

LAMPIRAN B PERHITUNGAN

B.2 Perhitungan Bahan Baku

Penggunaan Minyak 3000 ml , dimana Rasio Minyak Methanol yang digunakan yaitu 1 : 7 dan katalis NaOH yang digunakan sebesar 1%.

$$\begin{aligned} \rho \text{ Minyak} &= 0.9087 \text{ gr/ml} \\ \text{Massa Minyak} &= 3000 \text{ ml} \times 0.9087 \text{ gr/ml} \\ &= 2726.1 \text{ gr} \\ \text{Mol Trigliserida} &= \frac{\text{Massa Minyak}}{\text{BE Trigliserida}} \\ &= \frac{2726.1 \text{ gr}}{256 \text{ gr/mol}} \\ &= 10.6488 \text{ mol} \\ \\ \text{Mol Methanol} &= 7 \times 10.6488 \text{ mol} \\ &= 74.5418 \text{ mol} \\ \text{Volume Methanol} &= \frac{\text{Mol Methanol} \times \text{BM Methanol}}{\text{Densitas Methanol}} \\ &= \frac{74.5418 \text{ mol} \times 32 \text{ gr/mol}}{0.792 \text{ gr/ml}} \\ &= 3011.789773 \text{ ml} \\ \text{Massa Methanol} &= 3011.789773 \text{ ml} \times 0.792 \text{ gr/ml} \\ &= 2385.3375 \text{ gr} \\ \\ \text{Massa NaOH} &= 1\% \times \text{Massa Minyak} \\ &= 0.01 \times 2726.1 \text{ gr} \\ &= 27.261 \text{ gr} \\ \\ \text{Mol NaOH} &= \frac{\text{Massa NaOH}}{\text{BM NaOH}} \\ &= \frac{27.261 \text{ gr}}{40 \text{ gr/mol}} \\ &= 0.6815 \text{ mol} \end{aligned}$$

	NaOH	+	CH₃OH	→	NaOCH₃	+	H₂O	
m :	0.6815		0.6815		-		-	mol
b :	0.6815		0.6815		0.6815		0.6815	mol
s :	0		0		0.6815		0.6815	mol
BM	40		32		70		18	gr/mol

$$\begin{aligned}
 \text{Mol CH}_3\text{OH} &= \text{Mol NaOCH}_3 \\
 &= 0.6815 \text{ mol} \\
 \text{Mol CH}_3\text{OH} &= \frac{\text{Massa CH}_3\text{OH}}{\text{BM CH}_3\text{OH}} \\
 0.6815 \text{ mol} &= \frac{\text{Massa CH}_3\text{OH}}{32 \text{ gr/mol}} \\
 \text{Massa CH}_3\text{OH} &= 0.6815 \text{ mol} \times 32 \text{ gr/mol} \\
 &= 21.8088 \text{ gr}
 \end{aligned}$$

$$\begin{aligned}
 \text{Berat Methanol yang dilebihkan 10\%} & \\
 &= 0.1 \times 21.8088 \text{ gr} \\
 &= 2.1809 \text{ gr}
 \end{aligned}$$

$$\begin{aligned}
 \text{Jumlah Methanol yang dibutuhkan} & \\
 &= 21.8088 \text{ gr} + 2.1809 \text{ gr} \\
 &= 23.9897 \text{ gr}
 \end{aligned}$$

$$\begin{aligned}
 \text{Atau} & \\
 &= \frac{\text{Massa Methanol}}{\text{Densitas Methanol}} \\
 &= \frac{23.9897 \text{ gr}}{0.792 \text{ gr/ml}} \\
 &= 30.2900 \text{ ml}
 \end{aligned}$$

Penggunaan Jumlah Bahan Baku

Rasio Molar Minyak : Methanol adalah 1 : 7

Banyak Katalis yang digunakan adalah 1%

No.	Bahan	Massa (gr)	Volume (ml)
1.	Minyak	2726.1	3000
2.	Methanol	2385.3375	3011.7898
3.	NaOH	27.2610	12.7992
4.	Methanol (Katalis)	23.9897	30.2900
Total		5162.7	6054.9

B.3 Densitas Biodiesel

Massa Piknometer Kosong = 59.95 gr

Volume Piknometer = 100.29 ml

Apabila

$$\rho = \frac{\text{Massa Pikno \& Sampel} - \text{Massa Pikno Kosong}}{\text{Volume Piknometer}}$$

B.3.1. Kecepatan Pengadukan 1000 rpm dan 60 Menit Waktu Pengadukan

Massa Piknometer + Sampel = 145.7581 gr

$$\begin{aligned}\rho &= \frac{145.7581 \text{ gr} - 59.95 \text{ gr}}{100.29 \text{ ml}} \\ &= 0.8556 \text{ gr}\end{aligned}$$

