

Blending of palm oil with petroleum derivatives and controlling the swirl flow strength and direction can overcome the poor physical properties of such fuel and enhance its spray atomization. In this work, evaluations of the blends with and without swirl flow were done by comparing their spray characteristics. Then they were compared with the spray characteristics of diesel fuel. The objectives of this research are to study the effects of blending ratios on the spray characteristics and to evaluate the effects of swirling flow on the spray characteristics. Two new designs of air swirlers were found to be capable of producing variable swirl flow strengths and directions. To characterize the spray of the Refined, Bleached, Deodorized Palm Oil (RBDPO)/diesel blends under different swirl strengths and directions, five blends of B5, B10, B15, B20 and B25 were physically blended on volume basis. The physical properties of the blends were experimentally and analytically determined. A Phase Doppler Particle Analyzer (PDPA) was used to measure the droplet size while direct photography was used to measure the spray angle. The Lagrangian Dispersed Phase Model (DPM) was used to simulate the spray of the various RBDPO/diesel blends in an unconfined domain. The three dimensional spray CFD model was first validated for the case of diesel spray with the experimental results. The validated model was then used to characterize the spray of RBDPO/diesel blends. The results showed that when the volume blending ratio increased to 0.25 (B25), the percentage increase in Sauter mean diameter (SMD) was 57.25% and percentage decrease in spray angle was 12.23% compared to the diesel fuel. The results also showed that when the swirl number increased from 0.654 to 1.57, a reduction of 46.39% in SMD was achieved with the improvement in the particle dispersion. In addition the results showed that when the direction of swirled air stream changed from co-rotating flows to the counter-rotating flows, the SMD was reduced by 13.99 % with better spatially dispersed spray due to the increase in the shear layers produced and the improved turbulent mixing. The findings suggest that the two blends B5 and B10 were comparable with diesel in terms of fuel physical properties and spray characteristics. It was also found that the optimum swirl number for B15 is 1.273, which resulted in 36.9 % reduction in SMD. This meant that this swirl number produced comparable spray characteristics to diesel spray for blend B15, and higher blends needed higher swirl numbers. Finally it was also found that the counter-rotating swirler is more appropriate for the RBDPO blends than the co-rotating swirler