

The materials, procedures and results of the standard methods and the modified trace detection methods for amylose and fat content in rice

1. Detection results of the amylose content (AC) in rice by using the two methods

Thirteen samples of rice with different ACs were selected for the determination of rice AC by using the standard and trace detection methods. For the standard and trace detection methods, approximately 100 mg and 10 mg of rice flour was weighed for each sample, respectively.

1.1 The standard method for the determination of AC (the iodine colorimetric method)

The standard assay method (the iodine colorimetric method) was implemented as described in reference [9].

1.2 Trace detection method for AC in rice (the modified iodine colorimetric method)

(1) Sample Preparation:

Each rice kernel was manually dehusked, ground in a mortar, and passed through a 100-mesh sieve (0.150 mm sieve) to obtain brown rice flour. The flours were then dried at 70°C for 12 hours.

(2) The calculation of standard curve:

Four standard samples of amylose were selected, which consisted of potato flours with AC values of 1.5%, 10.4%, 16.2%, and 26.5%. Approximately 10 mg of powder was weighed for each sample on a balance with an accuracy of 0.01 mg (Mettler Toledo, Zurich, Switzerland) and placed in a 2 ml centrifuge tube. The mass of each standard sample was recorded as m .

After 100 μ l of anhydrous ethanol and 900 μ l of 1 mol/L NaOH were added to each tube, the tubes were heated in a water bath at 100°C for 20 minutes, with the tube was shaken gently several times every 5 minutes. After the water bath was finished, the tubes were removed and cooled, after which 1 ml of water was added to each tube.

40 μ l of liquid from each centrifuge tube was transferred into a new 5 ml centrifuge tube, and then 860 μ l of water, 40 μ l of 1 mol/L HAc, 60 μ l of 0.2% I₂-KI solution, and 3 ml of water were added into the tube. After standing for 10 minutes, the absorbance of the mixture in each tube was measured by an ultraviolet-visible spectrophotometer (PerkinElmer, Singapore) at 620 nm. The absorbances of each sample were measured twice and averaged. The absorbance value of each standard solution is recorded as A .

The amylose content was used as the horizontal coordinate, and $A/m * 10$ was used as the vertical coordinate to draw the standard curve of amylose.

(3) The determination of AC in single rice kernels:

The determination procedure of the test samples is the same as that of the standard samples. The mass of the weighed powder was recorded as m_n , and the absorbance value was recorded as A_n . The AC of each test sample was calculated as follows:

$$W_{ac} = \frac{10C_n}{m_n} \times 100\%$$

where m_n (mg) is the mass of the test sample and C_n is the AC of the test sample calculated according to the standard curve.

1.3 Detection results of AC in rice

The standard curves established by the two methods are shown in Figure S1 and Figure S2.

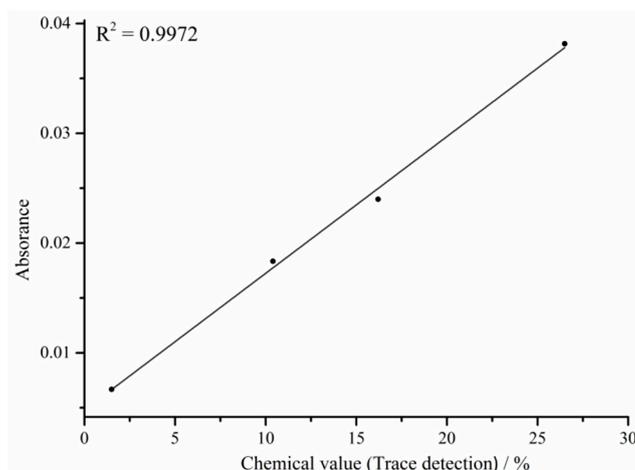


Figure S1. Standard curve based on the trace detection method

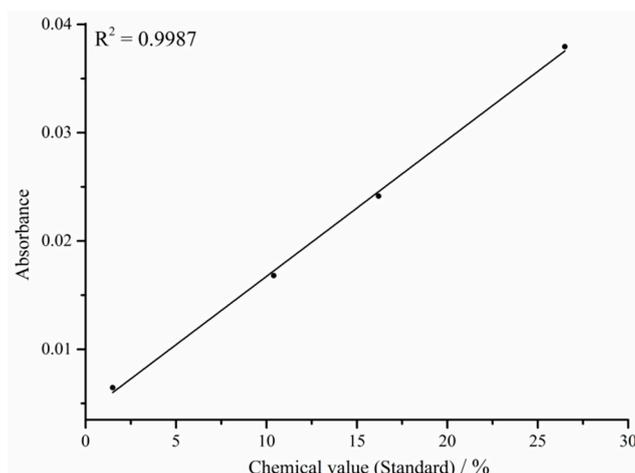


Figure S2. Standard curves based on the standard method

As shown in the figure, the coefficients of determination (R^2) for the absorbance/mass and the chemical value of amylose content were 0.9987 and 0.9972, respectively. The correlation coefficient (R value) between the absorbance/weight values of the standard samples measured by the two methods was 0.9950 (not shown in the figure), which indicates that the standard curves constructed by the trace detection method and the standard method

are close in accuracy.