B.3.2 Kecepatan Pengadukan 1500 rpm dan 60 Menit Waktu Pengadukan

Massa Piknometer + Sampel = 145.2466 gr

$$\begin{aligned}\rho &= \frac{145.2466 \text{ gr} - 59.95 \text{ gr}}{100.29 \text{ ml}} \\ &= 0.8505 \text{ gr}\end{aligned}$$

B.3.3. Kecepatan Pengadukan 2000 rpm dan 60 Menit Waktu Pengadukan

Massa Piknometer + Sampel = 145.8985 gr

$$\begin{aligned}\rho &= \frac{145.8985 \text{ gr} - 59.95 \text{ gr}}{100.29 \text{ ml}} \\ &= 0.8570 \text{ gr/ml}\end{aligned}$$

B.3.4. Kecepatan Pengadukan 1000 rpm dan 90 Menit Waktu Pengadukan

Massa Piknometer + Sampel = 146.0590 gr

$$\rho = \frac{146.0590 \text{ gr} - 59.95 \text{ gr}}{100.29 \text{ ml}}$$

$$= 0.8586 \text{ gr/ml}$$

B.3.5. Kecepatan Pengadukan 1500 rpm dan 90 Menit Waktu Pengadukan

$$\text{Massa Piknometer + Sampel} = 145.5074 \text{ gr}$$

$$\rho = \frac{145.5074 \text{ gr} - 59.95 \text{ gr}}{100.29 \text{ ml}}$$

$$= 0.8531 \text{ gr/ml}$$

B.3.6. Kecepatan Pengadukan 2000 rpm dan 90 Menit Waktu Pengadukan

$$\text{Massa Piknometer + Sampel} = 146.0389 \text{ gr}$$

$$\rho = \frac{146.0389 \text{ gr} - 59.95 \text{ gr}}{100.29 \text{ ml}}$$

$$= 0.8584 \text{ gr/ml}$$

B.3.7. Kecepatan Pengadukan 1000 rpm dan 120 Menit Waktu Pengadukan

$$\text{Massa Piknometer + Sampel} = 145.4071 \text{ gr}$$

$$\rho = \frac{145.4071 \text{ gr} - 59.95 \text{ gr}}{100.29 \text{ ml}}$$

$$= 0.8521 \text{ gr/ml}$$

B.3.8. Kecepatan Pengadukan 1500 rpm dan 120 Menit Waktu Pengadukan

$$\text{Massa Piknometer + Sampel} = 145.3369 \text{ gr}$$

$$\rho = \frac{145.3369 \text{ gr} - 59.95 \text{ gr}}{100.29 \text{ ml}}$$

$$= 0.8514 \text{ gr/ml}$$

B.3.9. Kecepatan Pengadukan 2000 rpm dan 120 Menit Waktu Pengadukan

$$\text{Massa Piknometer + Sampel} = 145.4673 \text{ gr}$$

$$\rho = \frac{145.4673 \text{ gr} - 59.95 \text{ gr}}{100.29 \text{ ml}}$$

$$= 0.8527 \text{ gr/ml}$$

B.4 Viskositas Biodiesel

$$K \text{ Bola} = 3.3 \text{ mpa m cm}^3/\text{gr m}$$

$$\text{Densitas Bola} = 8.02 \text{ gr/ml}$$

Apabila

$$\mu = K \times (\rho \text{ Bola} - \rho \text{ Biodiesel}) \times t$$

$$= \frac{\mu}{\rho \text{ Biodiesel}}$$

B.4.1. Kecepatan Pengadukan 1000 rpm dan 60 Menit Waktu Pengadukan

$$\text{Waktu Bola Jatuh Rata-rata} = 10.85 \frac{1 \text{ menit}}{60 \text{ s}}$$

$$= 0.18 \text{ menit}$$

$$\mu = 3.3 \text{ mpa m cm}^3/\text{gr m} \times (8.02 \text{ gr/ml} - 0.8556 \text{ gr/ml}) \times 0.18 \text{ menit}$$

$$= \frac{4.274042369}{0.8556 \text{ gr/ml}} = 4.9954 \text{ cSt}$$

B.4.2. Kecepatan Pengadukan 1500 rpm dan 60 Menit Waktu Pengadukan

$$\text{Waktu Bola Jatuh Rata-rata} = 10.51 \frac{1 \text{ menit}}{60 \text{ s}}$$

$$= 0.18 \text{ menit}$$

$$\mu = 3.3 \text{ mpa m cm}^3/\text{gr m} \times (8.02 \text{ gr/ml} - 0.8505 \text{ gr/ml}) \times 0.18 \text{ menit}$$

