

LAMPIRAN I
DATA ANALISA

Tabel L.1.1 Sistem Penamaan Sampel

Sampel	Kode
Tempurung Kelapa 4-5 cm	Tb
Tempurung Kelapa 1-3 cm	Tk
Akasia 20 mesh	Ab
Akasia 60 mesh	Ak
Racuk 20 mesh	Rb
Racuk 60 mesh	Rk

Tabel L.1.2 Data Perhitungan Kadar Air Sampel

Kode	Berat Cawan Kosong (gr)	Berat Sampel (gr)	Berat sebelum (gr)	Berat sesudah (gr)
Tb	74,04	2,01	76,05	75,842
Tk	74,04	1,15	75,19	75,08
Ab	56,02	1	57,02	56,977
Ak	56,02	1,01	57,03	56,99
Rb	62,85	1,05	63,9	63,849
Rk	62,85	1,08	63,93	63,878

Tabel L.1.4 Data Perhitungan Densitas Sampel

Kode	Erlenmeyer kosong (gr)	Erlenmeyer + air (gr)	Erlen + sampel (gr)
Tb	11,0898	16,7082	17,449
Tk	11,0898	16,7082	17,492
Ab	11,0898	16,7082	17,401
Ak	11,0898	16,7082	17,486
Rb	11,0898	16,7082	17,349
Rk	11,0898	16,7082	17,378

Tabel L.1.5 Data Perhitungan Bilangan Asam Sampel

Kode	Vol titran (ml)	Kons titran (ek/ml)	Massa sampel (gr)	BM NaOH (gr/ek)
Tb	2,7	0,5	11,32	40
Tk	2,6	0,5	11,40	40
Ab	2,6	0,5	11,23	40
Ak	2,5	0,5	11,38	40
Rb	4,5	0,5	11,14	40
Rk	4,4	0,5	11,19	40

Tabel L.1.6 Data Perhitungan Fenol Sampel

Kode	Fenol (ppm)	Vol Sampel (ml)	Berat sampel (gr)	F. Pengenceran
Tb	146,59	10	0,057	1
Tk	229,74	10	0,0513	1
Ab	103,73	10	0,05	1
Ak	114,73	10	0,0557	1
Rb	187,98	10	0,05	1
Rk	248,43	10	0,0599	1

Tabel L.1.7 Data Perhitungan *Specific Energy Consumption* Sampel

Kode	Waktu		Ceramic Heater		Band Heater		Pompa	
	Total Cair (l)	Proses (h)	Tegangan (v)	Arus (A)	Tegangan (v)	Arus (A)	Tegangan (v)	Arus (A)
Tb	0,7685	4,9	220	2,2909	220	3,655	220	0,1
Tk	0,7952	3,4	220	2,2909	220	3,65	220	0,1
Ab	0,4628	5,47	220	2,2864	220	3,65	220	0,1
Ak	0,5057	3,8	220	2,2909	220	3,655	220	0,1
Rb	0,3676	5,3	220	2,2818	220	3,645	220	0,1
Rk	0,4362	4,05	220	2,2727	220	3,645	220	0,1

Tabel L.1.8 Data Perhitungan %Rendemen Asap Cair

Kode	Fasa 1 (ml)	Fasa 2 (ml)	Den fasa 1 (gr/ml)	Den Fasa 2 (gr/ml)
Tb	100	52,5	1,132	1,139
Tk	210	85,2	1,123	1,138
Ab	136,5	42,3	1,11	1,117
Ak	211	49,7	1,114	1,119
Rb	143	34,6	1,117	1,128
Rk	178	34,2	1,116	1,127

Lampiran II Perhitungan

1. Menganalisa Karakteristik Bahan Baku

a. Menghitung Kadar Air Sampel

Sampel Tempurung Kelapa 4-5 cm

$$W = 76,05 \text{ gr} \quad \text{massa sampel} = 2,01 \text{ gr}$$

$$W = 75,842 \text{ gr}$$

$$\begin{aligned} \text{Kadar Air} &= \frac{(W_1 - W_2)}{\text{massa sampel}} \times 100\% \dots \dots \dots 1 \\ &= \frac{76,05 \text{ gr} - 75,842 \text{ gr}}{2,01 \text{ gr}} \times 100\% \\ &= 10,35\% \end{aligned}$$

