

### BAB III

## NERACA MASSA

Kapasitas produksi = 70.000 ton/tahun

Jumlah hari kerja = 330 hari/tahun

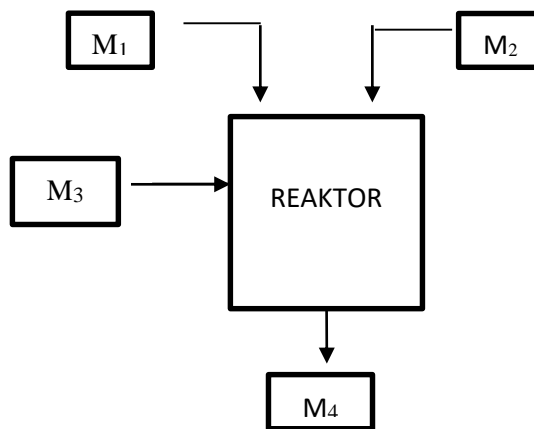
Waktu operasi = 24 jam/ hari

$$\begin{aligned} \text{Kapasitas produksi} &= \frac{70.000}{\text{tahun}} \times \frac{1000}{\text{ton}} \times \frac{1}{330} \times \frac{1}{24} \\ &= 8838,3838 \text{ kg/jam} \end{aligned}$$

Basis = 23414 kg/jam

### 3.1. Reaktor (R-110)

Fungsi : Mereaksikan antara HCHO (37%), NaOH (50%), dan CH<sub>3</sub>CHO (99%)



Neraca Massa Total:

$$M_1 + M_2 + M_3 = M_4$$

Keterangan :

M<sub>1</sub> = Massa HCHO 37% (Formaldehid)

M<sub>2</sub> = Massa NaOH 50% (Natrium Hidroksida)

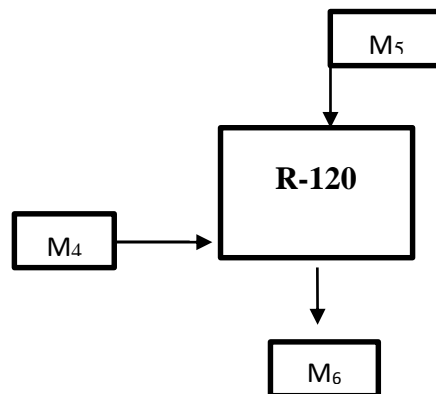
M<sub>3</sub> = Massa CH<sub>3</sub>CHO 99% (Acetaldehid)

M<sub>4</sub> = Massa larutan keluar dari reaktor

Neraca Massa Reaktor (R-110)			
Maasuk Bahan (kg/jam)		M4 keluaran reaktor (kg/jam)	
HCHO	8663,2620	C(CH <sub>2</sub> OH) <sub>4</sub>	8838,3838
CH <sub>4</sub> O	2341,4222	HCHO	866,3262
NaOH	11707,1108	HCOONa	4414,8101
CH <sub>3</sub> CHO	23180,0793	CH <sub>4</sub> O	2341,4222
H <sub>2</sub> O	24350,7904	NaOH	9110,6639
		CH <sub>3</sub> CHO	20320,2681
		H <sub>2</sub> O	24350,7904
Total	<b>70242,6646</b>	Total	<b>70242,6646</b>

### 3.2. Netralizer (R-120)

Fungsi: Untuk menetralkan larutan saat kelebihan alkali



Neraca Massa Total :

$$M_4 + M_5 = M_6$$

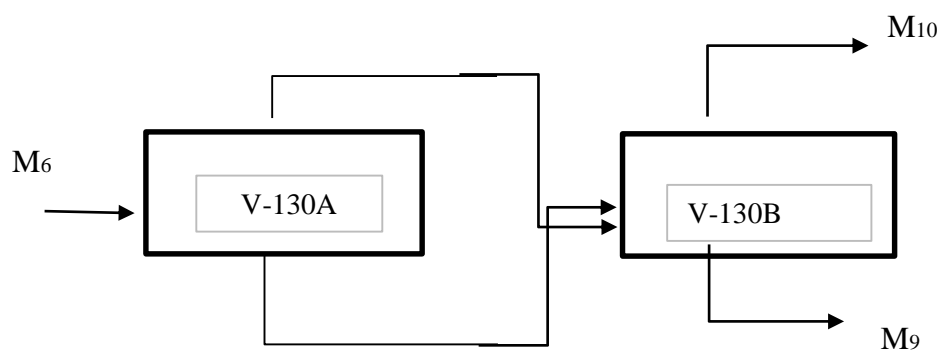
#### Keterangan :

- M<sub>4</sub> = Massa masuk dari Reaktor  
M<sub>5</sub> = Massa HCOOH 98% (Asam format)  
M<sub>6</sub> = Massa menuju evaporator

