Electronic Appendix 5

The measurement of ascorbic acid by digital analysis method

As Figure S5-1 and S5-2 shown, the linear range between R value and ascorbic acid is the same as that between OD and ascorbic acid, which is 0-0.2 g/L. The R^2 of R value is a bit (2%) higher than that of OD. The measurement results showed that the digital color analysis method can well apply to the measurement of ascorbic acid, which is comparable to the traditional OD method. Using the linear prediction model which wrote as R = -547.4 × ascorbic acid (g/L) + 117) shown in Fig. S5-2, the detection limit of ascorbic acid was as low as 0.002 g/L. The results of the validation experiment were given in Table 3 of the manuscript.

To extend the detection range of ascorbic acid, the artificial neural network was also applied. The setup of artificial neural network was followed the method employed in our manuscript. The kinetics of color development reactions with different ascorbic acid concentrations (0 - 0.5 g/L) were shown in Fig. S5-3, and the specified point-in-time for data recording was set at 0.1, 0.2，0.3, 0.4, 0.5, 0.6,0.7, 0.8, 0.9, 1.0, min respectively (Fig. S5-3). The results of the validation experiment were given in Table 3 of the manuscript. The detection range and the detection limit were 0 - 0.5 g/L and 0.02 g/L respectively.

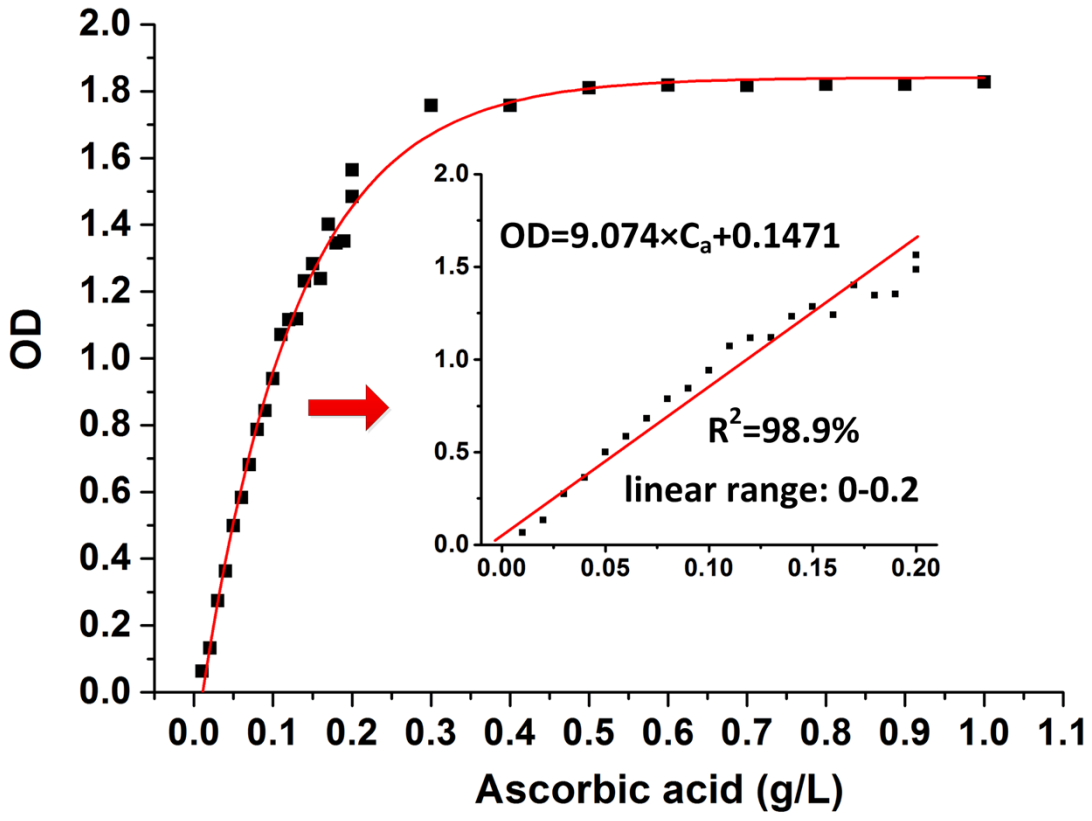

Fig. S5-1 the correlationship between OD and ascorbic acid. The correlation between OD and ascorbic acid can be written as $OD = 9.074 \times c_a + 0.1471.$ The

linear range is 0-0.2 g/L and detection limit was 0.002 g/L.

