Impact of eccentricity on bubble size, gas hold-up, and separation efficiency in a planar cyclone

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August 26, 2022

Abstract

The movement of fine bubbles in a swirling field determines the mass transfer, heat transfer, and reaction performance of the swirl equipment. This study investigated the separation of fine bubbles strengthened by a swirling field in order to achieve higher separation efficiency of the planar cyclone through optimizing the structure of the convection field. The bubble size and gas holdup in the swirling flow field under different working conditions were explored by combining high-speed camera online measurement and computational fluid dynamics(CFD) simulation. The gas holdup and bubble size of each region in the swirl region, as well as the separation efficiency of gas by swirl eccentricity, were observed at different liquid and gas Reynolds numbers, Re_l and Re_g, respectively. Furthermore, the influence of different swirl eccentricities, d_c, was investigated. It found that the highest separation efficiency can be achieved under all working conditions when swirl eccentricity d_c= 5 mm.

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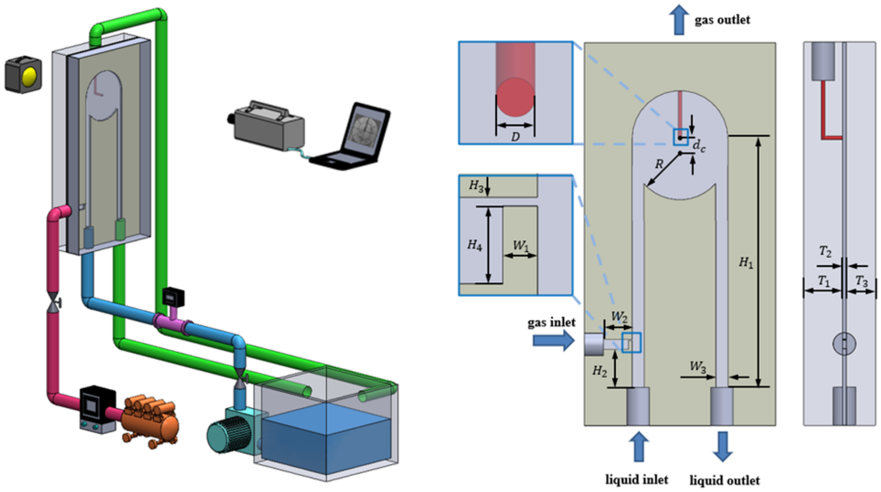

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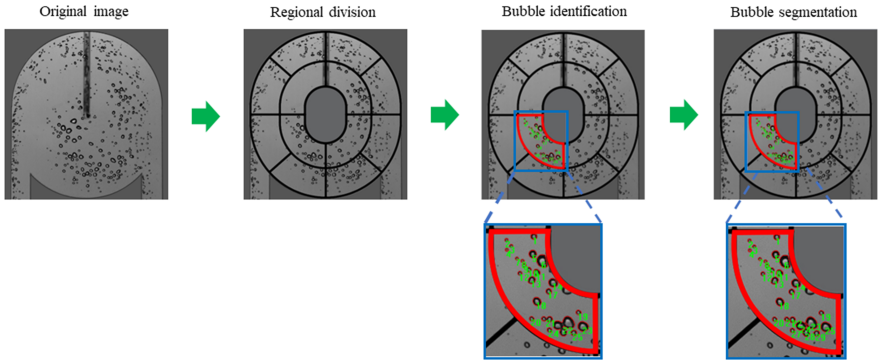

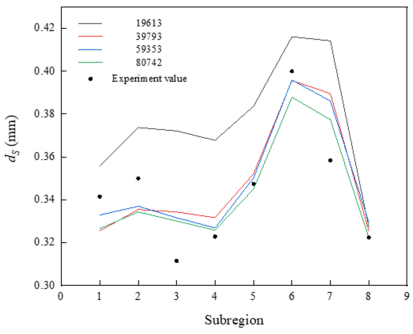

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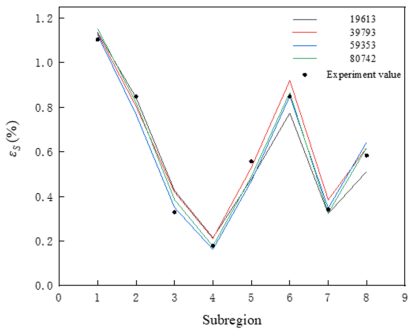

