

## Tables

**Table S1.** Sensory evaluation of *rice wine*

Projects	Scores 1-9	Scores 10-19	Scores 20-25
appearances	The product has the colour it should have, there is a large amount of sediment at the bottom of the packaging container, there are foreign impurities	The product has the colour it should have, with visible sediment at the bottom of the packaging container and no foreign impurities	The product has the colour it should have, with a trace of sediment at the bottom of the packaging container and no foreign impurities
Aromas	Slight aroma of rice wine	Aromas characteristic of rice wine	Aromas of rich rice wine, with no other aromas
Taste	Poor taste with off flavors	Good mouthfeel, no off flavors	Mellow, sweet, crisp, harmonious and free from unpleasant flavors
Styles	Almost unfermented rice wine style	With a fermented rice wine style	A distinctive fermented rice wine style

**Table S2.**Basic physical and chemical indices of rice wine

Fermentation methods	Alcohol content (%vol)	Reducing sugars (mg/mL)	Total sugars (mg/mL)	Total acids (mg/mL)	pH
SC	14.70±0.57 <sup>a</sup>	25.76±0.80 <sup>c</sup>	42.13 ±3.98 <sup>d</sup>	3.08±0.14 <sup>ab</sup>	4.83±0.01 <sup>b</sup>
DOSC	14.50±0.94 <sup>a</sup>	24.18±1.82 <sup>cd</sup>	45.71±2.16 <sup>c</sup>	3.17±0.10 <sup>a</sup>	4.90±0.03 <sup>bc</sup>
WA	6.80±0.76 <sup>c</sup>	122.31±4.16 <sup>a</sup>	140.65±4.58 <sup>a</sup>	2.93±0.05 <sup>b</sup>	4.97±0.05 <sup>a</sup>
DOWA	12.88±0.0.63 <sup>b</sup>	39.87±1.43 <sup>b</sup>	58.80±2.87 <sup>b</sup>	3.17±0.10 <sup>a</sup>	4.70±0.02 <sup>c</sup>

Different lowercase letters indicate significant differences, P<0.05.

**Table S3.**Active substance contents in rice wine

Fermentation methods	Polysaccharides (mg/mL)	Total flavonoids (mg/L)	Total phenols (mg/L)
SC	0.44±0.08 <sup>d</sup>	27.62±4.11 <sup>d</sup>	641.88 ±10.60 <sup>d</sup>
DOSC	2.40±0.07 <sup>b</sup>	137.73±4.26 <sup>b</sup>	878.03±20.29 <sup>b</sup>
WA	1.05±0.04 <sup>c</sup>	87.23±5.83 <sup>c</sup>	822.47±21.12 <sup>c</sup>
DOWA	2.91±0.13 <sup>a</sup>	157.07±6.00 <sup>a</sup>	926.18±3.87 <sup>a</sup>