2. Menganalisa Hasil Percobaan Asap Cair

a. Menghitung Densitas Asap Cair

Sampel Tempurung Kelapa 4-5 cm

$$W = 11,0898 \text{ gr} \quad W = 16,7082 \text{ gr}$$

$$W = 17,449 \text{ gr}$$

$$\begin{aligned} \text{Densitas} &= \frac{(W_2 - W_1)}{(V_2 - V_1)} \dots \dots \dots 3 \text{ W W} \\ &= \frac{17,449 \text{ gr} - 11,09 \text{ gr}}{16,708 \text{ gr} - 11,09 \text{ gr}} \\ &= 1,132 \text{ gr/ml} \end{aligned}$$

b. Menghitung Kandungan Asam Asap Cair

Sampel Tempurung Kelapa 4-5 cm

$$V = 2,7 \text{ ml} \quad BM = 40 \text{ gr/mol}$$

$$T = 0,5 \text{ ek/ml} \quad G = 11,31852 \text{ gr}$$

$$\begin{aligned} \text{Bilangan Asam} &= \frac{(W_2 - W_1)}{(V_2 - V_1)} \dots \dots \dots 4 \text{ W W} \\ &= \frac{2,7 \text{ ml} \times 0,5 \text{ ek/ml} \times 40 \text{ gr/mol}}{11,31852485 \text{ gr}} \\ &= 4,771\% \end{aligned}$$

c. Menghitung Kandungan Fenol Asap Cair Sampel

Tempurung Kelapa 4-5 cm

$$C = 146,59 \text{ ppm} \quad F = 1$$

$$V = 10 \text{ ml} \quad m = 0,057 \text{ gr}$$

$$\text{Fenol} = \frac{(C_{\text{ppm}} \times V \times F)}{m}$$

$$= \frac{146,59 \text{ ppm} \times 10 \text{ ml} \times 1}{0,057 \text{ gr}}$$

$$= 25717,54 \text{ mg GAE/gr}$$

d. Menghitung %rendemen Cair, Padat

Sampel Tempurung Kelapa 4-5 cm

$$m = 1500 \text{ gr}$$

$$V = 100 \text{ ml} \quad \rho = 1,132 \text{ gr/ml}$$

$$V = 52,5 \text{ ml} \quad \rho = 1,139 \text{ gr/ml}$$

Kondenser 1

$$\text{Rendemen} = \frac{m_{\text{kondenser 1}}}{m_{\text{total}}} \times 100\%$$

$$\text{Rendemen} = \frac{V_{\text{Kond.1}} \times \rho_{\text{Kond.1}}}{m_{\text{total}}} \times 100\%$$

$$= \frac{100 \text{ ml} \times 1,132 \text{ gr/ml}}{1500 \text{ gr}} \times 100 \%$$

$$= 7,55 \%$$

Kondenser 2

$$\text{Rendemen} = \frac{m_{\text{kondenser 2}}}{m_{\text{total}}} \times 100\%$$

$$\text{Rendemen} = \frac{V_{\text{Kond.2}} \times \rho_{\text{Kond.1}}}{m_{\text{total}}} \times 100\%$$

$$= \frac{52,5 \text{ ml} \times 1,139 \text{ gr/ml}}{1500 \text{ gr}} \times 100 \%$$

$$= 3,99 \%$$

3. Menghitung Spesific Energy Consumption (SEC)

d. Menghitung Total Konsumsi Daya

Sampel Tempurung Kelapa 4-5 cm

$$\begin{aligned}
 v &= 220 \text{ V} & t &= 4,9 \text{ jam} \\
 I &= 2,291 \text{ A} \\
 I &= 3,655 \text{ A} \\
 I &= 0,1 \text{ A}
 \end{aligned}$$

Daya Ceramic Heater

$$\begin{aligned}
 \text{Daya} &= V \times I & \text{A} \\
 &= 220 \text{ V} \times 2,291 \text{ A} \\
 &= 504 \text{ Watt}
 \end{aligned}$$

Daya Band Heater

$$\begin{aligned}
 \text{Daya} &= V \times I & 2,291 \text{ A} \\
 &= 220 \text{ V} \times 3,655 \text{ A} \\
 &= 804 \text{ Watt}
 \end{aligned}$$

Daya Pompa

$$\begin{aligned}
 \text{Daya} &= V \times I & 0,1 \text{ A} \\
 &= 220 \text{ V} \times 0,1 \text{ A} \\
 &= 22 \text{ Watt}
 \end{aligned}$$

Total Daya

$$\begin{aligned}
 \text{Total Daya} &= P_1 + P_2 + P_3 & 0,1 \text{ Watt} + 22 \text{ Watt} \\
 &= 504 \text{ Watt} + 804 \text{ Watt} + 22 \text{ Watt} \\
 &= 1330 \text{ Watt}
 \end{aligned}$$

Total Konsumsi Daya

$$\begin{aligned}
 \text{Total Konsumsi Daya} &= P \times t & \text{jam} \\
 &= 1330 \text{ Watt} \times 4,9 \text{ jam} \\
 &= 6517 \text{ Wh} / 1000 \text{ W/kWh} = 6,517 \text{ kWh}
 \end{aligned}$$

e. Menghitung Specific Energy Consumption (SEC)

