

$$\text{Densitas} = \frac{m}{v}$$

Maka,

a. Suhu 150°C

$$\begin{aligned}
 m_{\text{piknometer+minyak}} &= 140,00 \text{ gr} \\
 m_{\text{minyak}} &= 79,51 \text{ gr} \\
 \rho_{\text{minyak}} &= \frac{79,51 \text{ gr}}{100,40 \text{ ml}} \\
 &= 0,7919 \text{ gr/ml}
 \end{aligned}$$

b. Suhu 200°C

$$\begin{aligned}
 m_{\text{piknometer+minyak}} &= 138,52 \text{ gr} \\
 m_{\text{minyak}} &= 78,03 \text{ gr} \\
 \rho_{\text{minyak}} &= \frac{78,03 \text{ gr}}{100,40 \text{ ml}} \\
 &= 0,7772 \text{ gr/ml}
 \end{aligned}$$

c. Suhu 250°C

$$\begin{aligned}
 m_{\text{piknometer+minyak}} &= 141,94 \text{ gr} \\
 m_{\text{minyak}} &= 81,45 \text{ gr} \\
 \rho_{\text{minyak}} &= \frac{81,45 \text{ gr}}{100,40 \text{ ml}} \\
 &= 0,8113 \text{ gr/ml}
 \end{aligned}$$

C. Berat produk yang terkonversi

a. Suhu 150°C

$$\begin{aligned}
 \rho &= 0,792 \text{ gr/ml} \\
 v &= 450 \text{ ml} \\
 m &= v \times \rho \\
 &= 0,7919 \text{ gr/ml} \quad \times \quad 100 \text{ ml} \\
 &= 79,51 \text{ gr}
 \end{aligned}$$

b. Suhu 200°C

$$\begin{aligned}
 \rho &= 0,7772 \text{ gr/ml} \\
 v &= 1744 \text{ ml} \\
 m &= m \times p \\
 &= 0,777 \text{ gr/ml} \quad \times \quad 1744 \text{ ml} \\
 &= 1355,42 \text{ gr}
 \end{aligned}$$

c. Suhu 250°C

$$\begin{aligned}
 \rho &= 0,8113 \text{ gr/ml} \\
 v &= 1800 \text{ ml} \\
 m &= m \times p \\
 &= 0,8113 \text{ gr/ml} \quad \times \quad 1800 \text{ ml} \\
 &= 1460,26 \text{ gr}
 \end{aligned}$$

$$m_{\text{total}} = 2895,19 \text{ gr}$$

D. Menghitung % konversi

$$\% \text{ Konversi} = \frac{m_{\text{produk}}}{m_{\text{bahan baku}}}$$

$$\begin{aligned} \% \text{ Konversi} &= \frac{2895,19 \text{ gr}}{4000 \text{ gr}} \times 100 \% \\ &= 72,38 \% \end{aligned}$$