Different lowercase letters indicate significant differences

**Table S4.** Compositions of free amino acids in rice wine.

Flavoring characteristics	Free amino acid types (mg/100g)	Fermentation methods			
		SC	DOSC	WA	DOWA
Harmonious taste	ASP	3.30±0.50 <sup>d</sup>	5.13±0.23 <sup>c</sup>	8.20±0.26 <sup>b</sup>	9.60±0.10 <sup>a</sup>
	GLU	6.30±0.30 <sup>c</sup>	12.50±0.10 <sup>b</sup>	5.97±0.32 <sup>c</sup>	17.17±0.60 <sup>a</sup>
	Total	9.60	17.63	14.17	26.77
sweet taste	MET	2.10±0.40 <sup>d</sup>	2.80±0.10 <sup>bc</sup>	4.09±0.62 <sup>a</sup>	3.93±0.47 <sup>a</sup>
	GLY	2.05±0.05 <sup>e</sup>	3.57±0.31 <sup>d</sup>	6.60±0.61 <sup>c</sup>	8.53±0.90 <sup>b</sup>
	ALA	8.40±0.20 <sup>d</sup>	12.57±0.12 <sup>c</sup>	26.23±1.15 <sup>b</sup>	28.80±0.98 <sup>a</sup>
	CYS	1.00±0.00 <sup>ab</sup>	1.30±0.10 <sup>ab</sup>	1.20±0.17 <sup>ab</sup>	1.57±0.35 <sup>a</sup>
	PRO	6.05±0.65 <sup>c</sup>	7.80±0.17 <sup>b</sup>	8.90±0.30 <sup>a</sup>	8.57±1.00 <sup>ab</sup>
	THR	1.90±0.10 <sup>c</sup>	3.00±0.17 <sup>b</sup>	4.43±0.15 <sup>a</sup>	4.67±0.57 <sup>a</sup>
	SER	3.05±0.15 <sup>c</sup>	5.30±0.50 <sup>b</sup>	9.80±0.80 <sup>a</sup>	10.07±0.35 <sup>a</sup>
	Total	24.55	36.33	61.25	66.14
	ILE	1.80±0.10 <sup>d</sup>	3.00±0.10 <sup>c</sup>	7.93±0.47 <sup>a</sup>	5.47±0.57 <sup>b</sup>
	LEV	6.35±0.35 <sup>d</sup>	9.87±0.38 <sup>c</sup>	19.23±1.40 <sup>a</sup>	15.07±0.68 <sup>b</sup>
bitter taste	VAL	3.90±0.20 <sup>d</sup>	5.40±0.26 <sup>cd</sup>	13.57±0.90 <sup>a</sup>	9.20±1.47 <sup>b</sup>
	PHE	5.10±0.20 <sup>d</sup>	7.50±0.10 <sup>c</sup>	18.30±0.62 <sup>a</sup>	13.60±0.53 <sup>b</sup>
	HIS	0.60±0.00	0.87±0.06	0.90±0.30	1.13±0.23
	LYS	4.50±0.20 <sup>b</sup>	5.20±0.36 <sup>b</sup>	9.80±0.66 <sup>a</sup>	5.57±0.15 <sup>b</sup>
	ARG	4.40±0.20 <sup>b</sup>	6.60±0.56 <sup>b</sup>	5.10±0.35 <sup>b</sup>	8.50±0.72 <sup>a</sup>
	总计	26.65	38.43	74.83	58.54
	TYR	4.15±0.15 <sup>c</sup>	5.80±0.10 <sup>b</sup>	8.73±0.67 <sup>ab</sup>	9.40±0.92 <sup>a</sup>
astringent taste	Total	4.15	5.80	8.73	9.40
	Total	64.95	98.19	158.98	160.85

Different lowercase letters indicate significant differences.

