

LAMPIRAN A. NERACA MASSA

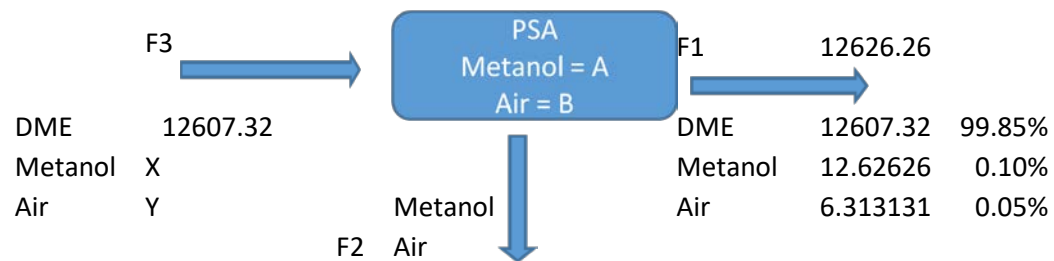
Kapasitas produksi = 100.000 ton/tahun

$$= 100.000 \frac{\text{ton}}{\text{tahun}} \times \frac{1 \text{ tahun}}{330 \text{ hari}} \times \frac{1 \text{ hari}}{24 \text{ jam}} \times \frac{1.000 \text{ kg}}{1 \text{ ton}}$$

= 12626.2626 kg/jam

Produk yang dihasilkan = 12626.2626 kg/jam

1. PSA (Pressure Swing Adsorption)



Kondisi Operasi :

- Temperatur : 40 °C
- Efisiensi : 98 % (Walas, Tabel 9.2)

Spesifikasi produk yang diinginkan 99.85 %

➤ Output

Komposisi Produk :

- DME = 12607.32 Kg/Jam
- Metanol = 12.6262 Kg/Jam
- Air = 6.313131 Kg/Jam

Komposisi :

- Metanol
- X= A + Metanol
- A= 95%X
- X= A + 12.6262
- X= 0.95X + 12.6262

$$0.05X = 12.6262$$

$$X = 252.5253$$

$$\text{Metanol } F1 = 252.5253 \text{ Kg/jam}$$

$$\text{Metanol } F2 = 239.899 \text{ Kg/jam}$$

- Air

$$Y = B + \text{Air}$$

$$Y = B + 6.313131$$

$$B = 0.9Y$$

$$Y = 0.9Y + 6.313131$$

$$0.1 Y = 6.313131$$

$$Y = 63.13131$$

$$\text{Air } F1 = 63.13131 \text{ Kg/jam}$$

$$\text{Air } F2 = 56.81818 \text{ Kg/jam}$$

Tabel LA.1 Neraca Massa PSA

Komponen	Input	Output	
	F3	F2	F3
C ₂ H ₆ O	12607.32	0	12607.32
CH ₃ OH	252.5253	239.899	12.62626
H ₂ O	63.13131	56.81818	6.313131
Sub		296.7172	12626.26
Total	12922.98	12922.98	

2. Flash Drum

Fungsi : Untuk memisahkan DME dengan air dan metanol

➤ Output

Komposisi Produk :

- DME = 12607.32 Kg/Jam

- Metanol = 252.525 Kg/Jam

- Air = 63.1313 Kg/Jam

Antoine Constans :

Komponen	a	B	c
C ₂ H ₆ O	6.976	889.3	242
H ₂ O	3.55959	643.748	-198.043
CH ₃ OH	5.20409	1581.341	-33.5

Sumber : G.V. Reklaitis. Hal. 649-652

Kondisi Operasi :

Tekanan (P) : 1 atm = 1.0333 bar

Temperatur (T) : 43.4 °C = 316.4 °K

Komponen	massa Top (Kmol)	Yi	Log Pi	Pi	Ki	Zi	Feed	Xi	Bottom
C2H6OH	274.07	0.96	5.383	241776.474	238603.05	0.476	272.52	4E-06	0.001
H2O	3.5073	0.01	-1.879	0.01319939	0.013026	0.482	276.33	0.94	269.25
CH3OH	7.8914	0.03	-0.386	0.4114693	0.406069	0.048	27.54	0.068	19.43
Total	285.47	1				1.006	576.398	1.011	288.685

Tabel LA.3 Neraca Massa

Komponen	Input	Output	
	Feed	Top	Bottom
CH3OH	881.2815359	252.525253	621.878324
C2H6OH	12536.1311	12607.3232	0.052838063
H2O	4974.007101	63.1313131	4846.508758
Sub	18391.41969	12922.9798	5468.43992
Total	18391.41969	18391.4197	

3. Vaporizer

Fungsi : untuk menguapkan keluar Flash drum

Kondisi Operasi :