Sampel Tempurung Kelapa 4-5 cm $m = 0,7685 \text{ liter}$

$$\begin{aligned}
 \text{SEC} &= P / m \\
 &= 6,517 \text{ kWh} / 0,7685 \text{ liter} \\
 &= 8,48 \text{ kWh/liter}
 \end{aligned}$$

Dengan perhitungan yang sama maka didapat hasil perhitungan analisa asap cair pada alat Asap Cair 2 Kondensor di tabel berikut

Tabel L.2.1 Hasil Perhitungan Analisa Sampel Asap Cair

Sampel	Kode	Kadar Air (%)	Densitas (gr/ml)	
			Fasa 1	Fasa 2
Tempurung Kelapa 4-5 cm	Tb	10,35	1,132	1,140
	Tk	9,57	1,123	1,138
Tempurung Kelapa 1-3 cm	Ab	4,30	1,110	1,117
	Ak	3,96	1,114	1,119
Akasia 20 mesh	Rb	4,86	1,117	1,128
Akasia 60 mesh	Rk	4,81	1,116	1,127
Racuk 20 mesh				
Racuk 60 mesh				

Tabel L.2.2 Lanjutan Perhitungan Analisa Sampel Asap Cair

Sampel	%Rendemen		%Asam	
	Fasa 1	Fasa 2	Fasa 1	Fasa 2
Tb	8	4	4,77	4,56
Tk	16	6	4,63	4,39
Ab	10	3	8,65	8,42
Ak	16	4	8,08	7,86
Rb	11	3	5,37	4,79
Rk	13	3	4,30	4,08

Tabel L.2.3 Lanjutan Hasil Perhitungan Analisa Sampel Asap Cair

Sampel	%Fenol		Total Konsumsi Daya (kWh)	SEC (kWh/l)
	Fasa 1	Fasa 2		
Tb	2,57	4,48	6,52	8,48
Tk	2,07	2,06	4,52	5,68
Ab	1,82	3,54	7,26	15,70
Ak	3,76	4,15	5,05	9,99
Rb	1,88	2,18	7,03	19,12
Rk	2,13	4,32	5,36	12,29

LAMPIRAN III
DOKUMENTASI

A. Persiapan Bahan Baku



Limbah Biomassa Serbuk Kayu



Proses Pengumpulan Limbah Biomassa Serbuk Kayu



Penjemuran Limbah Biomassa (Serbuk Kayu)



Proses Pengecekan Kadar Air





Proses Pengecekan Kadar Abu



Proses Pengecilan Ukuran

B. Proses Pirolisis Asap Cair



Proses Membuka Reaktor, Memasukkan Bahan, Dan Menutup Reaktor



Proses Pemasukan Bahan Baku Cair kedalam Reaktor

Seperangkat Alat Pirolisis Asap



Tempat Penampungan Asap Cair Pada Kondensor 1 dan Kondensor 2



Alat Ukur Suhu pada Reaktor, Tar, Kondensor 1, Dan Kondensor 2



Proses Penyaringan Asap Cair Dari Tar



Asap Cair Tempurung Kelapa 1-3 cm
4-6 Cm

Asap Cair Tempurung Kelapa



Asap Cair Kayu Jati 20 Mesh



Asap Cair Kayu Jati 60 Mesh



Asap Cair Racuk 20 Mesh



Asap Cair Racuk 60 Mesh

C. Analisa Asap Cair

- pH



Analisa pH dengan pHmeter

- Fenol



Pembuatan Larutan Asam Galat

Proses Homogenisasi



Persiapan Analisa



Analisa Fenol

- **%Asam**



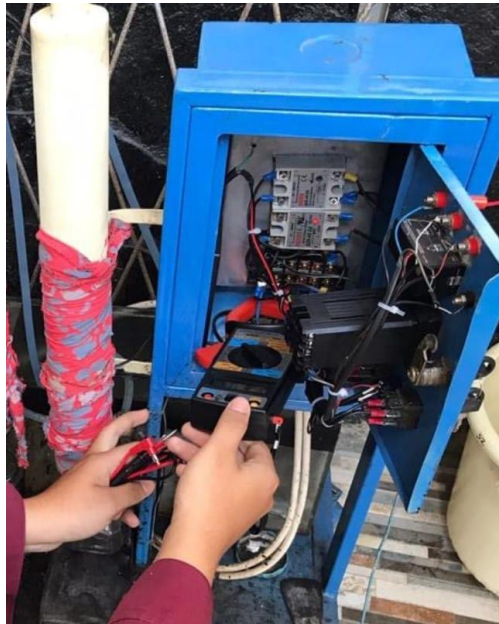
Proses Homogenisasi Larutan

Persiapan Titrasi Asam



Proses titrasi asam

D. Pengukuran SEC



Pengukuran Daya dan Tegangan

E. Spektrofotometri