$$= \frac{4.143015326}{0.8505 \text{ gr/ml}} = 4.8713 \text{ cSt}$$

B.4.3. Kecepatan Pengadukan 2000 rpm dan 60 Menit Waktu Pengadukan

$$\begin{aligned}\text{Waktu Bola Jatuh Rata-rata} &= 11.02 \frac{1 \text{ menit}}{60 \text{ s}} \\ &= 0.18 \text{ menit}\end{aligned}$$

$$\begin{aligned}\mu &= 3.3 \text{ mpa m cm}^3/\text{gr m} \times (8.02 \text{ gr/ml} - 0.8570 \text{ gr/ml}) \times 0.18 \text{ menit} \\ &= \frac{4.342807698}{0.8570 \text{ gr/ml}} = 5.0675 \text{ cSt}\end{aligned}$$

B.4.4. Kecepatan Pengadukan 1000 rpm dan 90 Menit Waktu Pengadukan

$$\begin{aligned}\text{Waktu Bola Jatuh Rata-rata} &= 10.68 \frac{1 \text{ menit}}{60 \text{ s}} \\ &= 0.18 \text{ menit}\end{aligned}$$

$$\begin{aligned}\mu &= 3.3 \text{ mpa m cm}^3/\text{gr m} \times (8.02 \text{ gr/ml} - 0.8586 \text{ gr/ml}) \times 0.18 \text{ menit} \\ &= \frac{4.207919248}{0.8586 \text{ gr/ml}} = 4.9009 \text{ cSt}\end{aligned}$$

B.4.5. Kecepatan Pengadukan 1500 rpm dan 90 Menit Waktu Pengadukan

$$\begin{aligned}\text{Waktu Bola Jatuh Rata-rata} &= 10.56 \frac{1 \text{ menit}}{60 \text{ s}} \\ &= 0.18 \text{ menit}\end{aligned}$$

$$\begin{aligned}\mu &= 3.3 \text{ mpa m cm}^3/\text{gr m} \times (8.02 \text{ gr/ml} - 0.8531 \text{ gr/ml}) \times 0.18 \text{ menit} \\ &= \frac{4.163849446}{0.8531 \text{ gr/ml}} = 4.8808 \text{ cSt}\end{aligned}$$

B.4.6. Kecepatan Pengadukan 2000 rpm dan 90 Menit Waktu Pengadukan

$$\text{Waktu Bola Jatuh Rata-rata} = 10.75 \frac{1 \text{ menit}}{60 \text{ s}}$$

$$= 0.18 \text{ menit}$$

$$\mu = 3.3 \text{ mpa m cm}^3/\text{gr m} \times (8.02 \text{ gr/ml} - 0.8584 \text{ gr/ml}) \times 0.18 \text{ menit}$$

$$= \frac{4.234296212}{0.8584 \text{ gr/ml}} = 4.9328 \text{ cSt}$$

B.4.7. Kecepatan Pengadukan 1000 rpm dan 120 Menit Waktu Pengadukan

$$\begin{aligned} \text{Waktu Bola Jatuh Rata-rata} &= 10.90 \frac{1 \text{ menit}}{60 \text{ s}} \\ &= 0.18 \text{ menit} \end{aligned}$$

$$\mu = 3.3 \text{ mpa m cm}^3/\text{gr m} \times (8.02 \text{ gr/ml} - 0.8521 \text{ gr/ml}) \times 0.18 \text{ menit}$$

$$= \frac{4.297156104}{0.8521 \text{ gr/ml}} = 5.0430 \text{ cSt}$$

B.4.8. Kecepatan Pengadukan 1500 rpm dan 120 Menit Waktu Pengadukan

$$\begin{aligned} \text{Waktu Bola Jatuh Rata-rata} &= 10.57 \frac{1 \text{ menit}}{60 \text{ s}} \\ &= 0.18 \text{ menit} \end{aligned}$$

$$\mu = 3.3 \text{ mpa m cm}^3/\text{gr m} \times (8.02 \text{ gr/ml} - 0.8514 \text{ gr/ml}) \times 0.18 \text{ menit}$$

$$= \frac{4.168779888}{0.8514 \text{ gr/ml}} = 4.8964 \text{ cSt}$$

B.4.9. Kecepatan Pengadukan 2000 rpm dan 120 Menit Waktu Pengadukan

$$\begin{aligned} \text{Waktu Bola Jatuh Rata-rata} &= 10.72 \frac{1 \text{ menit}}{60 \text{ s}} \\ &= 0.18 \text{ menit} \end{aligned}$$

$$\mu = 3.3 \text{ mpa m cm}^3/\text{gr m} \times (8.02 \text{ gr/ml} - 0.8527 \text{ gr/ml}) \times 0.18 \text{ menit}$$

$$= \frac{4.227153985}{0.8527 \text{ gr/ml}} = 4.9574 \text{ cSt}$$