Neraca Massa Pada Netralizer (R-120)			
Masuk (kg/jam)		Keluar (kg/jam)	
M <sub>4</sub>		M <sub>6</sub>	
C(CH <sub>2</sub> OH) <sub>4</sub>	8838,3838	C(CH <sub>2</sub> OH) <sub>4</sub>	8838,3838
HCOONa	4414,8101	HCOONa	19905,9227
HCOH	866,3262	CH <sub>2</sub> O	866,3262
CH <sub>4</sub> O	2341,4222	CH <sub>3</sub> CHO	20320,2681
NaOH	9110,6639	H <sub>2</sub> O	28662,2288
CH <sub>3</sub> CHO	20320,2681	CH <sub>4</sub> O	2341,4222
H <sub>2</sub> O	24350,7904		
M <sub>5</sub>			
HCOOH	10478,0502		
H <sub>2</sub> O	213,8378		
<b>Total</b>	<b>80934,5525</b>	<b>Total</b>	<b>80934,5516</b>

### 3.3. EVAPORATOR (V-130)

Fungsi : Meningkatkan konsentrasi C(CH<sub>2</sub>OH)<sub>4</sub>



Neraca Massa Total :  $M_6 = M_9 + M_{10}$

Keterangan:

$M_6$  = Massa Masuk dari Netralizer

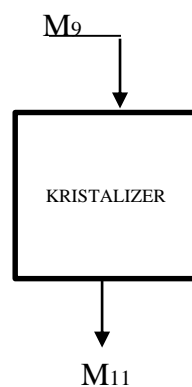
$M_{10}$  = uap air keluaran yang diuapkan dari proses pemekatan

$M_9$  = hasil akhir proses penguapan

Neraca Massa Pada Evaporator (V-130)			
Bahan masuk evaporator		Bahan keluar evaporator	
Komponen	Massa bahan (kg/jam)	Komponen	Massa bahan (kg/jam)
<b>M6</b>		<b>M7</b>	
C(CH <sub>2</sub> OH) <sub>4</sub>	8838,3838	H <sub>2</sub> O	28075,6103
HCOONa	19905,9227	<b>M8</b>	
HCHO	866,3262	H <sub>2</sub> O	586,6185
CH <sub>3</sub> CHO	20320,2681	C(CH <sub>2</sub> OH) <sub>4</sub>	8838,3838
H <sub>2</sub> O	28662,2288	HCOONa	19905,9227
CH <sub>4</sub> O	2341,4222	CH <sub>2</sub> O	866,3262
		CH <sub>3</sub> CHO	20320,2681
		CH <sub>4</sub> O	2341,4222
<b>Total</b>	<b>80934,5516</b>	<b>Total</b>	<b>80934,5516</b>

### 3.4. KRISTALIZER (X-140)

Fungsi : untuk membentuk Kristal Pentaeritritol C(CH<sub>2</sub>OH)<sub>4</sub>



Neraca massa total :  $M_9 = M_{11}$

Keterangan

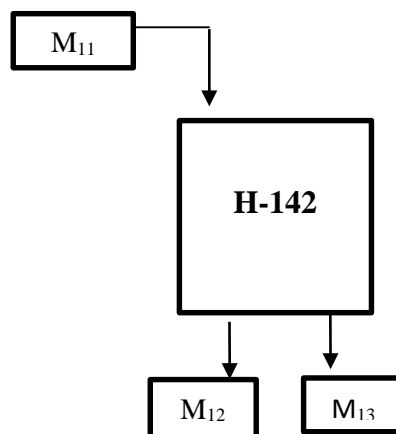
$M_9$  : Massa keluar evaporator

$M_{11}$  : Massa menuju centrifuge

Neraca Massa Kristalizer (X-140)			
Komponen	Massa bahan (kg/jam)	Komponen	Massa bahan (kg/jam)
		<b>Kristal</b>	
C(CH <sub>2</sub> OH) <sub>4</sub>	8838,3838	C(CH <sub>2</sub> OH) <sub>4</sub>	8635,7189
		<b>Rafinat</b>	
HCOONa	19905,9227	HCOONa	19905,9227
H <sub>2</sub> O	586,6185	H <sub>2</sub> O	586,6185
HCHO	866,3262	HCHO	866,3262
CH <sub>3</sub> CHO	20320,2681	C(CH <sub>2</sub> OH) <sub>4</sub>	202,6649
CH <sub>4</sub> O	2341,4222	CH <sub>3</sub> CHO	20320,2681
		CH <sub>4</sub> O	2341,4222
<b>Total</b>	<b>52858,9414</b>	<b>Total</b>	<b>52858,9414</b>

