

INTISARI

Kebutuhan energi dunia semakin meningkat sementara cadangan bahan bakar fosil semakin berkurang, sehingga diperlukan energi alternatif yang dapat diperbarui. Biodiesel sebagai energi potensial alternatif terbaru masih memiliki tantangan dalam penerapannya karena sulitnya mengetahui karakteristik beserta fenomena nyala api yang terjadi. Konfigurasi *burner* yang tepat masih sangat terbatas, serta pembakaran difusi yang sulit mencapai homogenitas campuran. Sehingga penelitian ini berfokus pada mengetahui karakteristik dan stabilitas nyala api proses pembakaran pada *swirler burner*.

Penelitian ini dilakukan menggunakan *swirler burner* dengan nozel 5 gph. Udara dialirkan dari *blower* dengan 7 variasi kecepatan yang berbeda. Selain itu divariasikan juga geometri *swirler* berdasarkan perbedaan diameter dalamnya. Proses pembakaran menggunakan bahan bakar B0 dan B100 yang kemudian dianalisis karakteristiknya melalui teknik *image processing* menggunakan MATLAB. Karakteristik nyala api merujuk pada fenomena area nyala api. Sedangkan stabilitasnya mengacu pada fenomena kestabilan nyala api mencakup fenomena *lift-off*, *break-up*, dan *blow-out flame*.

Hasil penelitian menunjukkan bahwa karakteristik area nyala api semakin besar seiring dengan peningkatan *equivalence ratio* menuju nilai yang stoikiometrik. Adapun B0 memiliki area nyala api lebih kecil dibandingkan B100. Sementara itu, semakin besar diameter dalam *swirler* mengakibatkan area nyala api semakin pendek, dan nyala api lebih fluktuatif. Fenomena *break-up*, *lift-off*, dan *blow-out* terjadi selama pengujian pembakaran.

Kata kunci: biodiesel, karakterisasi, stabilisasi, *swirler burner*, *image processing*

ABSTRACT

The world's energy demand is increasing while fossil fuel reserves are decreasing, making renewable alternative energy sources necessary. Biodiesel, as a potential renewable alternative energy source, still faces challenges in its application due to the difficulty in understanding its characteristics and flame phenomena. The appropriate burner configuration is still very limited, and achieving homogeneity in the diffusion combustion is difficult. Therefore, this study focuses on understanding the characteristics and flame stability of the combustion process on a swirler burner.

This research was conducted using a swirler burner with a 5 gph nozzle. Air is supplied from the blower with 7 different speed variations. In addition, the swirler geometry is also varied based on the difference in the inside diameter. The combustion process uses B0 and B100 fuels which are then analyzed for their characteristics through image processing techniques using MATLAB. The characteristics of the flame refer to the phenomenon of the flame area. Meanwhile, stability refers to the phenomenon of flame stability including the phenomenon of lift-off, break-up, and blow-out flame.

The results showed that the characteristic flame area was getting bigger as the equivalence ratio increased towards a stoichiometric value. The B0 has a smaller flame area than B100. Meanwhile, the larger the swirler's inner diameter, the shorter the flame area, and the more volatile the flame. Break-up, lift-off and blow-out phenomena occur during the combustion test.

Keywords: biodiesel, characterization, stabilization, swirler burner, image processing