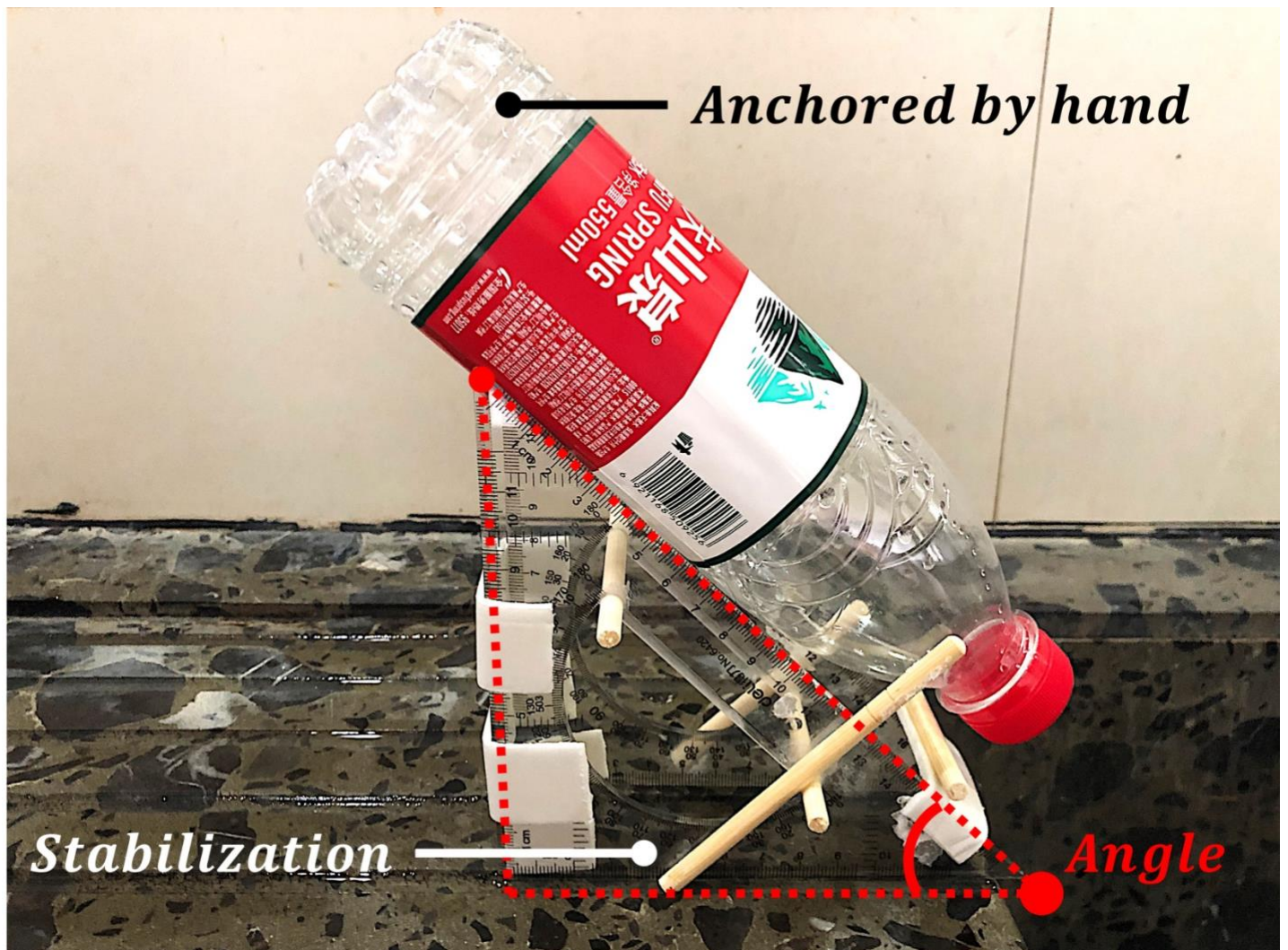
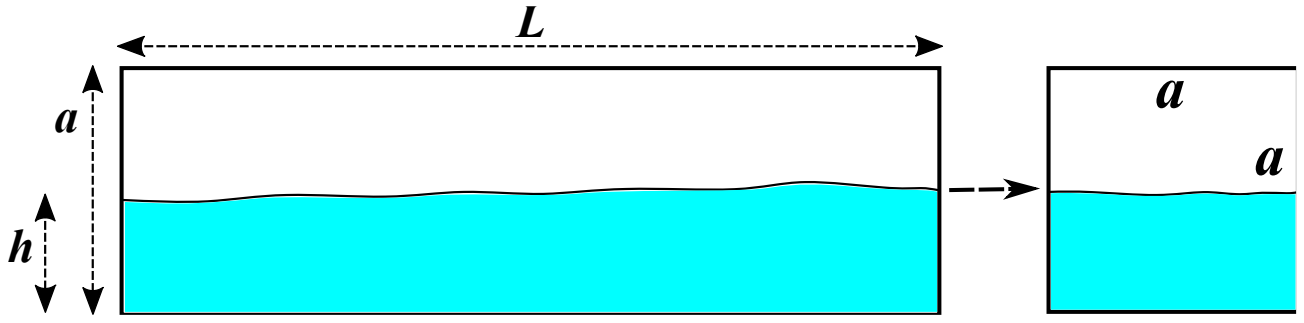


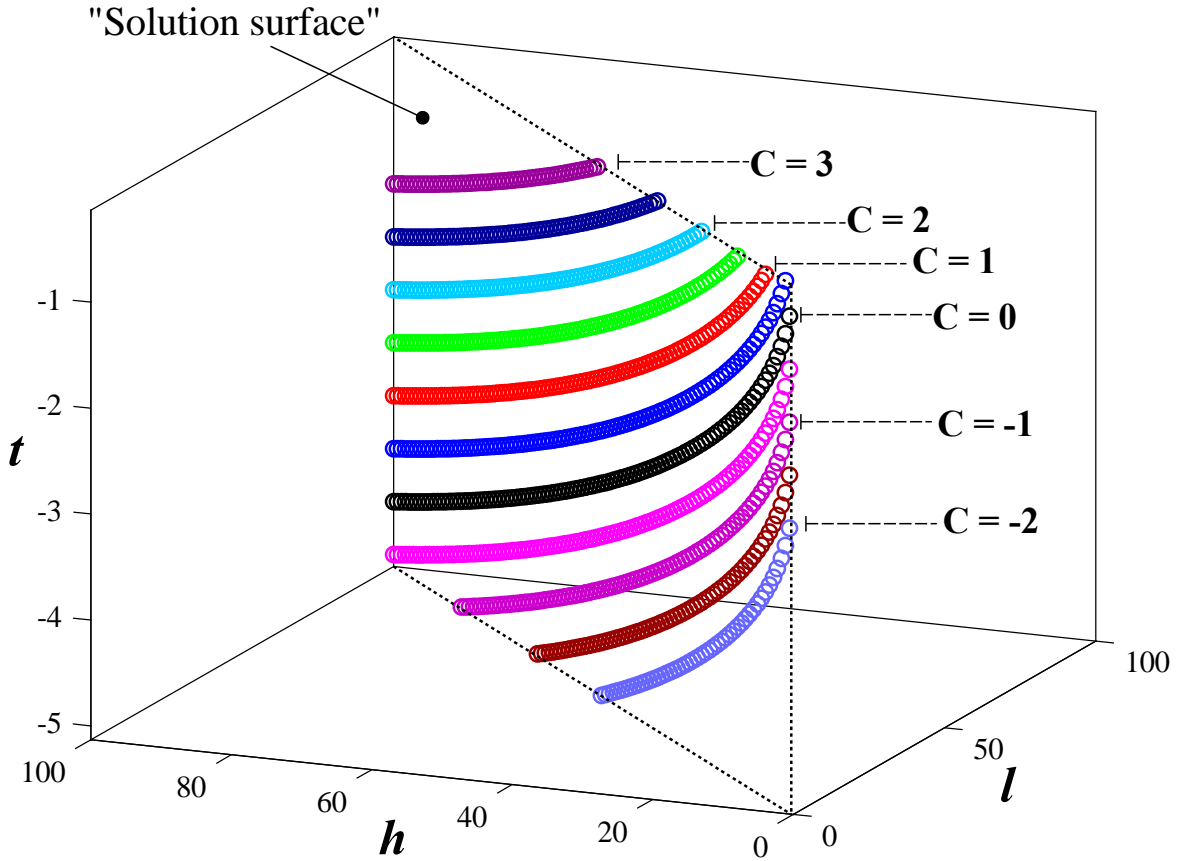
**Fig. 1** Schematic illustration for the water discharge problem and the experimental method. Note that the bottles are named coke, Nongfu spring, Pocalri, soda bottle, from left to right.