### 3.5. CENTRIFUGE (H-142)

Fungsi : Memisahkan kristal Pentaeritritol dari mother liquor yang masih tercampur



Neraca Massa Total:  $M_{11} = M_{12} + M_{13}$

Keterangan :

$M_8$  = Massa masuk dari *Crystallizer*

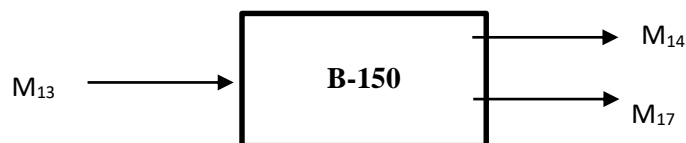
$M_{10}$  = Massa larutan keluar menuju *Waste*

$M_9$  = Massa keluar menuju *screw Conveyor*

Neraca Massa Pada Centrifuge (H-142)			
Bahan masuk Centrifuge		Bahan keluar Centrifuge	
Komponen	Massa bahan (Kg/jam)	Komponen	Massa bahan (Kg/jam)
<b>Kristal</b>		<b>Ke waste</b>	
C(CH <sub>2</sub> OH) <sub>4</sub>	8635,7189	HCOONa	19.886,0167
<b>Rafinat</b>		HCHO	865,4599
HCOONa	19905,9227	C(CH <sub>2</sub> OH) <sub>4</sub>	202,6649
HCHO	866,3262	CH <sub>3</sub> CHO	20299,9478
C(CH <sub>2</sub> OH) <sub>4</sub>	202,6649	CH <sub>4</sub> O	2339,0807
CH <sub>3</sub> CHO	20320,2681	H <sub>2</sub> O	410,6329
CH <sub>4</sub> O	2341,4222	<b>ke screw</b>	
H <sub>2</sub> O	586,6185	HCOONa	19,9059
		H <sub>2</sub> O	175,9855
		HCHO	0,8663
		CH <sub>3</sub> CHO	20,3203
		CH <sub>4</sub> O	2,3414
		Kristal C(CH <sub>2</sub> OH) <sub>4</sub>	8635,7189
<b>Total</b>	<b>52858,9414</b>	<b>Total</b>	<b>52.858,9414</b>

### 3.6. Rotary Dryer (B-150)

Fungsi : Mengurangi kadar air dari produk pentaeritritol



Neraca Massa Total:  $M_{13} = M_{14} + M_{17}$

Keterangan :

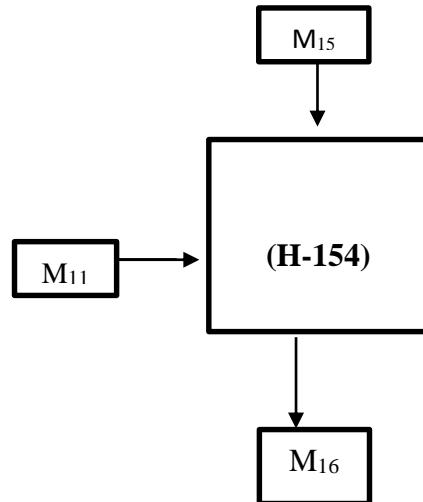
$M_{13}$  = Massa masuk dari *Centrifuge*

$M_{14}$  = Massa larutan keluar menuju cyclone

$M_{17}$  = Massa keluar menuju belt conveyor

<b>Neraca Massa Pada Rotary Dryer (B-150)</b>			
<b>Bahan masuk Rotary Dryer</b>		<b>Bahan keluar cyclone</b>	
<b>Komponen</b>	<b>Massa bahan (Kg/jam)</b>	<b>Komponen</b>	<b>Massa bahan (Kg/jam)</b>
HCOONa	19,9059	HCOONa	0,1991
Kristal C(CH <sub>2</sub> OH) <sub>4</sub>	8635,7189	CH <sub>2</sub> O	0,0087
H <sub>2</sub> O	175,9855	C(CH <sub>2</sub> OH) <sub>4</sub>	86,3572
CH <sub>2</sub> O	0,8663	CH <sub>4</sub> O	0,0234
CH <sub>3</sub> CHO	20,3203	CH <sub>3</sub> CHO	0,2032
CH <sub>4</sub> O	2,3414	H <sub>2</sub> O	172,4658
		Jumlah	259,2574
		<b>Bahan keluar belt conveyor</b>	
		<b>Komponen</b>	<b>Massa bahan (Kg/jam)</b>
		HCOONa	19,7069
		HCHO	0,8577
		C(CH <sub>2</sub> OH) <sub>4</sub>	8549,3617
		CH <sub>4</sub> O	2,3180
		CH <sub>3</sub> CHO	20,1171
		H <sub>2</sub> O	3,5197
		Jumlah	8.595,8810
<b>Total</b>	<b>8855,1384</b>	<b>Total</b>	<b>8.855,1384</b>

