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## Atomization Characteristics of Effervescent Atomizer with the Variations of Operating Conditions

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**Key Words :** Effervescent atomizer( ), LDPA(Laser Doppler Particle Analyzer), SMD(Sauter mean diameter), Spray angle( )

### Abstract

The atomization characteristics were investigated through the influence of the change of GLR and the change of working fluid on droplet size distribution and mean diameter of drop produced by effervescent atomizer. For simultaneous injection of water and high viscous waste vegetable oil, effervescent atomizer with two aerator tubes was specially designed. From the experimental results, regardless of mass fraction of vegetable oil in working fluids, it is expected that effervescent atomizer will exhibit excellent atomization performance at the high GLR conditions.

1.

GLR 가 /

F(D)

F(D<sup>3</sup>)

Frr Rosin-Rammler

$\dot{m}_G$  가 , g/s

$\dot{m}_L$  , g/s (1),(2),

$\dot{m}_W$  , g/s (2),(3), (4),(6), (1),(7)-(11)

$\dot{m}_{VO}$  , g/s

$\Phi$

=  $\dot{m}_W / \dot{m}_L$  가

q Rosin-Rammler

SMD Sauter ,  $\mu m$  가

X Rosin-Rammler ,  $\mu m$  가

가

† 가

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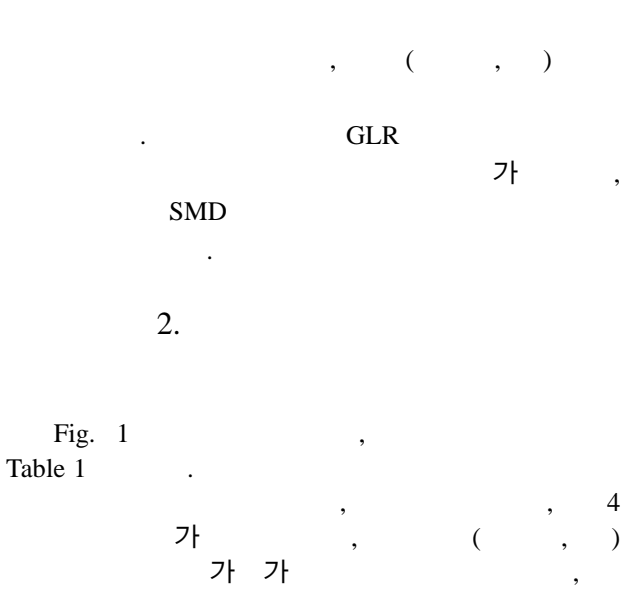


Fig. 1

Table 1

Atomizer geometry	
Nozzle exit orifice diameter, $D_o$	2.5 mm
Diffusion angle, $\theta$	60°
Volume of mixing chamber, $V_c$	$1.89 \times 10^{-5} m^3$

Fig. 1 Schematic diagram of effervescent atomizer

Table 1 Atomizer geometry

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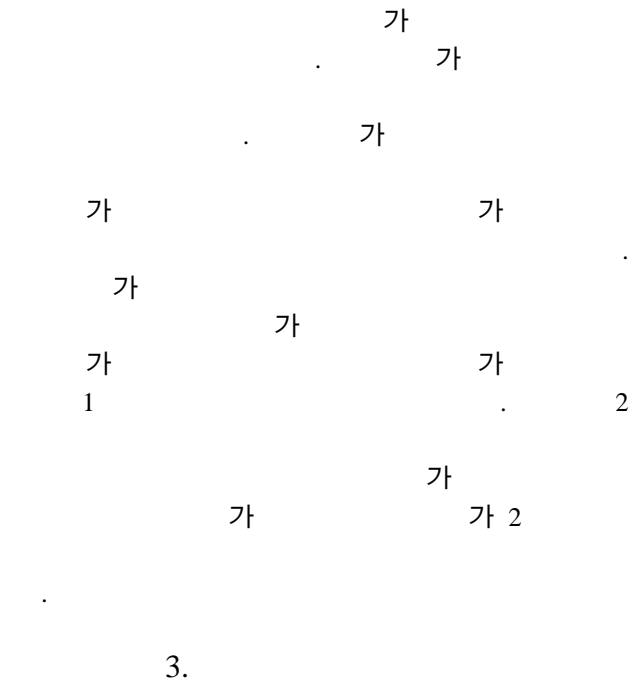