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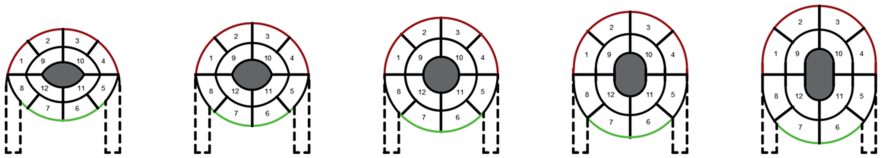

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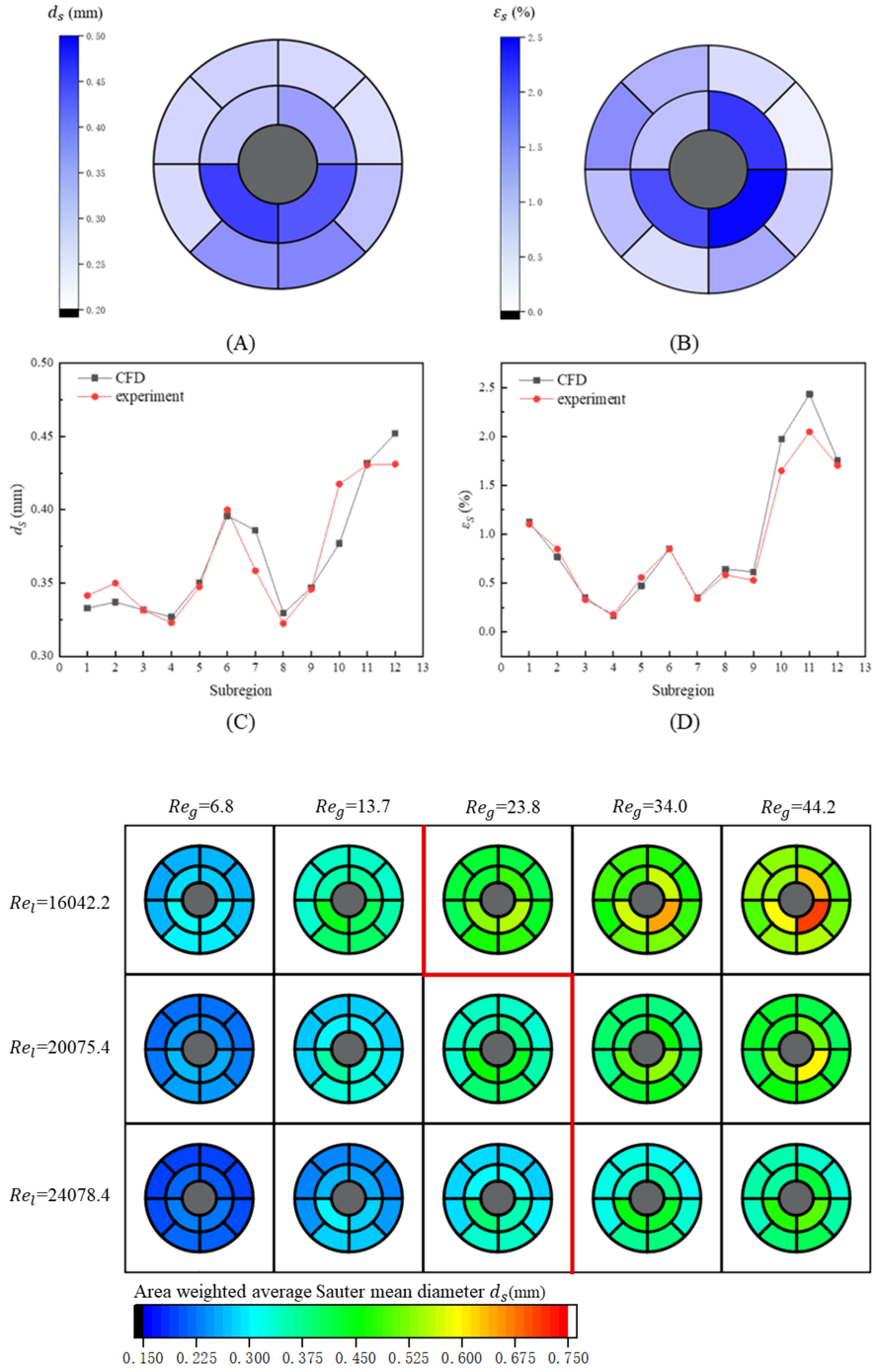