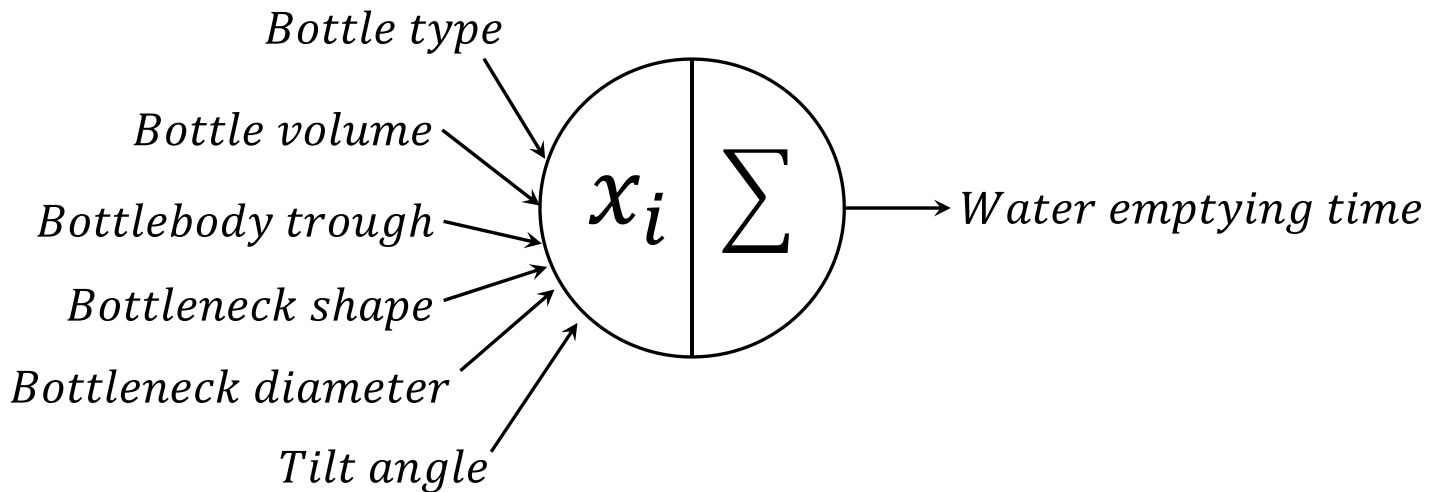
**Fig. 2** Picture for the experimental setup.



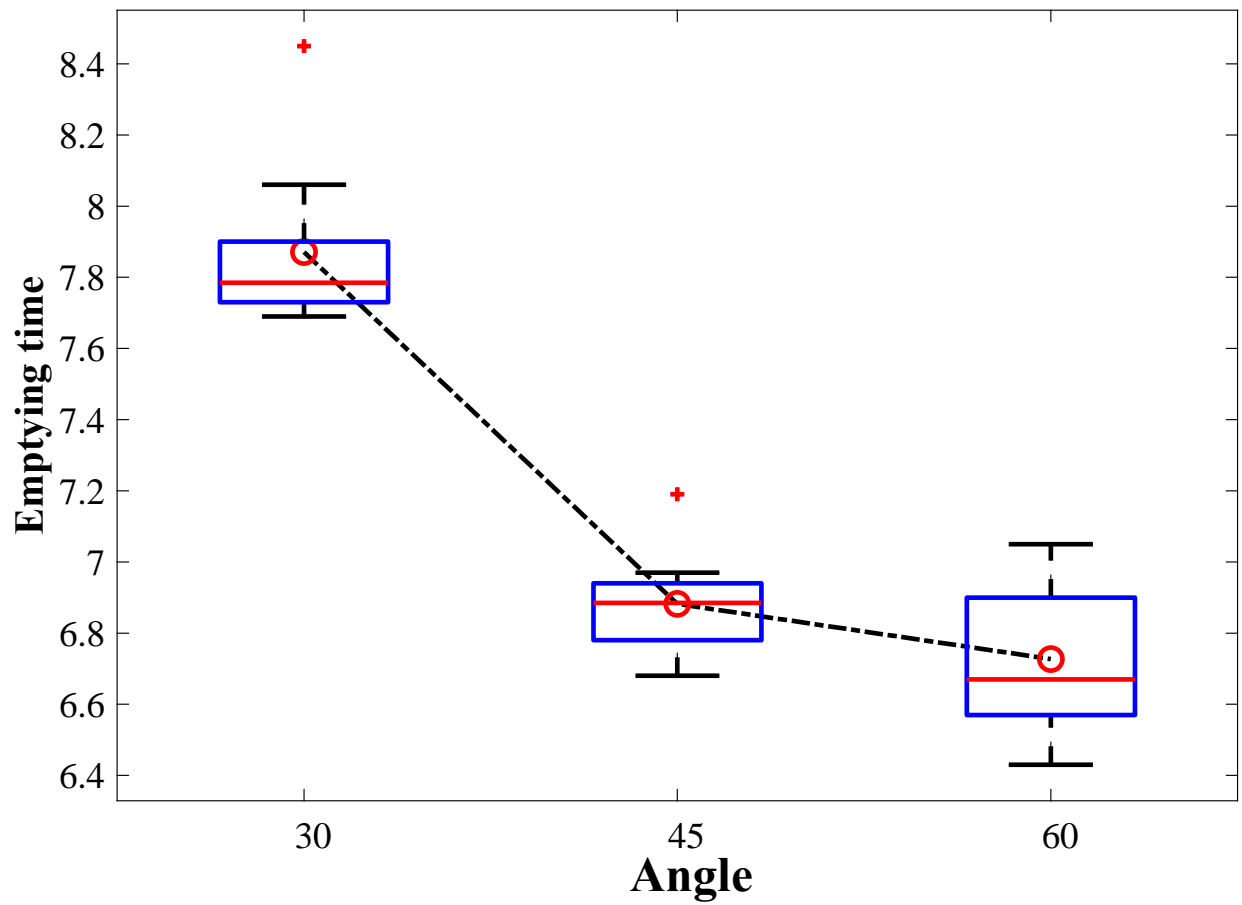
**Fig. 3** Schematic view for the water flow problem, in assumed conditions.



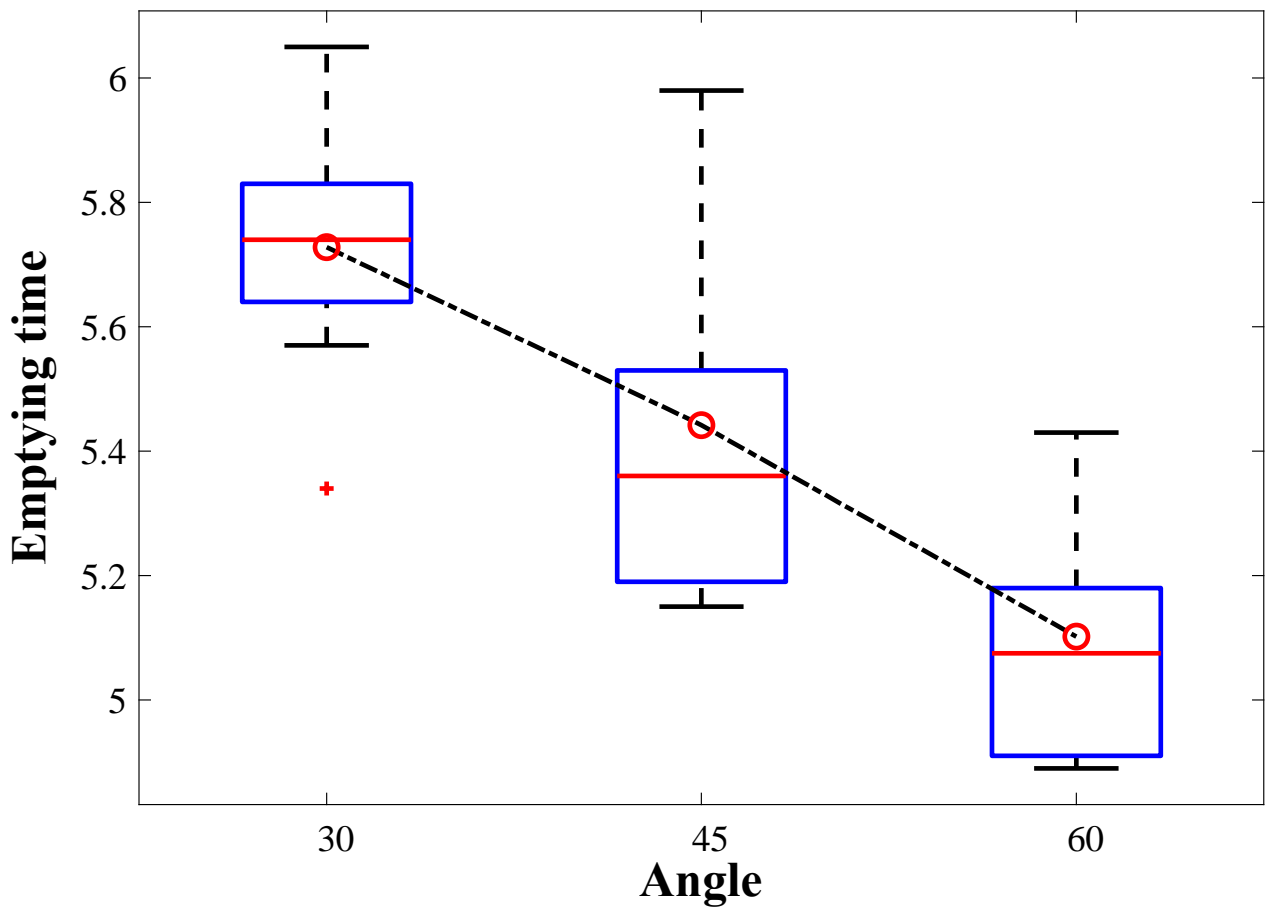
**Fig. 4** Visualization of the analytical solution corresponding water emptying time with length and water height.



