LAMPIRAN 1 : CONTOH PERHITUNGAN

1. Luas *Barrel Tip* (A_{barrel})

$$A_{barrel} = \frac{1}{4} \times \pi \times d^2 = \frac{1}{4} \times 3{,}14 \times \left(14 \times 10^{-3}\right)^2 = 1{,}5386 \times 10^{-4}\, m^2$$

2. Kapasitas Aliran Gas Propana (Q_f)

Berdasarkan hasil kalibrasi maka nilai $Q_f = y$ di mana x = indikator gas propana (contoh 0,5 cm), maka:

$$Q_f = y = \frac{(0{,}004x + 0{,}017)}{1000} = \frac{((0{,}004 \times 0{,}5) + 0{,}017)}{1000} = 0{,}000019\, {}^{m^3}/_{s}$$

3. Kapasitas Aliran Udara (Q_a)

Berdasarkan hasil kalibrasi maka nilai $Q_f = y$ di mana x = indikator gas propana (contoh 19,8 cm), maka: 0.0007x2 + 0.0285x + 0.0908

$$Q_a = y = \frac{(0{,}0338x + 0{,}0838)}{1000}$$

$$= \frac{((0{,}0338 \times 19{,}8) + 0{,}0838)}{1000} = 0{,}00075\, {}^{m^3}/_{s}$$

4. *Burning Load*

$$BL = \frac{Q_f \times \rho_f \times NKB}{A}$$

Di mana NKB = nilai kalor bahan bakar propana = 46,348 MJ/kg dan $\rho_f = 1{,}96$ kg/m^3

$$BL = \frac{Q_f \times \rho_f \times NKB}{A} = \frac{0{,}000019 \times 1{,}96 \times 46{,}348}{1{,}5386 \times 10^{-4}} = 11{,}218\, {}^{MJ}/_{m^2 s}$$

5. *Air-Fuel Ratio* (AFR) *by volume*

$$AFR = \frac{Q_a}{Q_f} = \frac{0.00075}{0.000019} = 39.63368$$

6. Viscositas campuran

Menghitung viscositas campuran gas adalah :

$$\Phi_{\alpha\beta} = \frac{1}{\sqrt{8}}\left(1+\frac{M_\alpha}{M_\beta}\right)^{-1/2}\left[1+\left(\frac{\mu_\alpha}{\mu_\beta}\right)^{1/2}\left(\frac{M_\alpha}{M_\beta}\right)^{1/4}\right]^2$$

$$\mu_{mix} = \sum_{\alpha=1}^{N}\frac{\chi_\alpha}{\sum_\beta \chi_\beta \Phi_{\alpha\beta}}$$

M_α = berat molekul propana = 44

M_β = berat molekul udara = 0,21x32 +0,79x28 = 28,84

μ_α = viskositas propana = 0,000008 kg/ms

μ_β = viskositas propana = 0,000018 kg/ms

Maka :

$$\Phi_{\alpha\beta} = \frac{1}{\sqrt{8}}\left(1+\frac{44}{28,84}\right)^{-1/2}\left[1+\left(\frac{0,000008}{0,000018}\right)^{1/2}\left(\frac{44}{28,84}\right)^{1/4}\right]^2$$

$\Phi_{\alpha\beta} = 0,168$

Fraksi mol masing-masing komponen adalah :

Propana = laju massa propana/ berat molekul = $0,0346.10^{-3}$ kg/ 44

= $7,859.10^{-7}$ kg/mol.s

Udara = laju masa udara/ berat molekul udara = 0,976/28,84 = 0,034 kg/mol.s

Fraksi mol gas propana $\chi_\alpha = 7,85910^{-7}/(7,85910^{-7}+0,034) = 0,0227$

Fraksi mol udara $\chi_\beta = 1- 0,0227 = 0,9773$

Sehingga viskositas campuran:

μ_{mix} =0,0227/{0,168x(0,0227+0,977)} = 0,00000108

7. Bilangan Reynold

$$Re = \frac{\rho_{mix} v_{mix} D}{\mu_{mix}}$$

Densitas campuran = (massa campuran/volume campuran)

ρ_{mix} = (0,0346+0,9761)/(0,019+0,7936) = 1.2438 kg/m^3

Kecepatan campuran = laju massa campuran/ (densitas campuran x penampang barel)

V = (0,0346+0,9761)/ (1,2438 x 0,25 x 3,14 x 0,00014^2) = 5,2814 m/s

Re = (1,2438 x 5,2814 x 0,00014/ 0,00000108

Re = 85.096

8. Bilangan Froud

Bilangan Froud untuk aliran campuran adalah :

Fr = V^2 /(D_{barel} x g)

Fr = 5,2814^2 / (0,0014 x x 9,81) = 203

9. Bilangan Lewis

Bilangan Lewis untuk aliran campuran adalah :

$$Le = \frac{k/(\rho_{mix}.C_p)}{0,5.ud_b}$$

$$Le = \frac{0.018/(1,2438.2,24)}{0,5.(5,2814x0,0014)} = 0,019$$