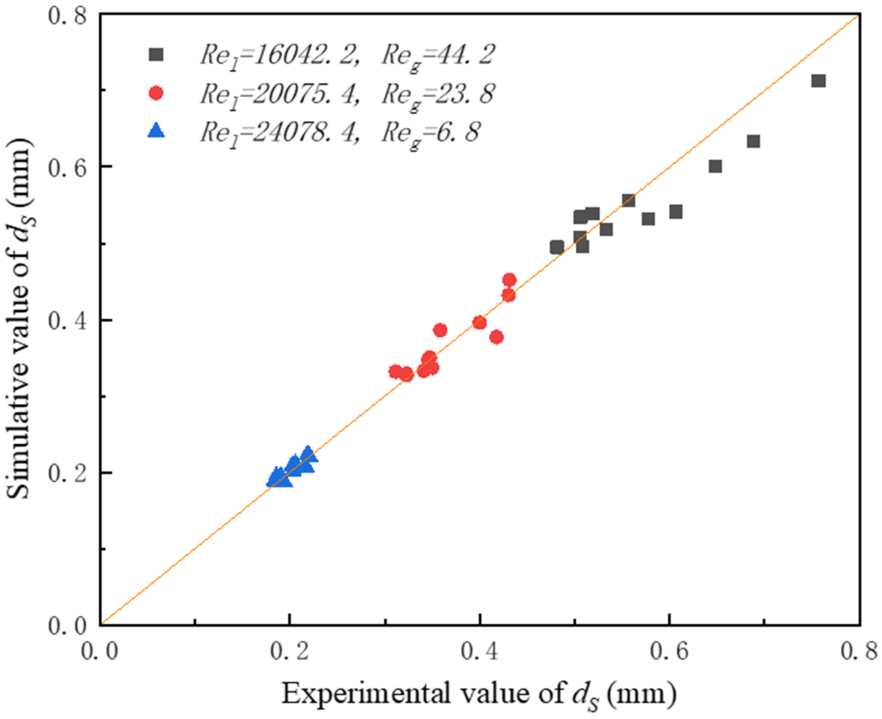

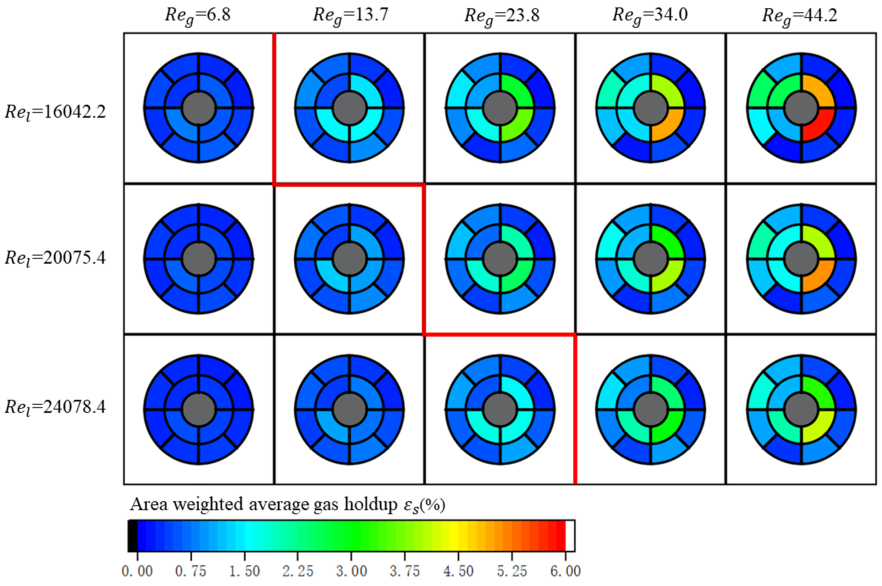

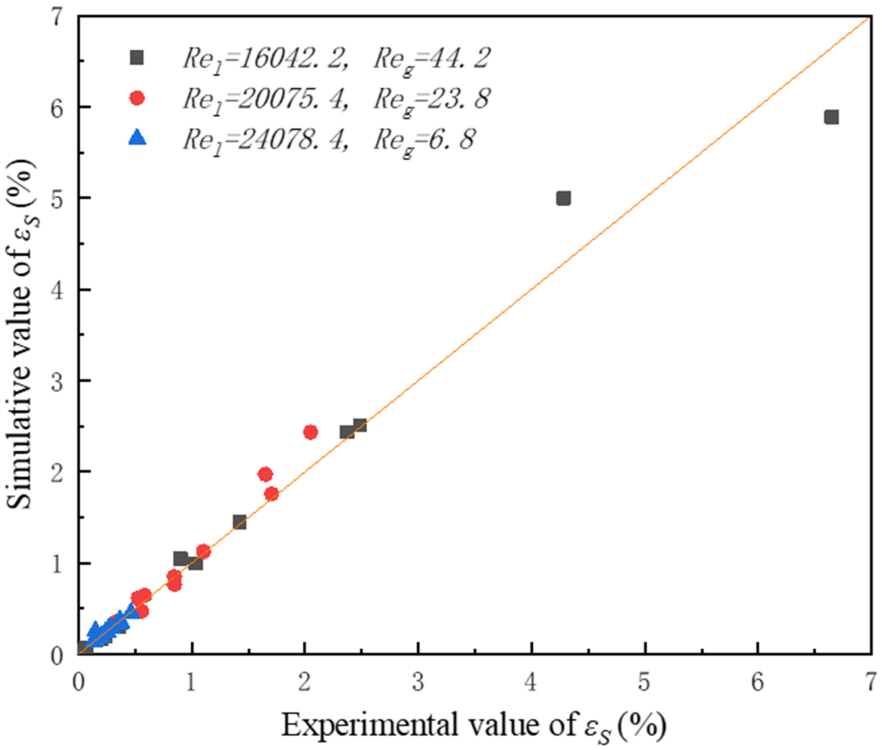

