Experimental Study about internal Cavitating Flow and Primary Atomization of a Large-Scaled VCO Diesel Injector with Eccentric Needle

T. Oda[1,*], Y. Goda[1], S. Kanaike[2], K. Aoki[3] and K. Ohsawa[1]
[1] Department of Mechanical Engineering, Tottori University, Koyama 4-101, TOTTORI 680-8552 JAPAN
[2] Mitsubishi Motors Corporation
[3] West Japan Railway Company

Abstract

This paper describes an experimental study to investigate the effects of eccentricity of needle inside a valve-covered-orifice (VCO) diesel nozzle on internal cavitating flow and primary atomization, so a 10 times large-scaled VCO nozzle was employed (Fig. 1). The needle incorporated into the nozzle was manipulated by a 3-D traverse with micrometers. When the needle is located around the nozzle center, the spray cone angle remains almost constant at high needle lift. However at low needle lift various behaviors are observed as follows: when the needle is positioned along the nozzle hole, significant increase of spray cone angle is observed around nozzle center. On the contrary, when the needle is perpendicularly positioned to the hole, the tendency of the spray cone angle is very complicated (Fig. 2) because of cavitating flow behavior inside hole. In this geometric condition the cavitating flow inside the nozzle hole can be classified into four regimes A, B, C and D although two regimes, the hollow cone spray regime (I) and the solid cone spray regime (II), can be obtained as jet breakup. The radial locations of the four flow regimes hardly depend on the injection pressure. Additionally the value of the discharge coefficient is less dependent on the injection pressure (Fig. 3) while the spray cone angle is strongly affected by the injection pressure.

Key words: Diesel Sprays, Internal Cavitating Flow, Primary Atomization, Discharge Coefficient, Large-Scaled VCO Nozzle

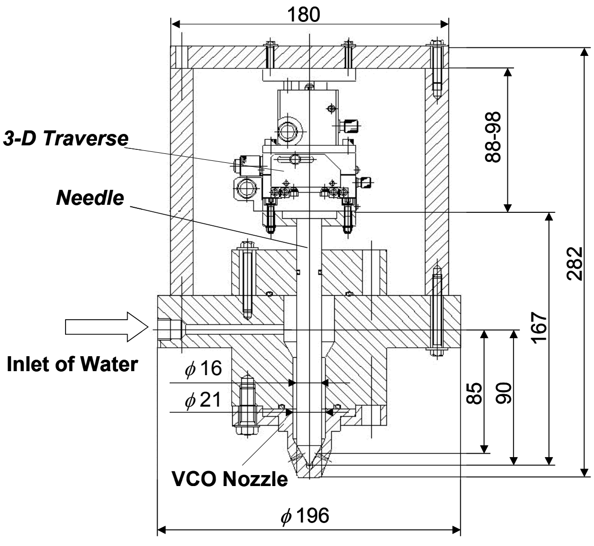

Figure 1. Schematic of nozzle holder with 10 times large-scaled VCO nozzle.

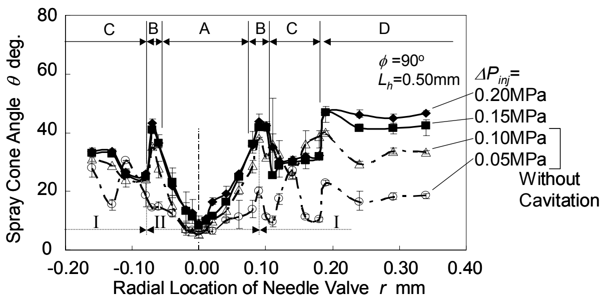

Figure 2. Effect of injection pressure on spray cone angle.

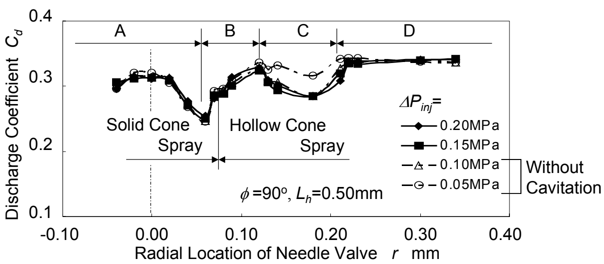

Figure 3. Effect of injection pressure on discharge coefficient.

*Corresponding author: odate@mech.tottori-u.ac.jp