LAMPIRAN A

REAKTOR

Fungsi : Tempat terjadinya Polimerisasi propilena menjadi Polipropilena

Jenis : Loop Tubular Reaktor

Fasa : cair-gas

Jumlah : 1 unit

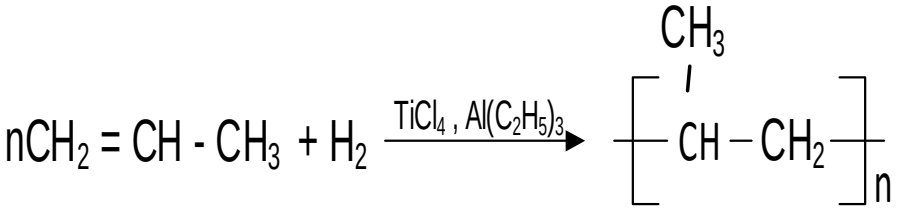
Kondisi Operasi : eksotermis

T = 70^{o}C

P = 30 atm

A. Menghitung Kecepatan Volumetris Umpan

Persamaan reaksi :



Diketahui:

komponen	kg/jam	kmol/jam	Rho, kg/m^3	m^3/jam	kmol/m3
C3H6	23787,2778	565,2870	404,107955	58,86367114	9,579679687
C3H8	35,7345	0,8103	405,1543977	0,088199755	0,013731922

H2	0,0660	0,0327	2,055351694	0,032119335	0,000554938
TiCl4	0,4209	0,0022	1642,636003	0,000256219	3,75923E-05
MgCl2	3,7879	0,0399	1850,376009	0,002047086	0,000675701
Mineral Oil	6,3131		920	0,006862098	0
TEAl	12,6915	0,1112	802,5961281	0,015813104	0,001883841
total	23846,2917	566,2833	6026,925845	59,00896873	9,59656368

A. Penentuan Volume Reaktor (V_T)

Massa bahan (m) = 52.834,6288 kg/jam

° campuran = 6026,925845 kg/m^3

Kp = konstanta laju kecepatan propagasi = 800 m^3/kmol.s

= 2880000 m^3/kmol.jam

C* = konsentrasi bagian aktif katalis = 42 mmol/mol Ti

= 1,57888E-06 kmol/m^3

M = konsentrasi monomer

Cao = konsentrasi propilena mula-mula

Volume Reaktor, V

$$V = F \int \frac{d}{k \times C^* \times C_{Ao}}$$

$$V = F \int \frac{d}{k \times C^* \times C_{Ao}(1-x)}$$

$$V = \frac{F}{k \times C * \times C_{AO}} \int \frac{d}{(1-x)}$$

$$V = \frac{F}{k \times C * \times C_{AO}} x - \ln(1-x)$$

$$V = \frac{5\ ,0}{2 \times 1,5\ E-0\ \times 9,5} x - \ln(1-0.53)$$

V= 9,797984481 m³

Didapatkan volume cairan sebesar 9,797984481 m³. untuk mencari volume reaktor, maka volume Reaktor= 1,2 x volume cairan, maka:

Faktor keamanan = 20%

Volume design = 1,2 x 9,797984481 m³

Volume reaktor = 11,75758138 m³

Menghitung volume torus

V= $\pi x r^2 x 2\pi R$

Asumsi nilai R= 1,8

Maka, V= (3,14 x 0,3048²) x (2 x 3,14 x 1,8)

= 1,83197 m^3

Volume total = 2 volume reaktor + 2 volume torus

= (2 x 11,75758138 m^3) + (2 x 1,83197 m^3)

= 27,17911001 m

B. Perancangan Reaktor

Asumsi: 1. Laju alir steady state

2. Laju alir volumetrik tetap

Dari tabel 11. Kern dipilih diameter pipa:

Noeminal Pipe Size (NPS), IPS, in = 24 in

OD	=	24 in	= 0,6096 meter
ID	=	23,25 in	= 0,59055 meter
Schedule Number	=	20	
Jari-jari dalam	=	11,625 in	= 0,295275 meter
Jari-jari luar	=	12 in	= 0,3048 meter

Mencari Tinggi Reaktor

Volume total= 2 volume silinder + 2 volume torus

Rumus Volume Silinder= $\frac{1}{4}\pi d^2 t$

Rumus Volume Torus = $\pi x r^2 x 2\pi R$

Volume total= 2 volume silinder + 2 volume torus

27,17911001 $= 2x(\frac{1}{4}\pi d^2 t) + 2x(\pi x r^2 x 2\pi R)$

27,17911001 $= 2x(\frac{1}{4}3{,}14x0{,}6096^2 x\ t) + 2x\ (3{,}14x0{,}6096^2 x\ 2x3{,}14x1{,}8)$

27,17911001 $= 0{,}547536405\ x\ t + 24{,}75740609$

t = 4,422909418 meter

C. Merancang jaket pendingin

Htotal=Hreaktor

Hcairan(ZL)= 2 volume silinder + 2 volume torus

H total = 4,4229 meter

Menghitung Diameter Jaket

ID jaket = OD reaktor + (2 x tebal jaket)

Diketahui: OD= 24 in

Asumsi jarak antara dinding luar reaktor dan dindin bagian dalam jaker adalah 3 in (*brownell & young)*, maka

ID = 24 + (2 x 3)

ID jaket = 30 in

Menghitung Tebal Jaket

Diketahui: P operasi = 30 atm

= 441 psi

P Design = 441 x 1,2

= 529,2 psi

Digunakan persamaan;

$$t_s = \frac{P.ri}{f.E \;\; 0.6P} + C \qquad (Eq.13\text{-}12\ ,\ P.25 Brownell\&Young)$$

ts = Tebal dinding shell, in

P	= Tekanan Design	= 529,2	psi
ri	= Jari-jari, in	= 15	in
E	= Efisiensi Pengelasan	= 0,85	
f	= tekanan maksimum yang dizinkan	= 12650	psi
C	= faktor korosi	= 0,125	in

$$ts = \frac{5 \quad ,2\, x\, 1}{(1 \qquad x\, 0{,}8\ ) - (0{,}6\, x\, 1\ )} + 0{,}125$$

maka didapatkan ts = 0,885 in

diambil tebal standar dari Tabel brownell 5.6 sebesar 1 in

OD jaket = 32 in

OD jaket standar = 32 in

ID jaket standar = OD jaket standar – (2 x tebal standar)

= 32 – (2 x 1) = 30 in