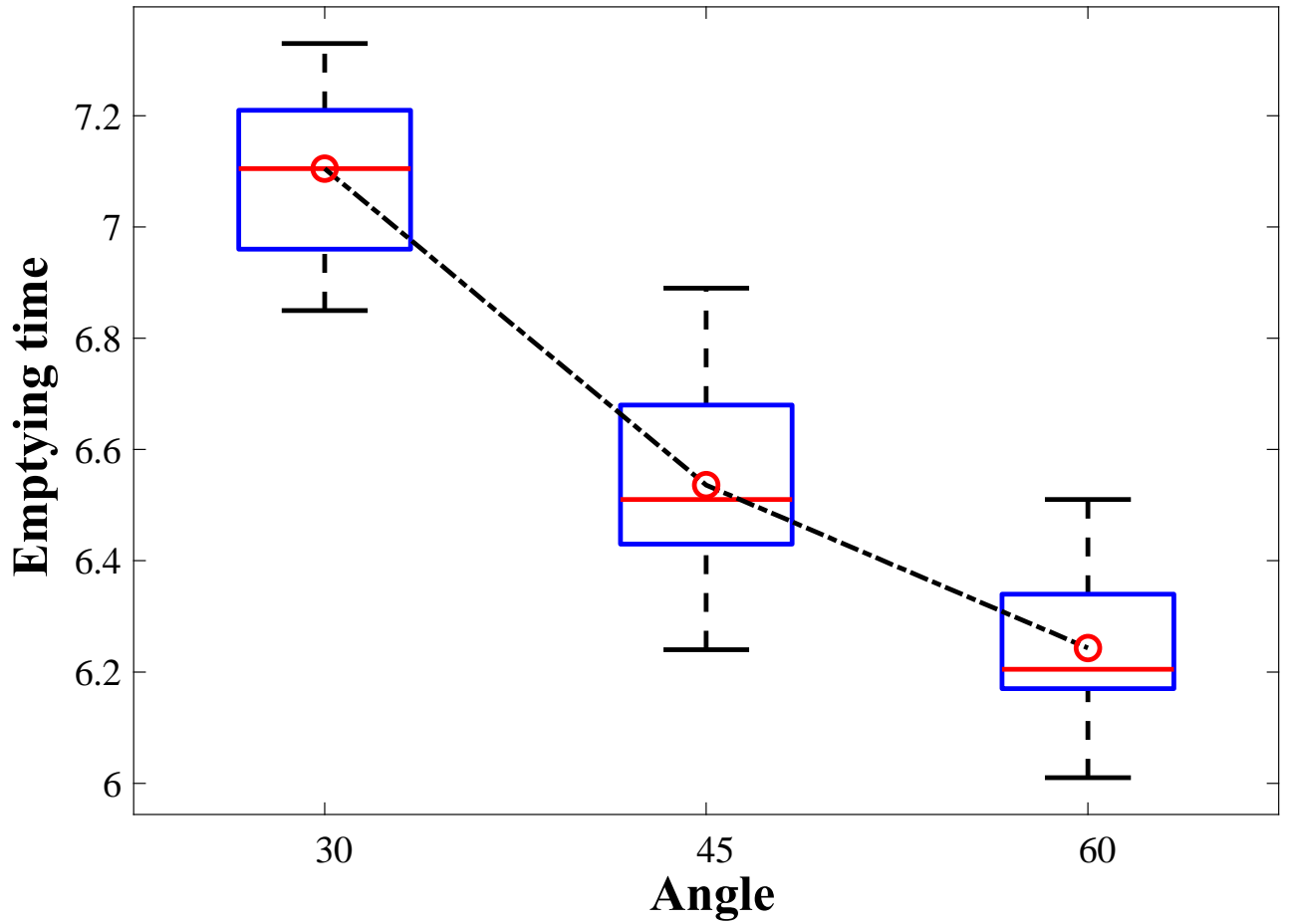
**Fig. 5** Illustration for the regression problem based on the experimental data.



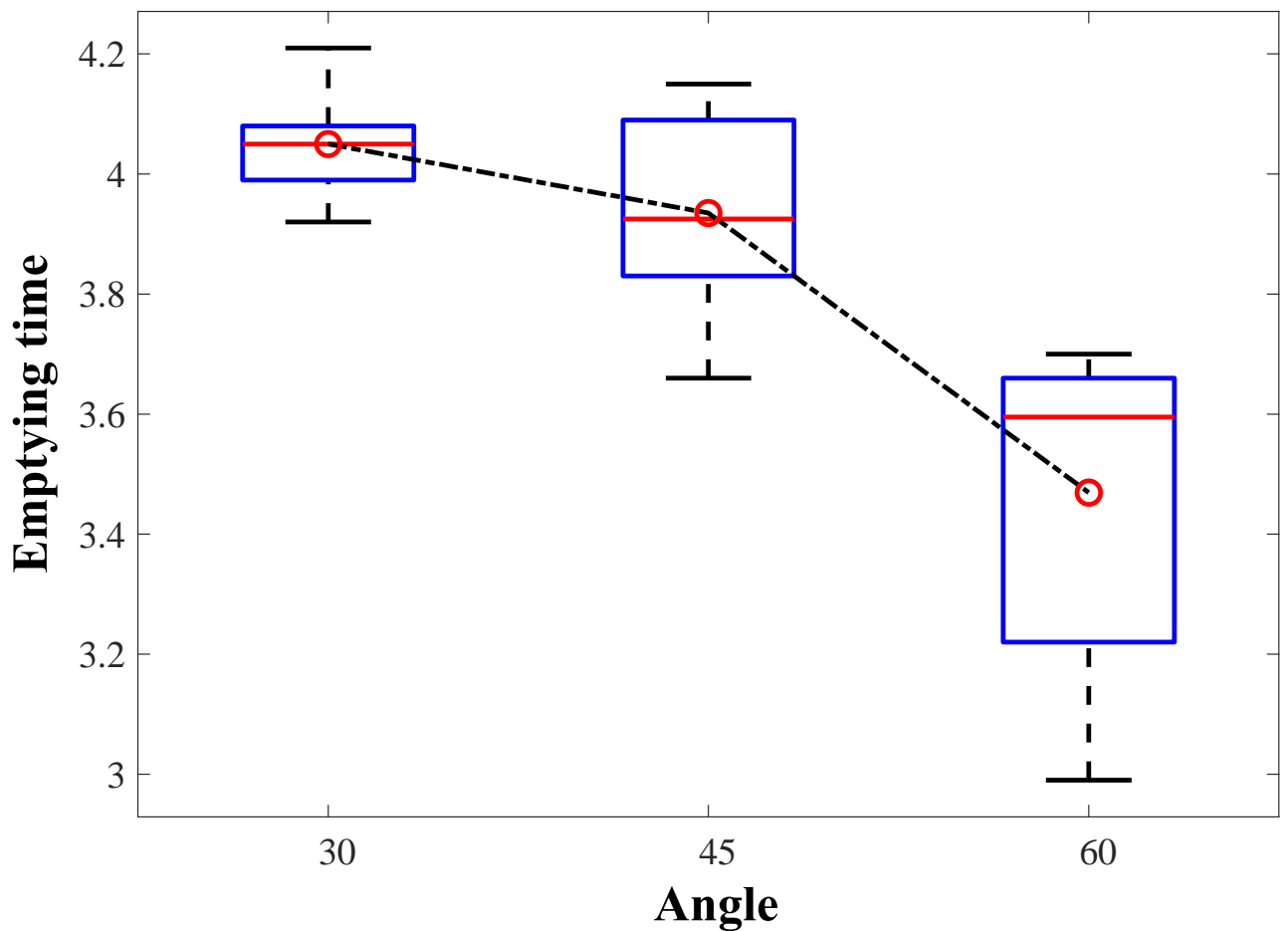
**Fig. 6** The Emptying time-angle boxplot diagram of the coke bottle.