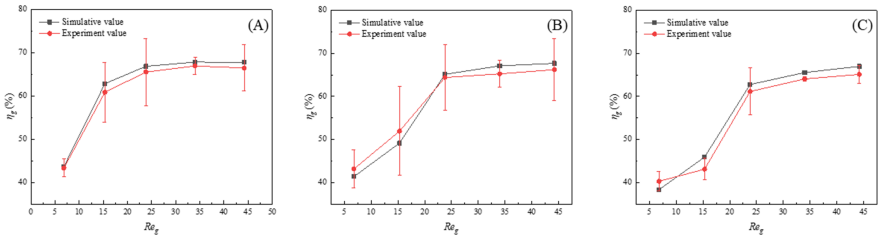

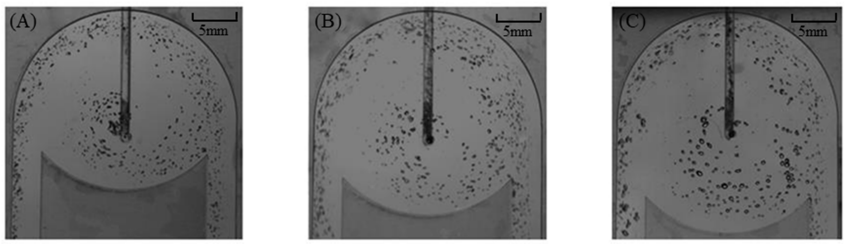

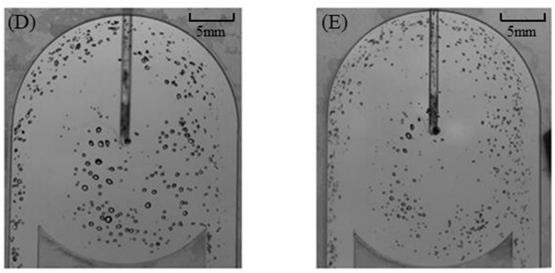

