Dropsizing of Near-Nozzle Diesel and RME Sprays by Microscopic Imaging

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Abstract

The morphological composition of a typical modern Diesel spray is known to include complex structures such as ligaments and amorphous droplets, but most laser dropsizing techniques cannot diagnose drops that deviate from the spherical shape. Whilst direct imaging has potential for resolving arbitrary shapes, challenges remain to measure microscopic droplets in dense sprays. To this end, progress made with ongoing experimental investigations of the atomisation of diesel and biodiesel fuels is reported for the near-nozzle region using a long working distance microscope. A number of image processing techniques were explored and described to identify both small and large liquid structures. A discrete wavelet transform was found to improve the detection of droplets smaller than 10 µm, and contrast-limited adaptive histogram equalisation provided the best detection of medium droplets and large ligaments. The measured diameters were compensated based on an analysis of the droplets' local contrast and size. Droplet size distributions were measured for a non-additised diesel fuel and rape-methyl ester. The image processing algorithm was found to successfully discriminate between the fuels.

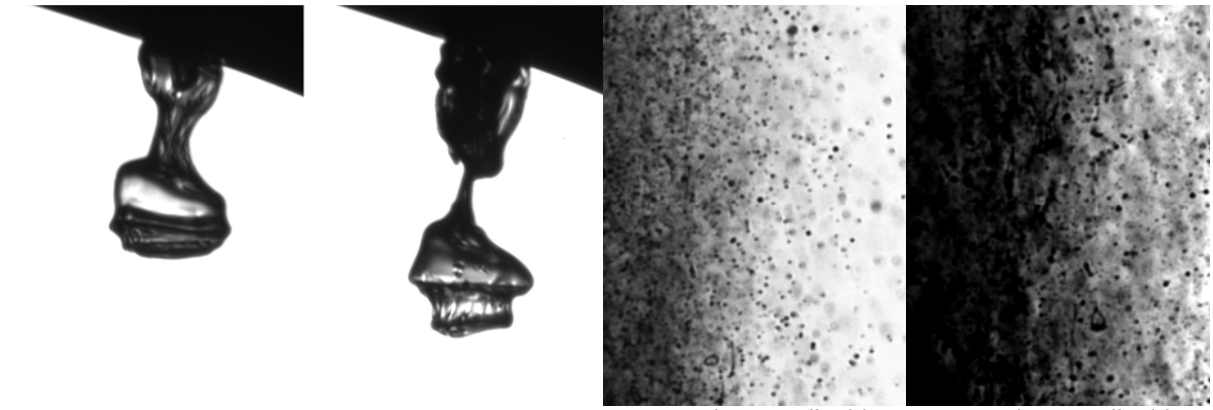
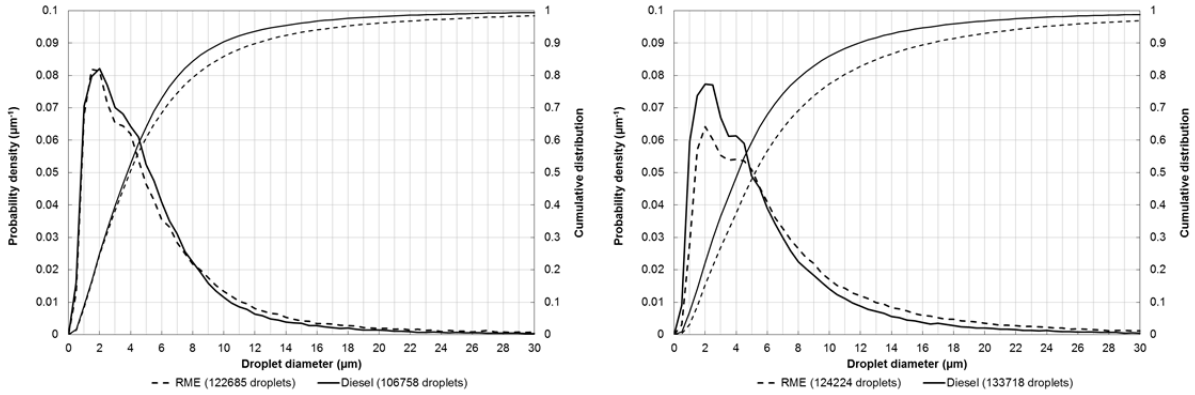


Figure 1 Examples of shadowgraphic micrographs recorded for RME at 3 locations (100 MPa pressure).



(a) 10 mm from nozzle exit (b) 15 mm from nozzle exit

Figure 2 Droplet size distributions recorded for RME and diesel sprays injected at 100 MPa.

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