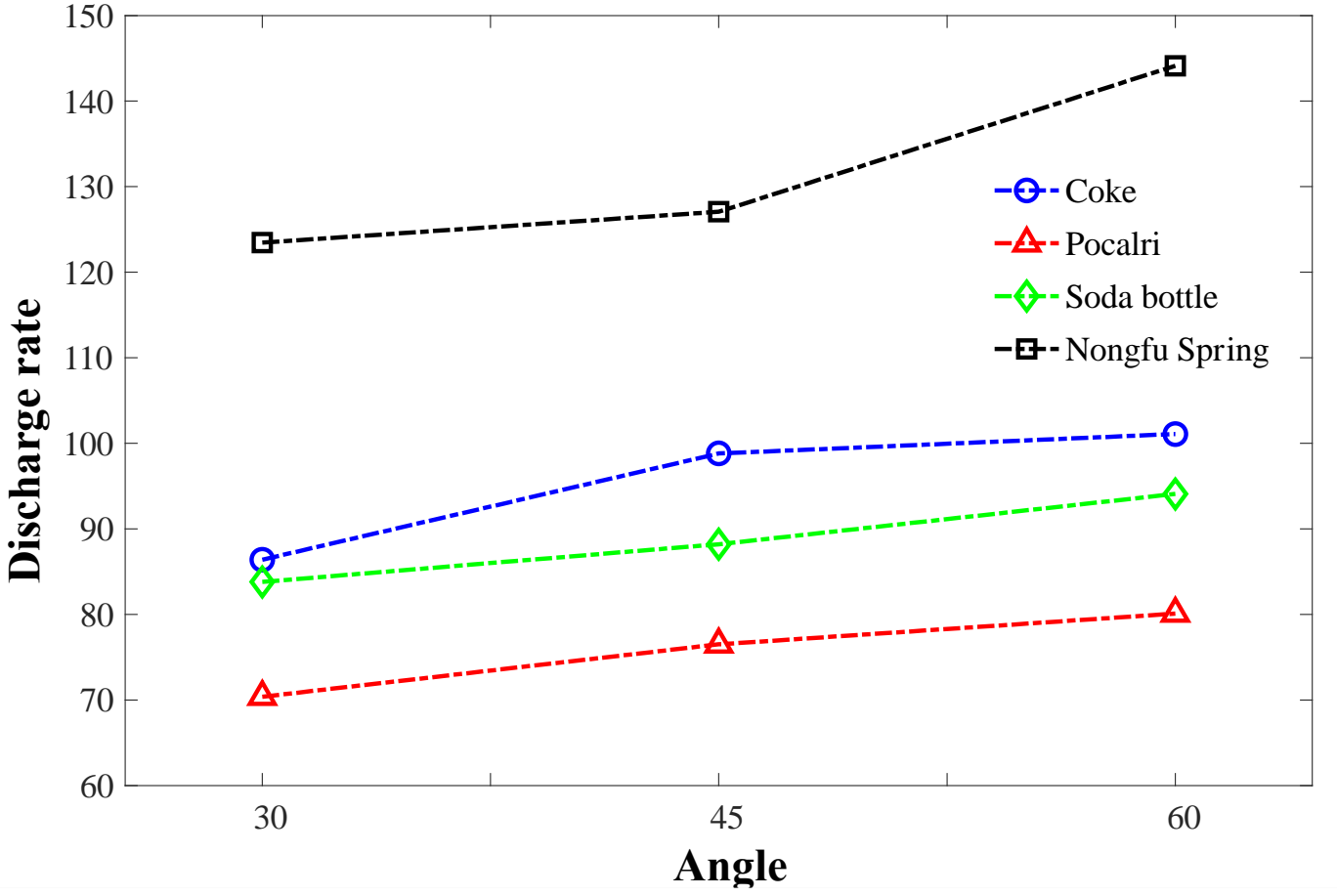
**Fig. 7** The Emptying time-angle boxplot diagram of the Pocalri bottle.



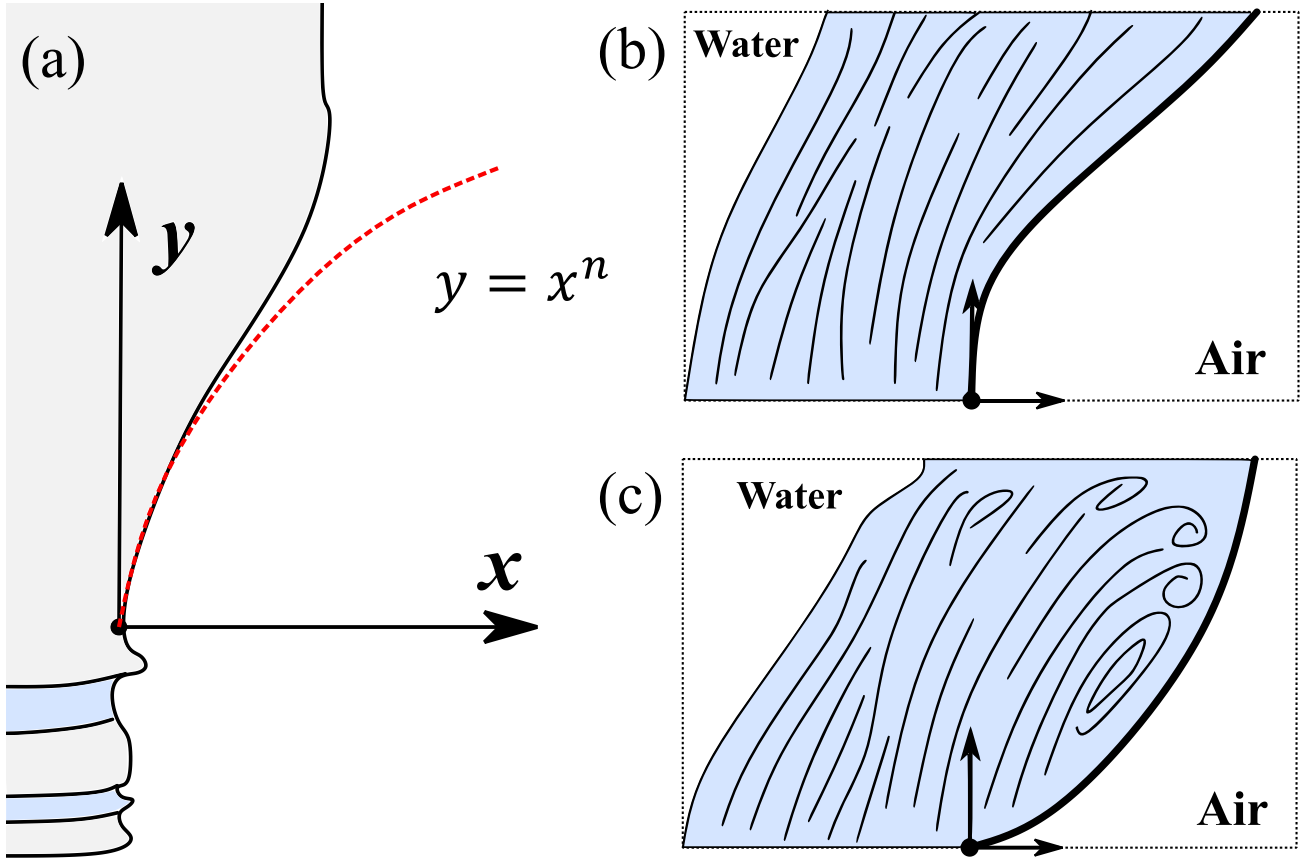
**Fig. 8** The Emptying time-angle boxplot diagram of the soda bottle.