**Table S5.** Volatile Components contents of Rice Wine

No.	Metabolite name	SC( $\mu\text{g/L}$ )	DOSC( $\mu\text{g/L}$ )	WA( $\mu\text{g/L}$ )	DOWA( $\mu\text{g/L}$ )
A1	Ethanol	94192.89 $\pm$ 11224.54 <sup>ab</sup>	84641.08 $\pm$ 1975.10 <sup>bc</sup>	20564.15 $\pm$ 976.87 <sup>d</sup>	73550.20 $\pm$ 466.98 <sup>c</sup>
A2	1-Propanol	44.97 $\pm$ 23.30 <sup>c</sup>	30.13 $\pm$ 0.92 <sup>d</sup>	-	75.83 $\pm$ 16.89 <sup>b</sup>
A3	2-methyl-1-Propanol	1331.47 $\pm$ 47.43 <sup>a</sup>	917.79 $\pm$ 32.92 <sup>b</sup>	168.62 $\pm$ 57.38 <sup>c</sup>	918.51 $\pm$ 237.27 <sup>b</sup>
A4	3-methyl-1-Butanol	7460.73 $\pm$ 357.55 <sup>ab</sup>	6995.73 $\pm$ 104.71 <sup>bc</sup>	1888.64 $\pm$ 115.56 <sup>d</sup>	6781.78 $\pm$ 192.81 <sup>c</sup>
A5	1-Pentanol	20.77 $\pm$ 2.23 <sup>a</sup>	-	8.85 $\pm$ 0.26 <sup>b</sup>	-
A6	1-Hexanol	68.73 $\pm$ 2.41 <sup>a</sup>	30.71 $\pm$ 2.31 <sup>b</sup>	33.19 $\pm$ 4.33 <sup>b</sup>	27.60 $\pm$ 5.61 <sup>b</sup>
A7	3-ethoxy-1-Propanol	-	-	-	14.50 $\pm$ 4.9
A8	1-Heptanol	44.29 $\pm$ 11.60 <sup>a</sup>	30.32 $\pm$ 2.72 <sup>bc</sup>	21.20 $\pm$ 4.03 <sup>ab</sup>	27.34 $\pm$ 3.14 <sup>bc</sup>
A9	2,3-Butanediol	1157.83 $\pm$ 88.96 <sup>a</sup>	1044.90 $\pm$ 34.83 <sup>b</sup>	61.53 $\pm$ 12.45 <sup>d</sup>	399.92 $\pm$ 5.80 <sup>c</sup>
A10	Propylene Glycol	60.17 $\pm$ 7.12 <sup>b</sup>	70.49 $\pm$ 9.48 <sup>a</sup>	-	35.30 $\pm$ 3.77 <sup>c</sup>
A11	3-(methylthio)-1-Propanol	19.59 $\pm$ 9.33 <sup>bc</sup>	14.78 $\pm$ 0.72 <sup>cd</sup>	9.67 $\pm$ 1.50 <sup>d</sup>	26.79 $\pm$ 6.42 <sup>a</sup>
A12	Phenylethyl Alcohol	4180.66 $\pm$ 76.88 <sup>a</sup>	4377.31 $\pm$ 238.50 <sup>a</sup>	1647.02 $\pm$ 245.63 <sup>b</sup>	3864.30 $\pm$ 125.72 <sup>a</sup>
	<b>Total alcohols</b>	<b>108582.10</b>	<b>99153.24</b>	<b>24402.87</b>	<b>85722.07</b>
B1	Ethyl Acetate	-	-	2549.51	2701.49 $\pm$ 233.22
B2	1-Butanol, 3-methyl-, acetate	1156.62 $\pm$ 76.45 <sup>a</sup>	1126.24 $\pm$ 38.36 <sup>a</sup>	168.24 $\pm$ 37.12 <sup>c</sup>	845.49 $\pm$ 45.35 <sup>b</sup>
B3	Hexanoic acid, ethyl ester	367.61 $\pm$ 5.50 <sup>a</sup>	295.68 $\pm$ 22.69 <sup>b</sup>	62.23 $\pm$ 17.02 <sup>d</sup>	170.88 $\pm$ 40.42 <sup>c</sup>
B4	Acetic acid, hexyl ester	-	15.48 $\pm$ 0.14	-	-
B5	Heptanoic acid, ethyl ester	31.66 $\pm$ 16.36 <sup>b</sup>	27.18 $\pm$ 6.01 <sup>c</sup>	27.28 $\pm$ 9.43 <sup>c</sup>	35.66 $\pm$ 12.14 <sup>ab</sup>
B6	Octanoic acid, ethyl ester	4304.53 $\pm$ 155.13 <sup>a</sup>	1406.47 $\pm$ 113.10 <sup>b</sup>	365.90 $\pm$ 39.67 <sup>c</sup>	1544.76 $\pm$ 162.09 <sup>b</sup>
B7	Nonanoic acid, ethyl ester	99.83 $\pm$ 7.03 <sup>a</sup>	37.35 $\pm$ 7.05 <sup>cd</sup>	30.01 $\pm$ 7.70 <sup>d</sup>	86.04 $\pm$ 5.43 <sup>b</sup>
B8	Butyrolactone	25.83 $\pm$ 12.71	23.71 $\pm$ 4.22	-	15.84 $\pm$ 1.24
B9	Decanoic acid, ethyl ester	10383.65 $\pm$ 338.57 <sup>a</sup>	579.44 $\pm$ 146.45 <sup>b</sup>	60.87 $\pm$ 2.58 <sup>d</sup>	295.85 $\pm$ 87.52 <sup>c</sup>
B10	Benzoic acid, ethyl ester	-	-	60.20 $\pm$ 18.12 <sup>b</sup>	121.91 $\pm$ 26.49 <sup>a</sup>