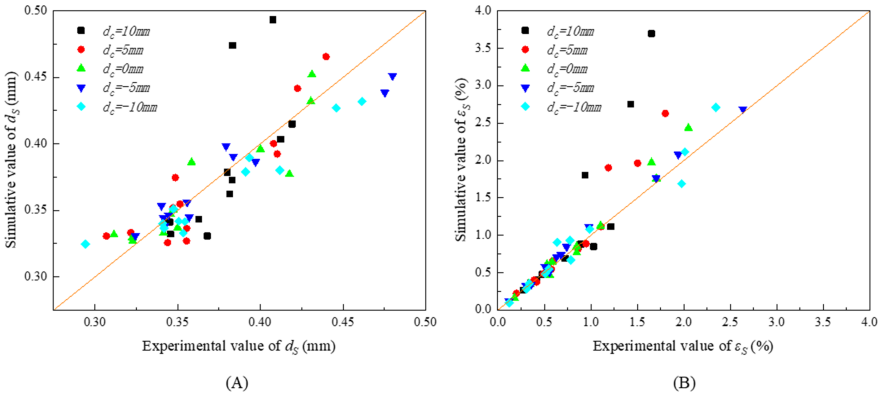

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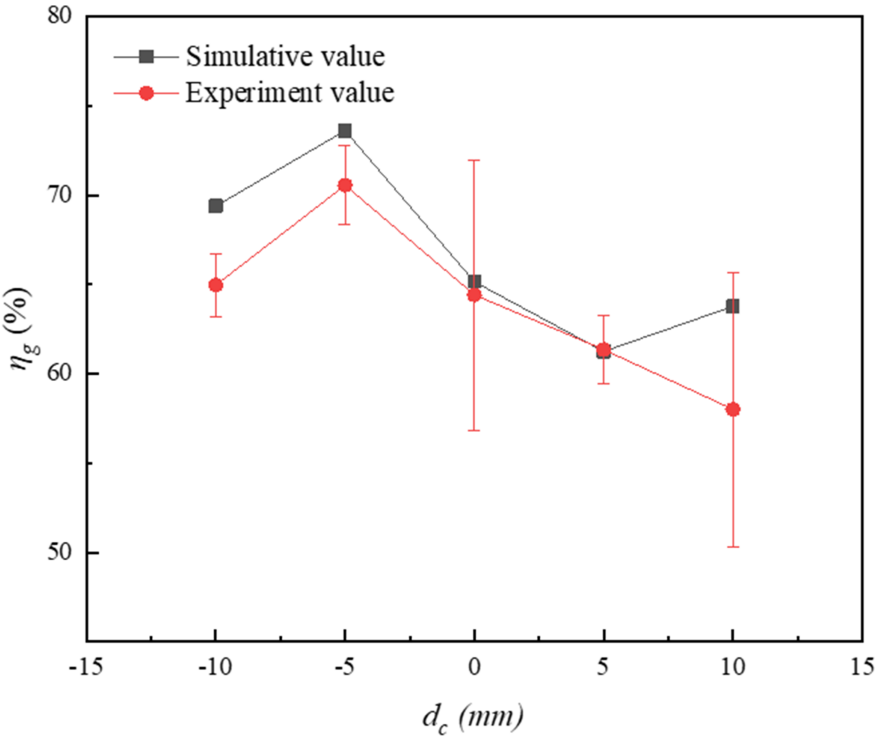