Fig.2

1. Effervescent atomizer
2. Water storage tank
3. Vegetable oil storage tank
4. Pressure gaugage
5. Regulator
6. Valve
7. Flow meter
8. Nitrogen tank
9. Spray receiver
10. Suction blower
11. He-Ne laser
12. Detector
13. Computer (image grabber)

Fig. 2 Schematic diagram of experimental set-up



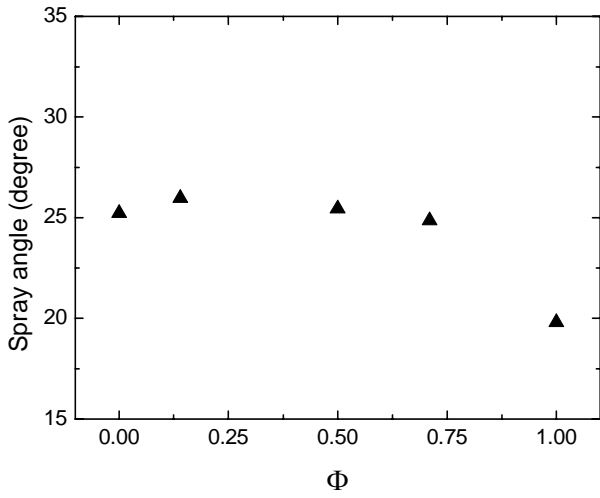
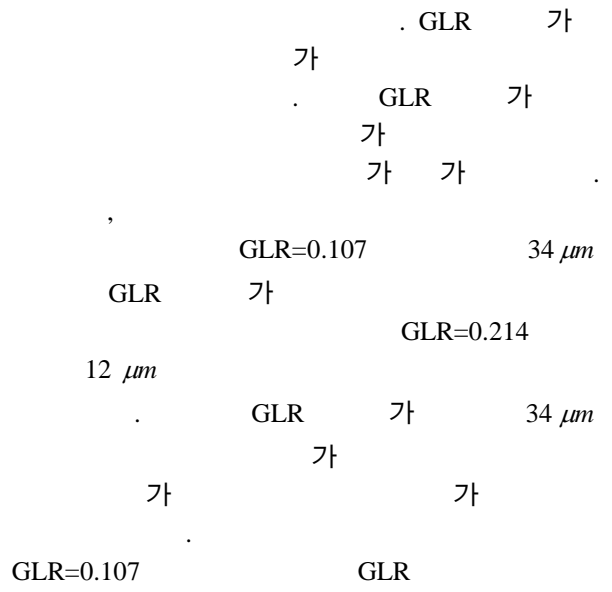


Fig. 4 Variation of spray cone angle with  $\Phi$



GLR=0.107

GLR

Fig.4

( $\Phi = 1.00$ )