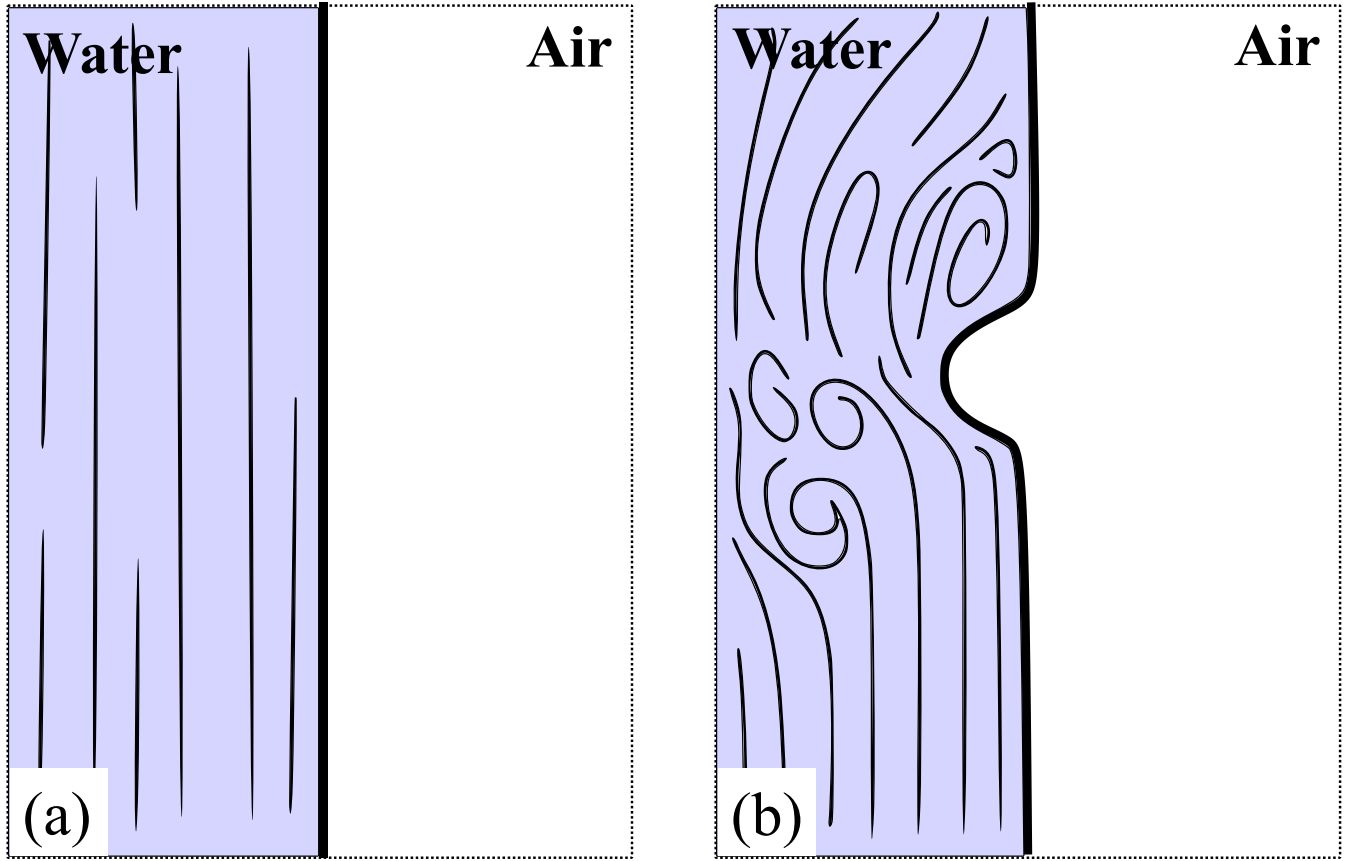
**Fig. 9** The Emptying time-angle boxplot diagram of the Nongfu spring bottle.



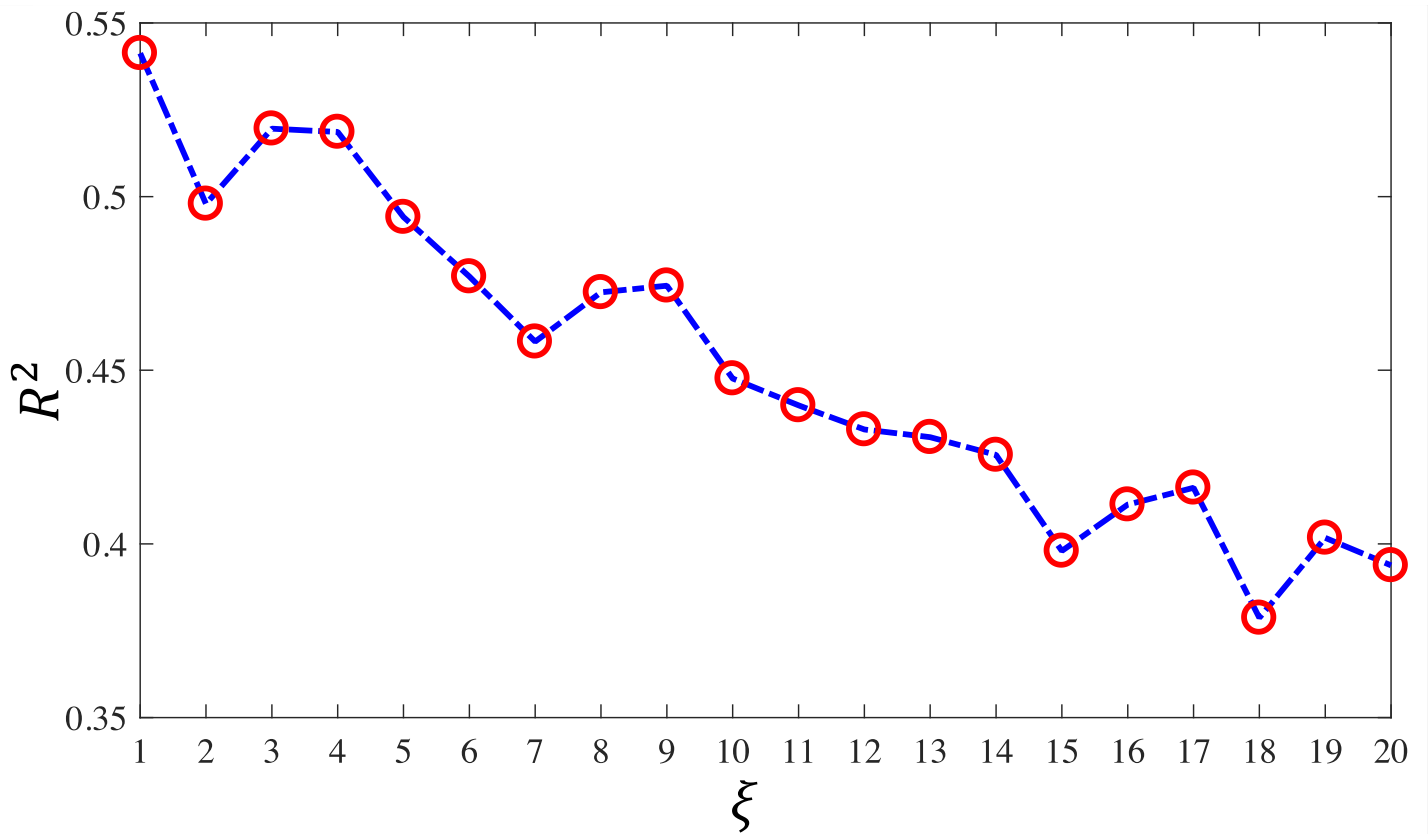
**Fig. 10** The discharging rate calculated as a mean value comparing the four bottles.