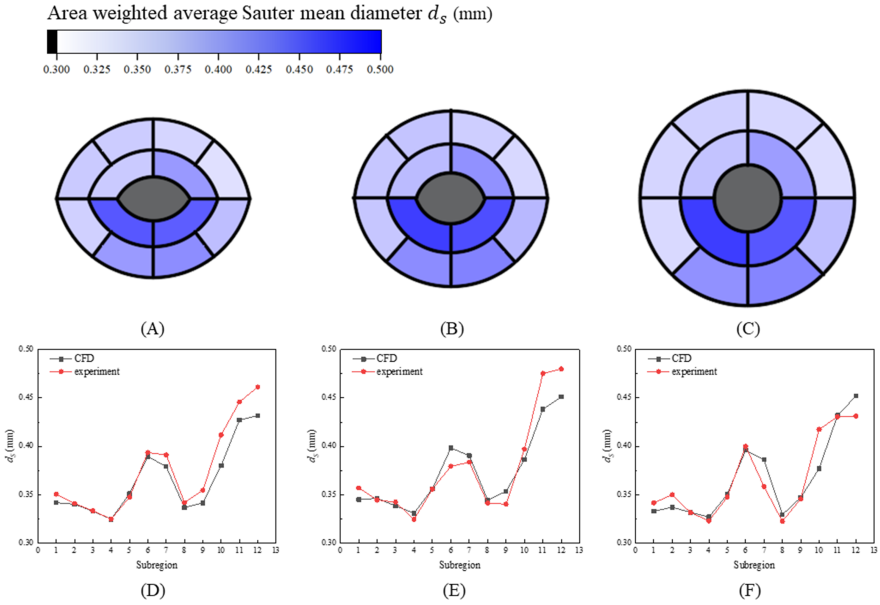

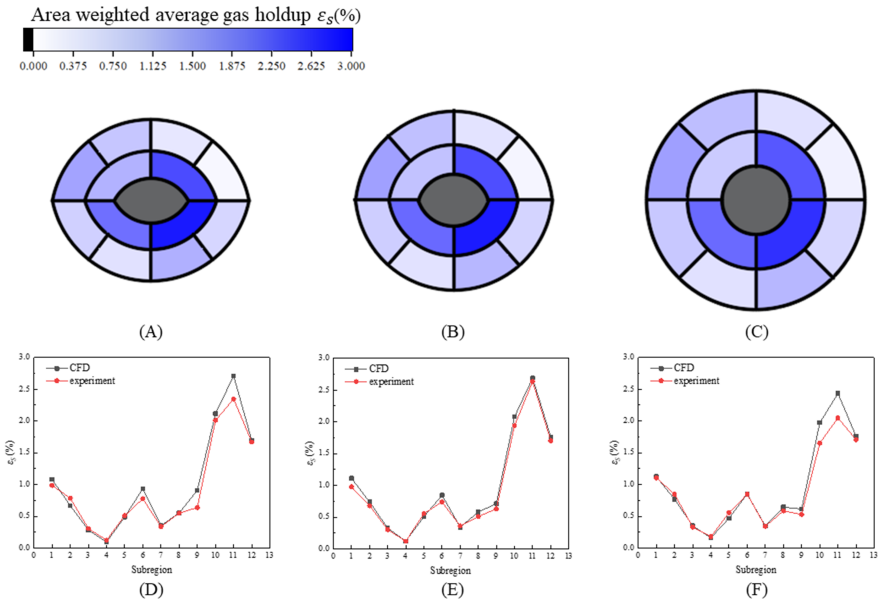

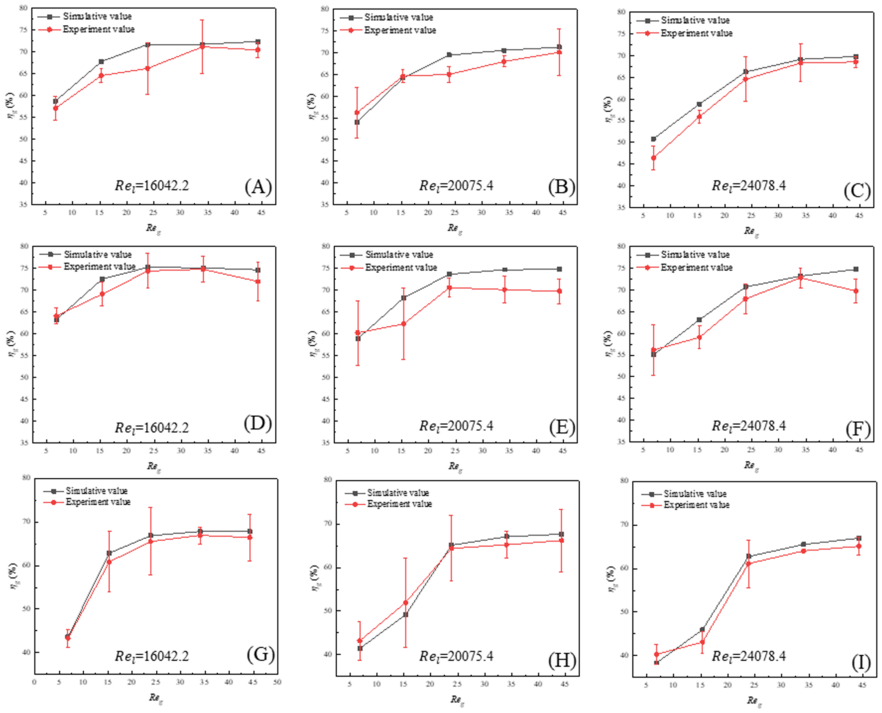

Symbol	Unit	Numerical value
D	mm	2
R	mm	25
d_c	mm	-10, -5, 0, 5, 10
W_1	mm	2
W_2	mm	15
W_3	mm	6.25
H_1	mm	130
H_2	mm	20
H_3	mm	0.5
H_4	mm	4.5
T_1	mm	20
T_2	mm	2
T_3	mm	15