A visual experimental research on spray characteristics of blended fuel with a large proportion of soybean oil methyl ester (SME)

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Abstract

As a biodegradable and oxygen-bearing fuel, biodiesel is valued extensively for its similar physical and chemical properties to fossil fuel. In recent years, biodiesel alternative application in diesel engine has been the great concern of researchers at home and abroad. Nevertheless, some key technologies have not been solved at present. Basing on synthetic consideration of economic and environment protection, alternative research of biodiesel in diesel engine focus on blended fuel with a certain proportion of biodiesel (volume ratio≤25%). Aiming at SME, transient injection process of blended fuel with different proportions of SME and diesel was investigated in this paper. High speed photography was adopted to test the transient evolution of the spray cone angle and growth process of spray penetration. The axial velocity, radial velocity and the distribution of particle size were studied using a phase-Doppler particle anemometer (PDPA) as well. Based on the visualization methods, the leading factors of blended fuel atomization were deeply investigated, especially for the heating blended fuel with a large proportion of SME.

The study shows that axial velocity is the main factor to affect the spray performances, which remarkably influenced the spray penetration and was also the vital factor of radial velocity. And the sauter mean diameter (SMD) of SME was 25% larger than the one of 0# diesel. It indicates that spray quality will get deteriorative obviously when mixing ratio of SME goes beyond 50%, and thermal enhancement before injection can make B75 take on good atomization performances and B75 exhibited a similar atomization quality to 0# diesel with the fuel temperature of 473K, but the influence of axial velocity on spray would be weakened simultaneously.

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