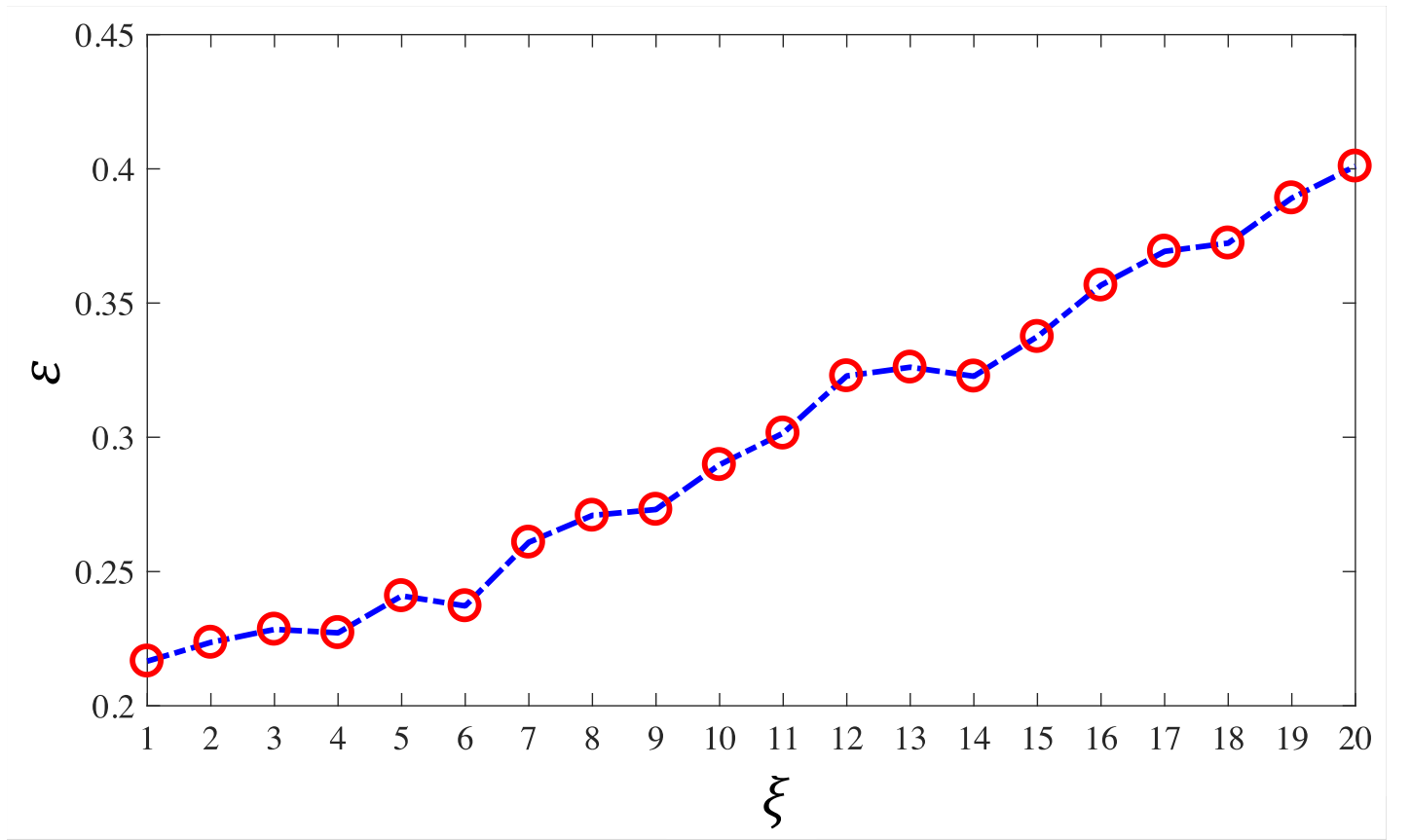
**Fig. 11** Schematic of the provided explanation of the water discharge rate considering the bottleneck shape.  
 (a) Basic strategy for mathematical description of the bottle shape. (b) The schematic of water emptying process when  $n < 1$ . (c) The schematic of water emptying process when  $n > 1$ .



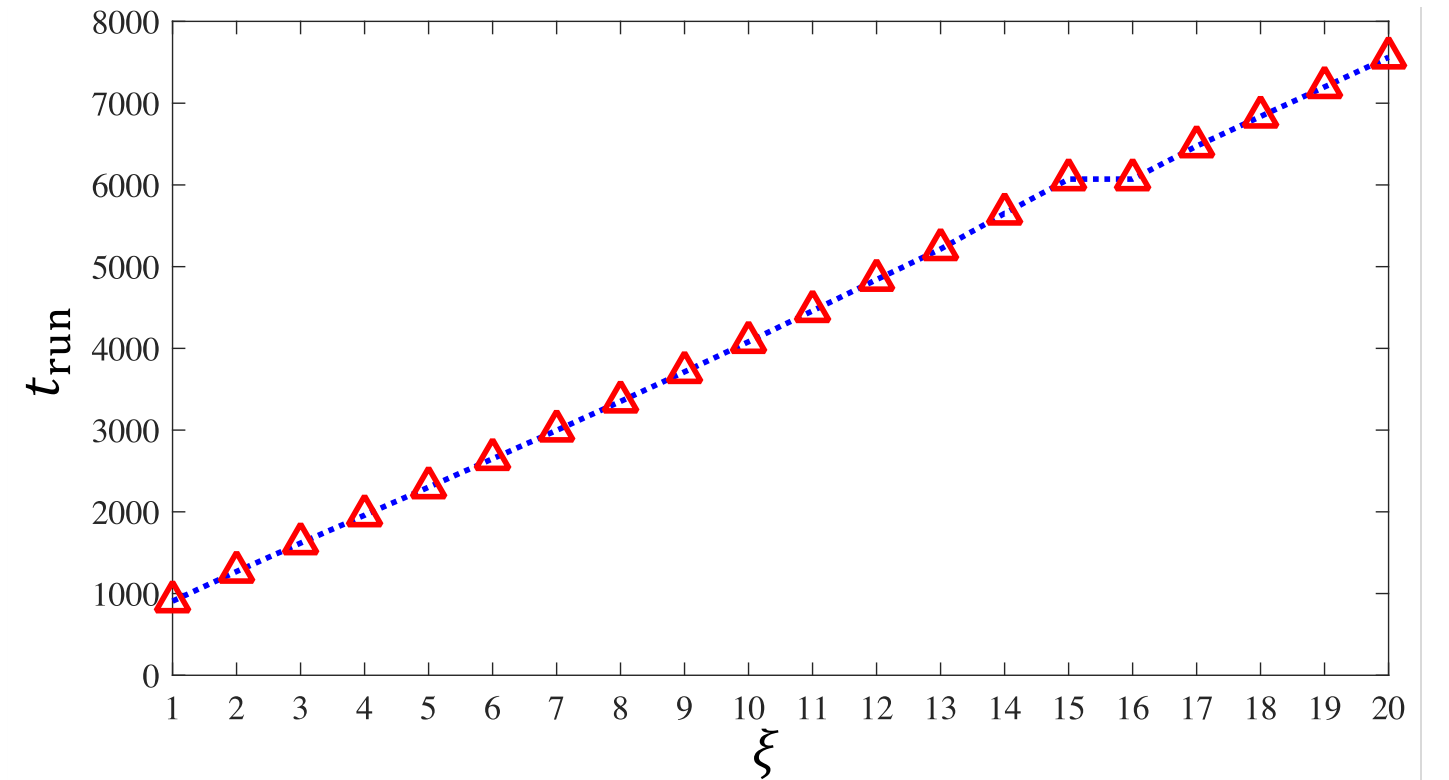
**Fig. 12** Schematic of the provided explanation of the water discharge rate considering the bottle-body shape. (b) The schematic of water emptying process when the bottle-body has no trough. (b) The schematic of water emptying process when the bottle-body has a trough.