T in =

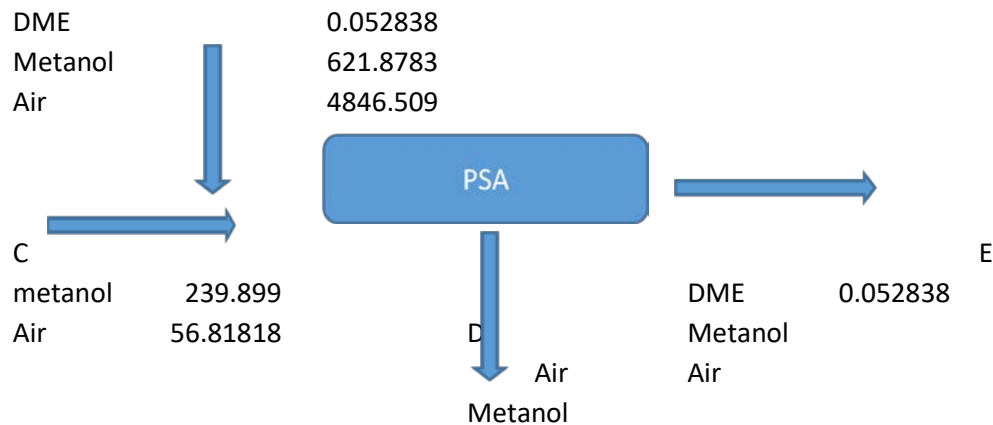
Komponen	Masuk		Keluar
	F2	F4	F9
C2H6O	0	0.05283806	0.052838063
CH3OH	239.89899	621.878324	861.7773139
H2O	56.8181818	4846.50876	4903.326939
Sub	296.717172	5468.43992	5765.157091
Total	5765.157091		5765.157091

4. PSA 2 (Pressure Swing Adsorbtion)

Fungsi : Pemisahan antara Air dan metanol

Kondisi Operasi :

- Temperatur : 40 °C
- Tekanan : 8 atm

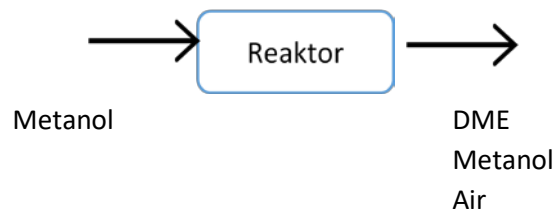


Tabel LA.3 PSA 2

Komponen	Input	Output	
	C	D	E
C2H6O	0.052838	0.052838	
CH3OH	861.7773	857.727	4.050353
H2O	4903.327	3.432329	4899.895
Sub	5765.157	861.2121	4903.945
Total	5765.157	5765.157	

5. Reaktor

Fungsi : Mereaksikan metanol dengan katalis Silica Alumina



Kondisi Operasi :

Temperatur (P) :

Tekanan (T) :

Komposisi umpan keluar :

DME = 12536.13 Kg/jam

Metanol = 881.2815 Kg/jam

Air = 4974.007 Kg/jam

Reaksi :



Mula² : 18322.8552

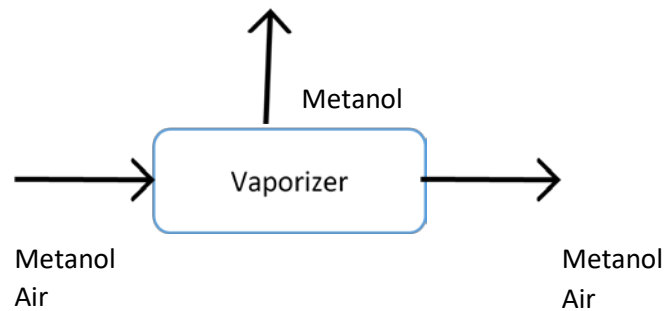
Bereaksi:	17441.5736	12536.131	4905.443	—
Sisa :	881.281536	12536.131	4905.443	

Tabel LA.9 Neraca Massa Reaktor

Komponen	Input	Output
	Massa	Massa
C ₂ H ₆ O	0	12536.13
CH ₃ OH	18322.86	881.2815
H ₂ O	68.56451	4974.007
Total	18391.42	18391.42

6. Vaporizer

Fungsi : Menguapkan Metanol



Kondisi Operasi:

- Temperatur : 145 °C
- Tekanan : 12 atm
- Efisiensi Alat : 80%

Komposisi Keluar :

Metanol : 18322.85518 Kg/jam

Air : 68.56451314 Kg/jam

Neraca Massa Komponen :

$$F1 = 100/80 \times F2$$

$$F1 = 1.25 \times 18391.42$$

$$F1 = 22989.27 \text{ Kg/jam}$$

$$\text{Metanol} = 98\% \times F1$$

$$\text{Metanol} = 0.98 \times 22989.27$$

$$\text{Metanol} = 22529.48913 \text{ Kg/jam}$$

$$\text{Air} = 2\% \times F1$$

$$\text{Air} = 0.02 \times 22989.27$$

$$\text{Air} = 459.7855 \quad \text{Kg/jam}$$

$$*F3$$

$$F3 = F1 - F2$$

$$F3 = 22989.27 - 459.7855$$

$$F3 = 4597.855 \quad \text{Kg/jam}$$

$$\text{Metanol} = 98\% \times F3$$

$$\text{Metanol} = 0.98 \times 4597.855$$

$$\text{Metanol} = 4505.898 \quad \text{Kg/jam}$$

$$\text{Air} = 2\% \times F3$$

$$\text{Air} = 0.02 \times 4597.855$$

$$\text{Air} = 91.9571 \quad \text{Kg/jam}$$

Tabel LA.11 Neraca massa Vaporizer

komponen	Masuk	keluar	
	F1	F2	F3
CH3OH (l)	22529.48913		4505.898
H2O (l)	459.7854924		91.9571
CH3OH (g)		18322.86	
H2O (g)		68.56451	
Sub	22989.27462	18391.42	4597.855
Total	22989.27462	22989.27462	