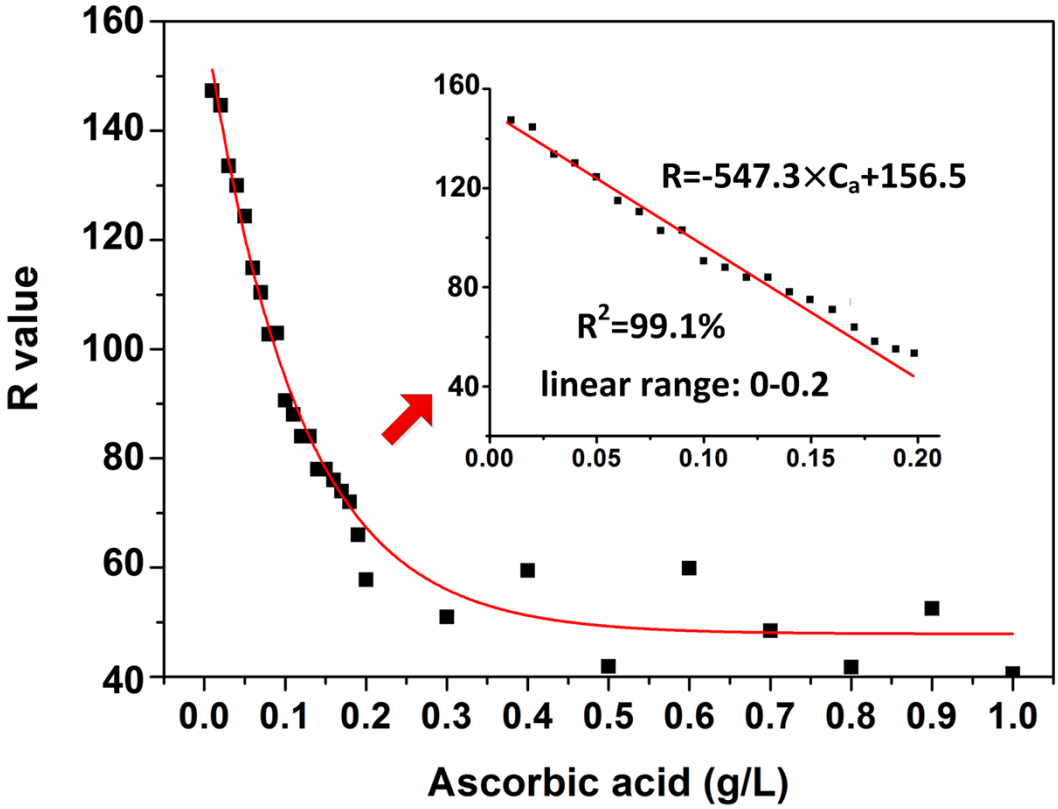

Fig. S5-2 the correlationship between R value and ascorbic acid. The correlation between R value and ascorbic acid can be written as $R = -547.3 \times c_a + 156.5.$ the linear range is 0 - 0.2 g/L and detection limit was 0.002 g/L using this linear prediction model.

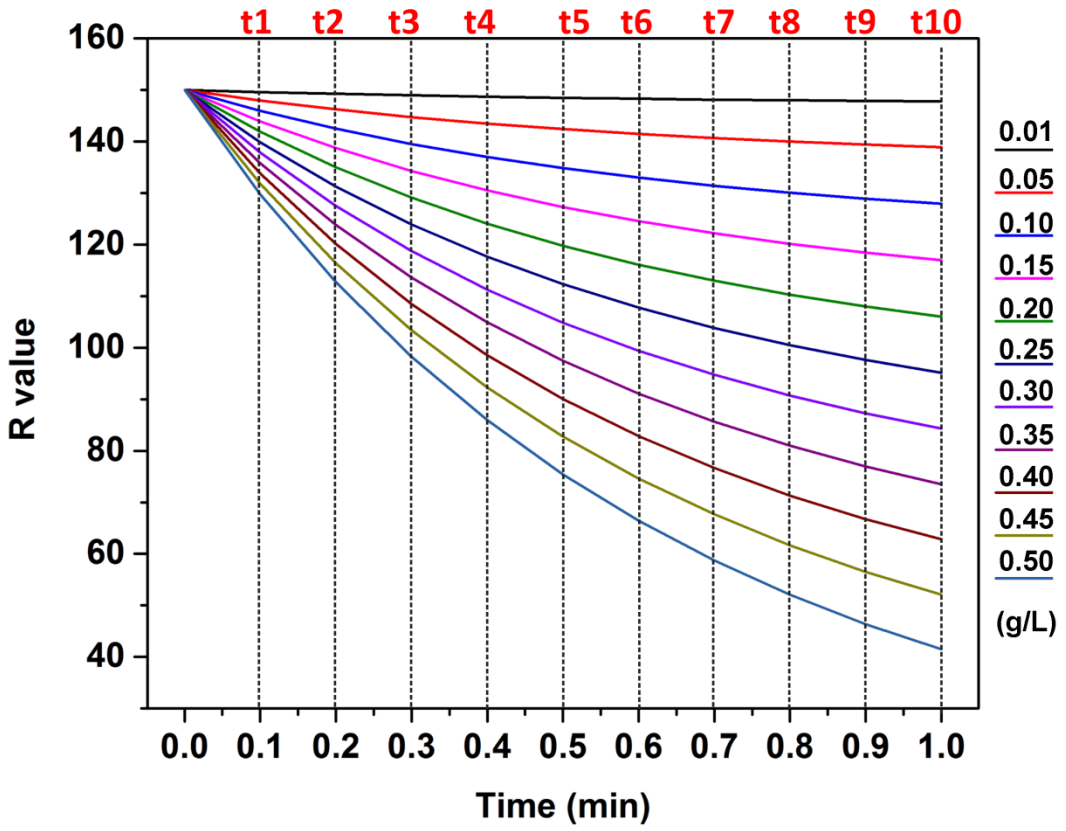

Fig. S5-3 the kinetics of color development reactions with different ascorbic acid concentrations (0 - 0.5 g/L). To set up of artificial neural network (ANNs), the color values of different ascorbic acid concentrations (0 - 0.5 g/L) were recorded at 0.1, 0.2，0.3, 0.4, 0.5, 0.6,0.7, 0.8, 0.9, 1.0, min respectively. The setup of ANNs followed the method employed in our manuscript. The results of the validation experiment were given in Table 3 of the manuscript. By using ANNs, The detection range was expanded to 0 - 0.5 g/L and the measurement limit was 0.02 g/L.