Fig.6

$\Phi = 0.00$

$\Phi = 0.71 \sim 0.14$

$34 \mu m$

4.2

Fig.5

( $\Phi = 1.00$ ),  $z=150mm$

GLR

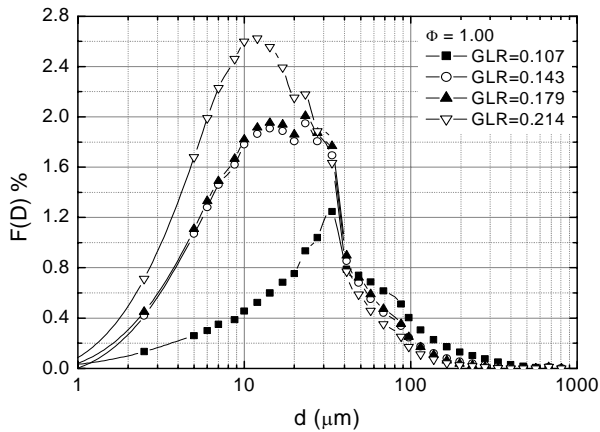


Fig. 5 Droplet size distribution at  $\Phi = 1.00$

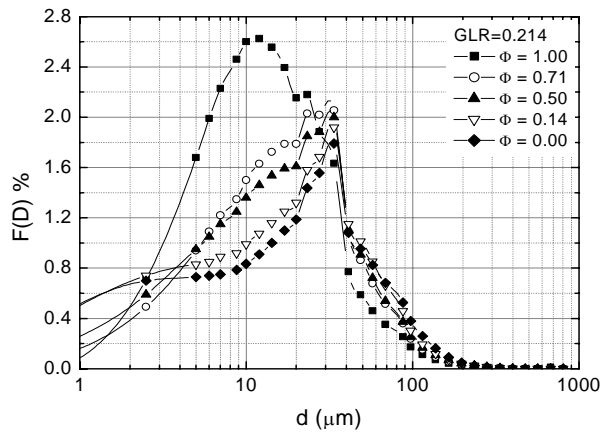


Fig. 6 Droplet size distribution at GLR=0.214

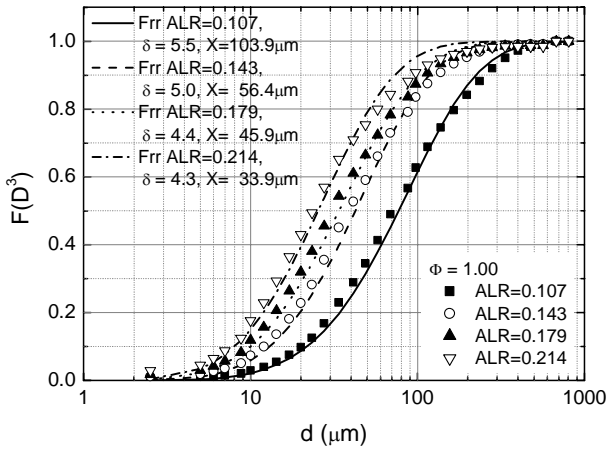


Fig. 7 Droplet size distribution functions at  $\Phi = 1.00$

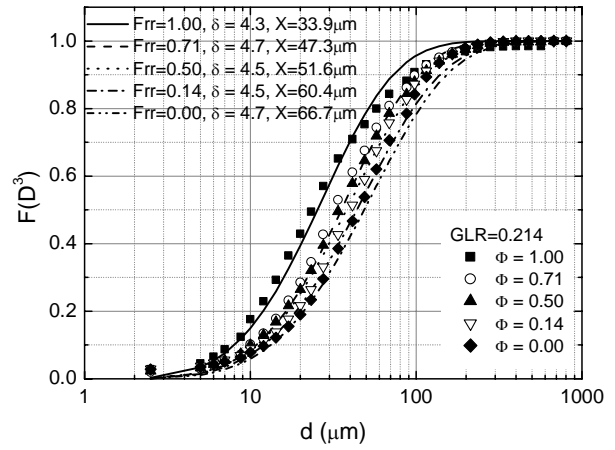


Fig. 8 Droplet size distribution functions at  $GLR = 0.214$

Fig.7  
 ( $\Phi = 1.00$ ),  $z = 150\text{mm}$  GLR  
 Rosin-Rammler  
 가  
 , GLR 가  
 GLR 가  
 Rosin-Rammler  
 가  
 X 가  $GLR = 0.107$   $103.9 \mu\text{m}$   
 가  
 $GLR = 0.214$   $33.9 \mu\text{m}$   
 가  
 가  
 가  
 가  
 Rosin-Rammler  
 가  
 $GLR = 0.214$   
 Fig. 8  
 ( $\Phi = 1.00$ )  
 가  
 가 ,  $\Phi$  가 0 가  
 q  $4.3 \sim 4.7$   
 X  $95.4 \sim 66.7 \mu\text{m}$

가  
 Fig.9  
 가  
 (SMD) GLR  
 Fig.9  
 GLR 가  
 GLR 가  
 가  
 $\Phi = 1$   
 GLR ( $GLR = 0.179 - 0.143$ ) GLR  
 가  
 GLR 가  
 Lefebvre et al.<sup>(7)</sup>, Li  
 et al.<sup>(8)</sup>

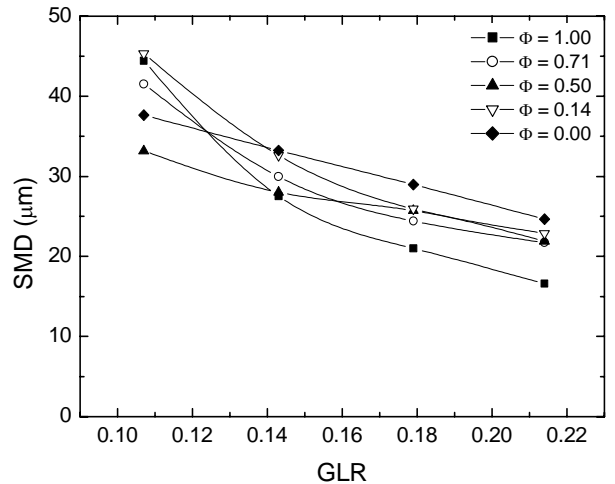


Fig. 9 Variations of SMD with GLR