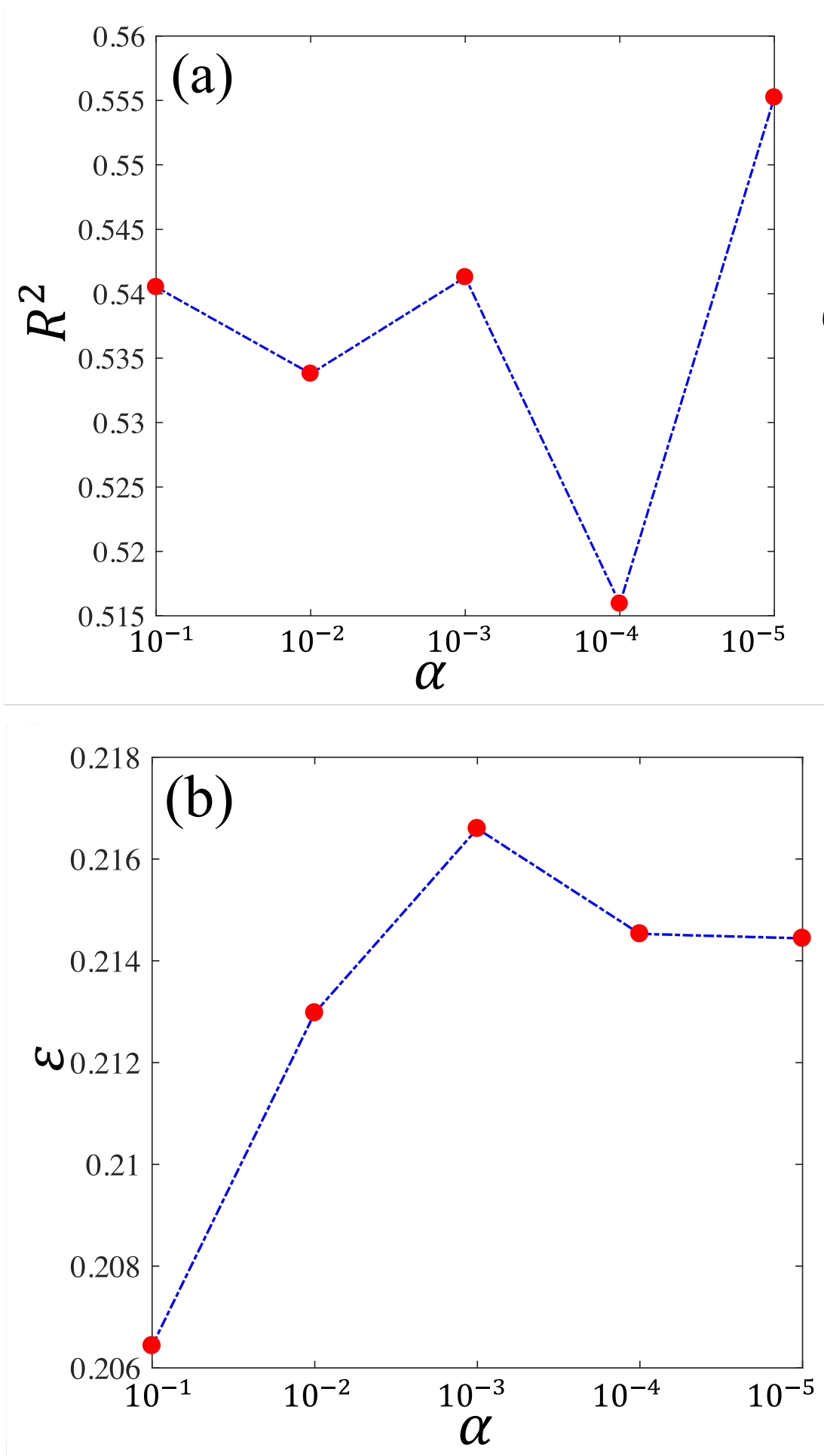
**Fig. 13** The relations between the neuron numbers  $\xi$  to determine factor  $R^2$ .



**Fig. 14** The relations between the neuron numbers  $\xi$  to relative error  $\varepsilon$ .

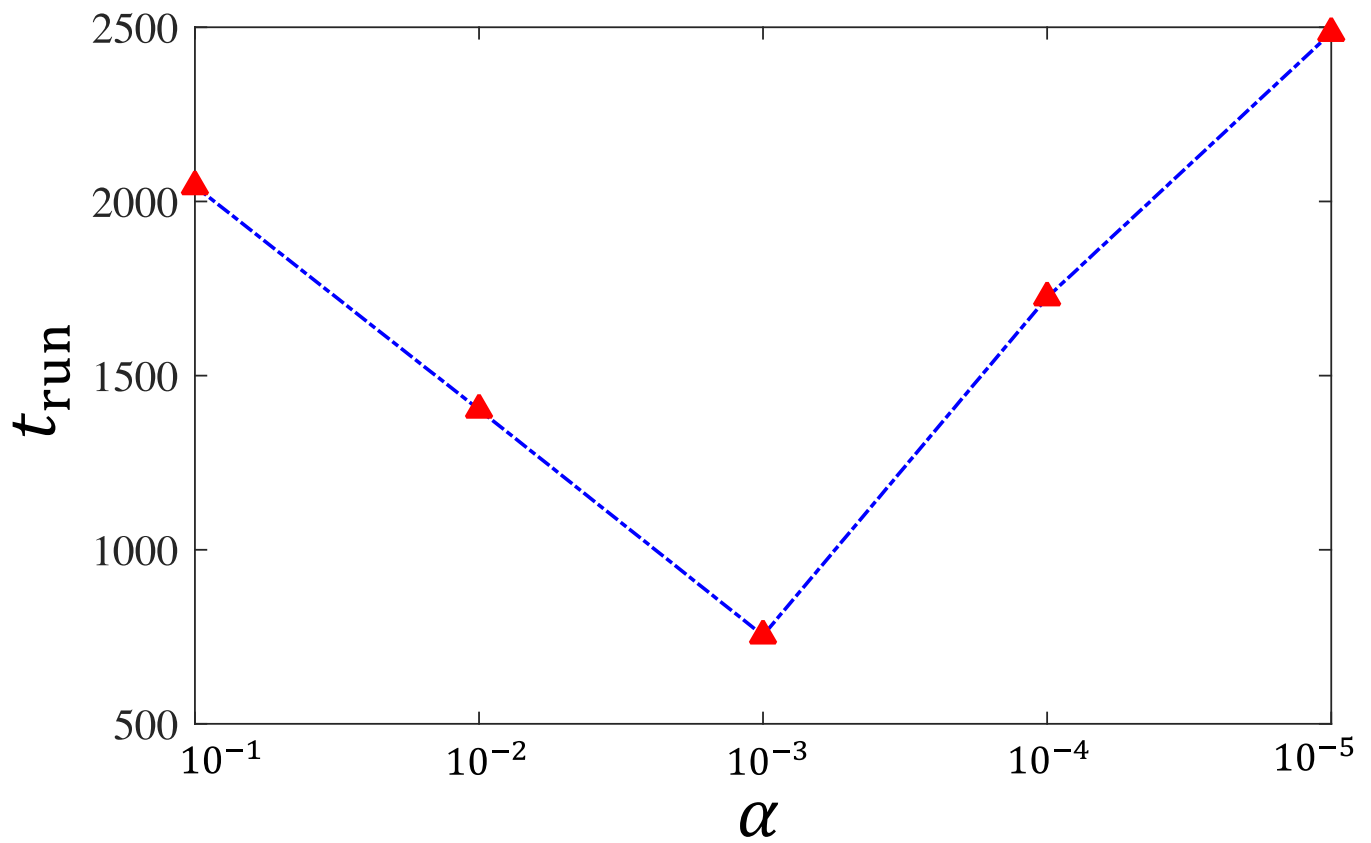


**Fig. 15** The relations between the neuron numbers  $\xi$  to CPU time  $t_{\text{run}}$ .

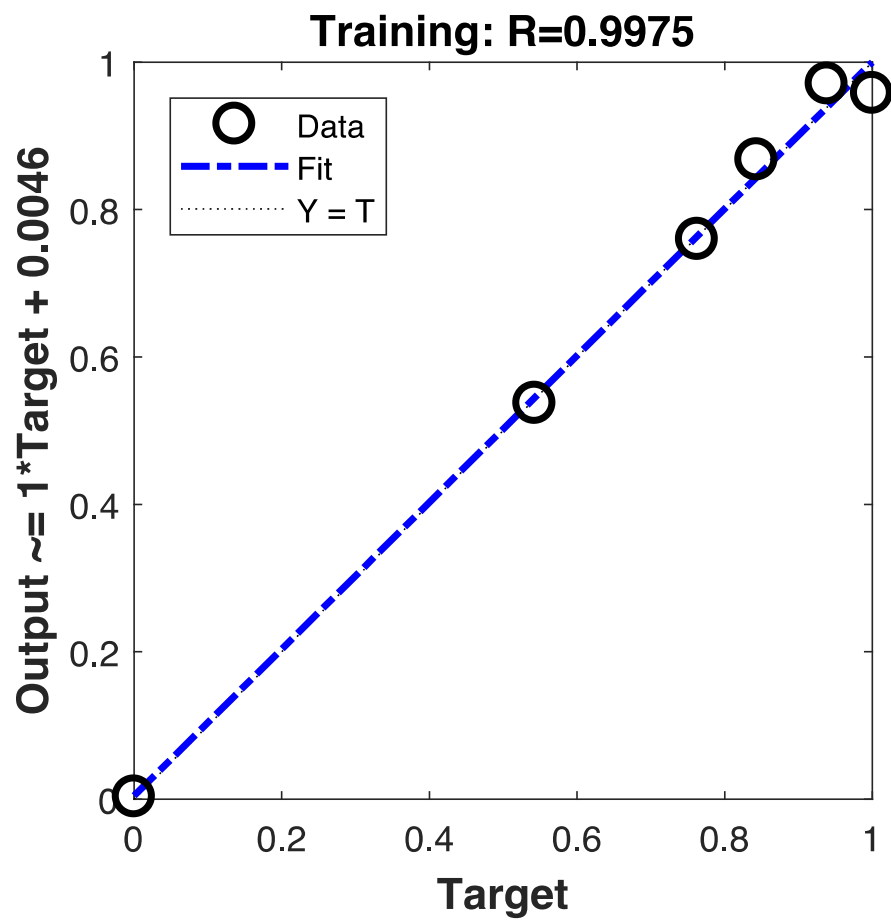


**Fig. 16** The learning rate  $\alpha$  effect on the network's performance. (a) The learning rate ( $\alpha$ ) – determine factor ( $R^2$ ) diagram. (b) The learning rate ( $\alpha$ ) – relative error ( $\epsilon$ ) diagram.