## 3.7. Cyclone



Neraca Massa Total:  $M_{14} = M_{15} + M_{16}$

Keterangan:

$M_{14}$  : Massa masuk dari rotary dryer

$M_{15}$  : Massa di dalam stack

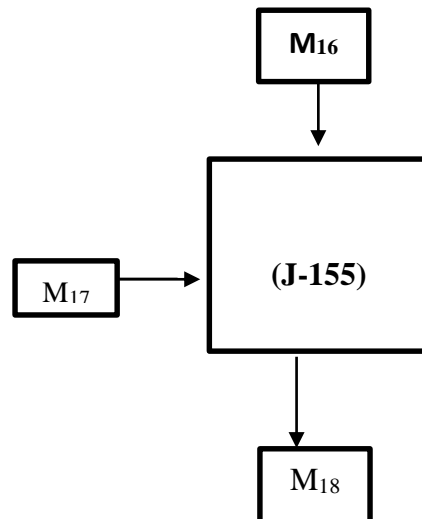
$M_{16}$  : Massa didalam screen

Neraca Massa Pada Cyclone (H-154)			
Bahan masuk Rotary Dryer		Massa di screen	
Komponen	Massa bahan (Kg/jam)	Komponen	Massa bahan (Kg/jam)
HCOONa	0,1991	HCOONa	0,1971
HCHO	0,0087	HCHO	0,0086
C(CH <sub>2</sub> OH) <sub>4</sub>	86,3572	C(CH <sub>2</sub> OH) <sub>4</sub>	85,4936
CH <sub>4</sub> O	0,0234	CH <sub>4</sub> O	0,0232
CH <sub>3</sub> CHO	0,2032	CH <sub>3</sub> CHO	0,2012
H <sub>2</sub> O	172,4658	H <sub>2</sub> O	170,7412
		Jumlah	256,6648
		<b>Massa ke stack</b>	
		<b>Komponen</b>	<b>Massa bahan (Kg/jam)</b>
		HCOONa	0,0020



		HCHO	0,0001
		C(CH <sub>2</sub> OH) <sub>4</sub>	0,8636
		CH <sub>4</sub> O	0,0002
		CH <sub>3</sub> CHO	0,0020
		H <sub>2</sub> O	1,7247
		Jumlah	2,5926
<b>Total</b>	<b>259,2574</b>	<b>Total</b>	<b>259,2574</b>

### 3.8. Belt Conveyor (J-155)



Neraca Massa Total:  $M_{17} + M_{16} = M_{18}$

Keterangan:

$M_{16}$  : Massa masuk dari Cyclone

$M_{17}$  : Massa masuk dari rotary

$M_{18}$  : Massa bahan keluar

Neraca Massa Pada Belt Conveyor (J-155)			
M17		Massa di Bucket	
Komponen	Massa bahan M <sub>17</sub> (Kg/jam)	Komponen	Massa bahan (Kg/jam)
HCOONa	19,7069	HCOONa	19,9039
HCHO	0,8577	HCHO	0,8662

<b>C(CH<sub>2</sub>OH)<sub>4</sub></b>	<b>8549,3617</b>	<b>C(CH<sub>2</sub>OH)<sub>4</sub></b>	<b>8634,8553</b>
<b>CH<sub>4</sub>O</b>	<b>2,3180</b>	<b>CH<sub>4</sub>O</b>	<b>2,3412</b>
<b>CH<sub>3</sub>CHO</b>	<b>0,2032</b>	<b>CH<sub>3</sub>CHO</b>	<b>0,4044</b>
<b>H<sub>2</sub>O</b>	<b>3,5179</b>	<b>H<sub>2</sub>O</b>	<b>174,2609</b>
<b>Jumlah</b>	<b>8575,9672</b>	<b>Jumlah</b>	<b>8832,6319</b>
<b>M<sub>16</sub></b>			
<b>Komponen</b>	<b>Massa bahan (kg/jam)</b>		
<b>HCOONa</b>	<b>0,1971</b>		
<b>HCHO</b>	<b>0,0086</b>		
<b>C(CH<sub>2</sub>OH)<sub>4</sub></b>	<b>85,4936</b>		
<b>CH<sub>4</sub>O</b>	<b>0,0232</b>		
<b>CH<sub>3</sub>CHO</b>	<b>0,2012</b>		
<b>H<sub>2</sub>O</b>	<b>170,7412</b>		
<b>Jumlah</b>	<b>256,6648</b>		
<b>Total</b>	<b>8832,6319</b>	<b>Total</b>	<b>8832,6319</b>