

Stabilisasi nyala api premix menggunakan rotating fan mixer pada bunsen burner. (Analisis-eksperimental)

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Abstrak

Pengaruh variasi putaran terhadap stabilitas dari nyala api premix campuran Udara -LPG diteliti secara eksperimental. Berdasarkan grafik Fuidge (AFR vs BL) dianalisis kontur dari nyala api Yellow Tip dan Lift Off untuk menentukan daerah stabilitas nyala api. Hasil penelitian membuktikan bahwa pemakaian mixer jenis Rotating Fan Mixer (RFM) meningkatkan daerah stabilitas nyala yang didefinisikan sebagai $\beta_s = AT / A * T_{w}$ yaitu sebesar 59,1% terhadap mixer standar (tanpa fan) khususnya pada putaran $n_{fin} = 0$ rpm. Tidak ditemukan terjadinya fenomena Back Fire selama pemakaian mixer RFM, bahkan daerah Lift Off-nya semakin tinggi yaitu pada kualitas campuran yang semakin kurus (AFR semakin tinggi).

Pada penelitian ini dipergunakan dua buah tabung pembakar ukuran diameter 14-23 mm panjang 210 mm dan diameter 14-30 mm panjang 420 mm yang dilaksanakan pada daerah aliran laminar dengan bilangan Reynold, $Re = 500$ sampai dengan 1200.

Ternyata pengaruh putaran Fan pada RFM mengakibatkan terjadinya aliran pusar hingga ujung tabung pembakar, sehingga homogenitas campuran udara LPG semakin baik dan hal ini dibuktikan dengan:

- Meningkatnya Burning Velocity dan Burning Rate Factor: $\phi = (T_f - T_{ig}) / (T_{ig} - T_u)$. dimana Burning Rate Factor didefinisikan sebagai rusio kenaikan suhu pada Reaction Zone terhadap kenaikan suhu pada Preheating Zone sekitar 17% sampai dengan 30%.
- Turunnya suhu penyalaan mencapai nilai minimum ($T_{igmin} = 497^\circ C$) dan meningkatnya suhu nyala api mencapai nilai maksimum ($T_{fmod} = 1871K$) sehingga panjang apl luminous semakin pendek ($h + \eta_{\{0\}} + \eta_{\{R\}}$) sekitar 3% s/d 11%.

Hasil eksperimental tersebut menunjukkan kesesuaian dengan hasil pembahasan perhitungan teoritis sebelumnya.

The effect of rotation variable on stabilization of LPG-Air premix bunsen flame is experimentally investigated. Both the flame Yellow Tip and Lift Off contours are determined in Fuidge Diagram Air Fuel Ratio versus burning load (AFR vs BL.) for define flame stabilization area. The experimental result showed that using Rotating Fan Mixer (RFM) increase the flame stabilization area is defined as $\beta_s = AT / A T$ that is 59,1% against RFM without fan at $n_{Fan} = 0$ rpm. Back Fire Phenomena is not found as long as using RFM, Lift Off area is much higher, in compared with mixer RFM without fan, because the mixture quality was leaner.

The experimentally of premix flame stability to be executed in laminar flow region with Reynolds number

in between $Re = 500$ to 1200 , using two type of Bunsen's barrel: $\phi 14-23$ mm length 210 mm and $\phi 30$ mm length 420 mm.

The effect of rotating fan increase swirling flows of mixture convected out from the Burner's tip, so that help to increase burning intensitas through enhanced homogeneity of mixing LPG air premixed. Its proved by the experimentally as shown as the result:

- Increase Burning Velocity and Burning Rate Factor $\phi = (T_r - T_{ig}) / (T_{ig} - T_u)$, with Burning Rate Factor defined as the ratio of temperature increase in reaction zone to temperature increase in Preheating zone about 17% to 30%

- Ignation temperature decrease until $T_{igmin} 497^\circ C$ and flame semperature increase until $T_{fmax} = 1871 K$. its affected the luminous flame length . shorted about 39% to $1196 h = \eta_{\{0\}} + \eta_{\{r\}}$

The result of the experimental findings are shown to be in accordance with the prior theoretical investigation.