The scatterplots of the AC measured by the two methods were shown in Figure S3.

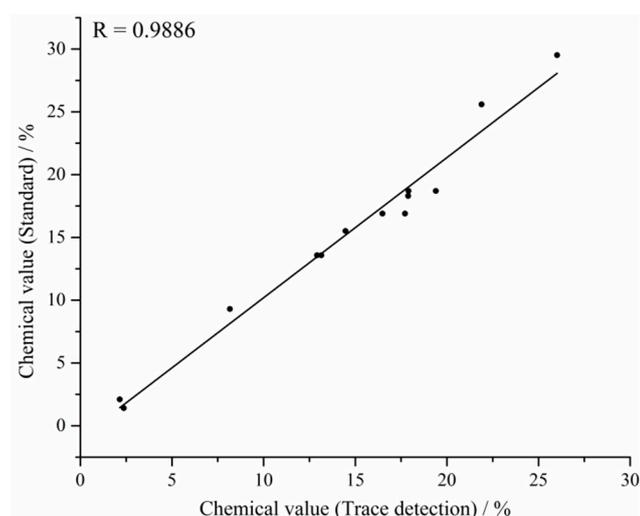


Figure S3. Correlation of chemical values measured by the two methods

The R value of the results of the 13 test samples determined by the two methods was 0.9886, and the $|T|$ value was 1.832, with a p-value of $0.092 > 0.05$, which indicated that the FC measured by the two methods was not significantly different and well correlated.

2. Detection results of the fat content (FC) in rice by using the two methods

Nine samples of rice with different fat contents (FCs) were selected for the determination of rice FC by using the standard and trace detection methods. For the standard and trace detection methods, approximately 2 g and 0.3 g of rice flour was weighed for each sample, respectively.

2.1 The standard method for the determination of FC in rice (the Soxhlet extraction method)

The standard assay method (the Soxhlet extraction method) was implemented as described in reference [10].

2.2 Trace detection method for FC in rice (the modified Soxhlet extraction method)

A modified Soxhlet extraction method was used for the trace detection of rice FC. Fifteen rice kernels were dehusked and ground to obtain rice flour and then dried at 70°C for 12 hours. All the rice flour for each sample was weighed, and its mass was recorded as m_0 . Each rice flour sample was transferred into a food-grade filter bag and sealed with a PFS-200 impulse sealer (Kayshark, Wenzhou, China), and then the filter bag was transferred to a handmade paper tube and sealed. The paper tube was put into the Soxhlet extractor for fat extraction. After the extraction, each rice flour sample was dried, removed from the paper tube and the filter bag, and weighed. The mass of the rice flour after extraction was recorded as m_1 . The fat content W_{FC} was calculated using the following equation:

$$W_{FC} = \frac{m_0 - m_1}{m_0} \times 100\%$$

2.3 Detection results of FC in rice

The scatterplots of the FC measured by the two methods were shown in Figure S4.

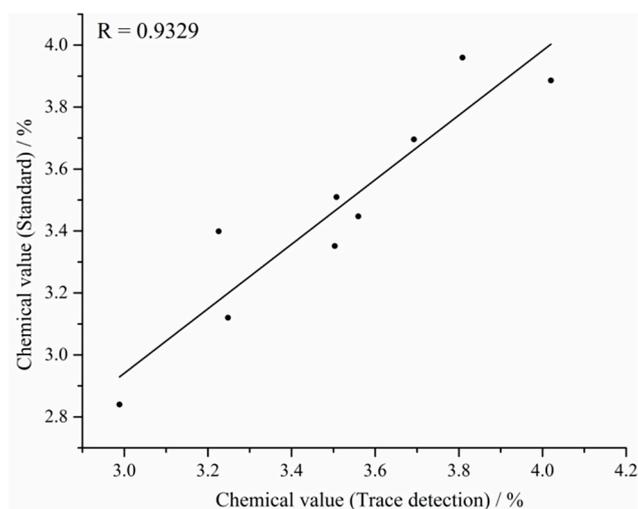


Figure S4. Correlation between the chemical values measured by the two methods

The R value between the absorbance/weight values of the 9 samples measured by the two methods was 0.9329, and the $|T|$ value was 0.898, with a p-value of 0.395 > 0.05, so it can be concluded that the FC measured by the two methods were not significantly different and well correlated.