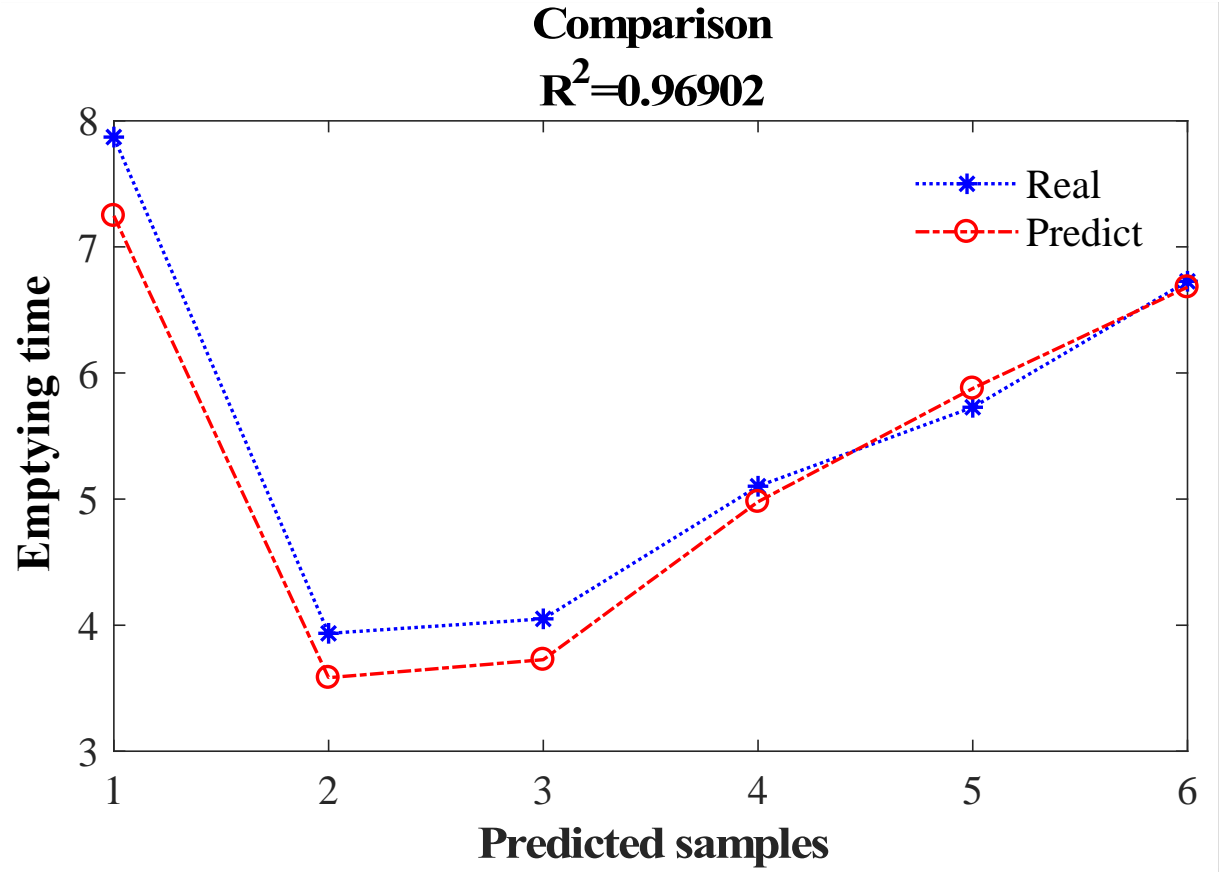




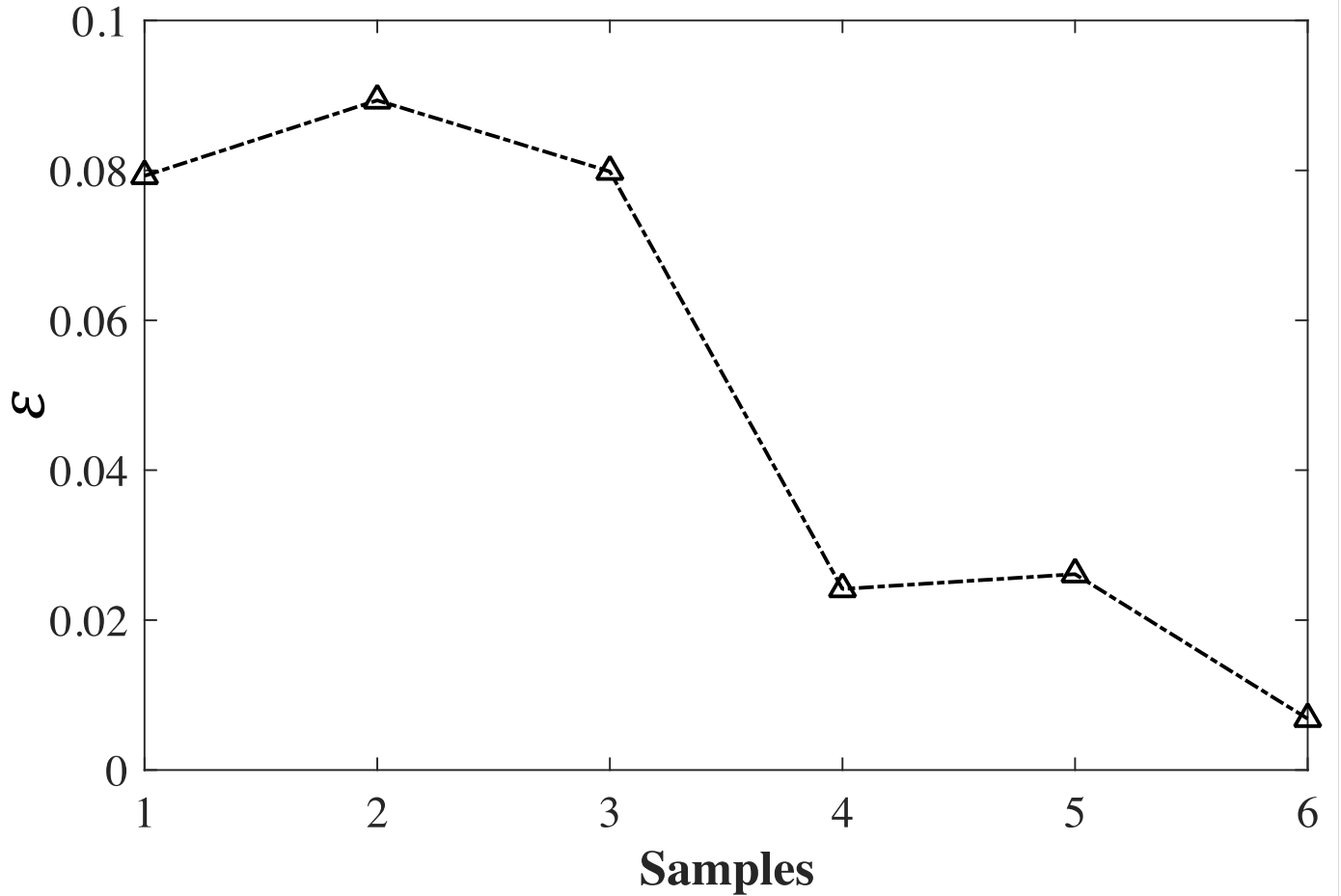
**Fig. 17** The relations between the learning rate  $\alpha$  to CPU time  $t_{run}$ .



**Fig. 18** The regression model of the generated network.



**Fig. 19** The comparison between the testing samples  $T_{test}$  and the neural network's simulation results  $T_{sim}$ .



**Fig. 20** The distribution of the relative errors  $\varepsilon$  with the testing samples.