Table S5.Cont

No.	Metabolite name	SC( $\mu\text{g/L}$ )	DOSC( $\mu\text{g/L}$ )	WA( $\mu\text{g/L}$ )	DOWA( $\mu\text{g/L}$ )
B11	Acetic acid, 2-phenylethyl ester	555.25 $\pm$ 121.17 <sup>a</sup>	424.94 $\pm$ 26.75 <sup>b</sup>	40.70 $\pm$ 2.05 <sup>c</sup>	112.59 $\pm$ 16.46 <sup>c</sup>
B12	Dodecanoic acid, ethyl ester	2911.55 $\pm$ 181.96 <sup>a</sup>	106.08 $\pm$ 14.68 <sup>c</sup>	51.35 $\pm$ 2.65 <sup>c</sup>	1102.30 $\pm$ 25.37 <sup>b</sup>
B13	Pentadecanoic acid, 3-methylbutyl ester	90.75 $\pm$ 24.36 <sup>a</sup>	-	19.82 $\pm$ 3.50 <sup>b</sup>	27.38 $\pm$ 2.13 <sup>b</sup>
B14	Benzenepropanoic acid, ethyl ester	17.97 $\pm$ 2.70 <sup>a</sup>	10.97 $\pm$ 1.96 <sup>c</sup>	10.55 $\pm$ 3.61 <sup>c</sup>	15.97 $\pm$ 4.11 <sup>ab</sup>
B15	Eicosanoic acid, ethyl ester	94.26 $\pm$ 12.65 <sup>a</sup>	-	25.74 $\pm$ 8.97 <sup>b</sup>	109.52 $\pm$ 11.89 <sup>a</sup>
B16	Tetradecanoic acid, ethyl ester	757.64 $\pm$ 172.86 <sup>b</sup>	76.34 $\pm$ 5.22 <sup>d</sup>	297.66 $\pm$ 12.79 <sup>c</sup>	1097.51 $\pm$ 153.61 <sup>a</sup>
B17	Pentadecanoic acid, ethyl ester	211.12 $\pm$ 31.39 <sup>a</sup>	-	26.18 $\pm$ 7.36 <sup>c</sup>	158.10 $\pm$ 7.57 <sup>b</sup>
B18	Hexadecanoic acid, ethyl ester	1040.42 $\pm$ 246.41 <sup>b</sup>	435.59 $\pm$ 31.89 <sup>c</sup>	554.37 $\pm$ 160.91 <sup>c</sup>	1594.31 $\pm$ 103.06 <sup>a</sup>
B19	Ethyl Oleate	-	-	173.29 $\pm$ 13.76 <sup>b</sup>	379.15 $\pm$ 26.90 <sup>a</sup>
B20	Linoleic acid ethyl ester	-	-	152.32 $\pm$ 7.44 <sup>b</sup>	554.20 $\pm$ 124.52 <sup>a</sup>
	<b>Total esters</b>	<b>21948.69</b>	<b>4565.47</b>	<b>4676.22</b>	<b>10968.95</b>
C1	Acetic acid	839.41 $\pm$ 23.38 <sup>a</sup>	635.09 $\pm$ 120.29 <sup>c</sup>	222.32 $\pm$ 21.05 <sup>d</sup>	732.25 $\pm$ 73.50 <sup>bc</sup>
C2	2-methyl-Propanoic acid	55.84 $\pm$ 3.45 <sup>a</sup>	-	-	28.47 $\pm$ 0.07 <sup>b</sup>
C3	3-methyl-Butanoic acid	-	-	9.90 $\pm$ 1.97 <sup>b</sup>	30.96 $\pm$ 6.59 <sup>a</sup>
C4	2-Amino-6-methyl benzoic acid	121.83 $\pm$ 15.98 <sup>a</sup>	57.34 $\pm$ 11.38 <sup>b</sup>	27.49 $\pm$ 3.68 <sup>d</sup>	43.73 $\pm$ 8.27 <sup>c</sup>
C5	Neodecanoic acid	106.64 $\pm$ 6.27 <sup>b</sup>	139.59 $\pm$ 23.58 <sup>a</sup>	-	79.01 $\pm$ 8.47 <sup>c</sup>
C6	Hexanoic acid	-	20.73 $\pm$ 2.26 <sup>a</sup>	2.33 $\pm$ 0.33 <sup>c</sup>	10.82 $\pm$ 0.22 <sup>b</sup>
C7	Octanoic acid	74.81 $\pm$ 14.87 <sup>a</sup>	49.16 $\pm$ 2.31 <sup>b</sup>	7.45 $\pm$ 2.23 <sup>d</sup>	27.05 $\pm$ 0.41 <sup>c</sup>
	<b>Total acids</b>	<b>1198.53</b>	<b>901.91</b>	<b>269.49</b>	<b>952.29</b>
D1	2-Octanone	46.54 $\pm$ 5.65 <sup>b</sup>	47.10 $\pm$ 0.09 <sup>ab</sup>	43.74 $\pm$ 1.59 <sup>b</sup>	53.78 $\pm$ 6.11 <sup>a</sup>
D2	Acetoin	118.34 $\pm$ 10.62 <sup>b</sup>	174.84 $\pm$ 45.40 <sup>ab</sup>	16.06 $\pm$ 2.22 <sup>c</sup>	32.70 $\pm$ 2.07 <sup>c</sup>
D3	2,5-Hexanedione	9.87 $\pm$ 1.11 <sup>a</sup>	-	5.17 $\pm$ 0.21 <sup>b</sup>	9.10 $\pm$ 1.73 <sup>a</sup>
	<b>Total ketone</b>	<b>174.75</b>	<b>221.94</b>	<b>64.97</b>	<b>95.58</b>

**Table S5.Cont**

No.	Metabolite name	SC( $\mu\text{g/L}$ )	DOSC( $\mu\text{g/L}$ )	WA( $\mu\text{g/L}$ )	DOWA( $\mu\text{g/L}$ )
E1	Propane, 1-(1-ethoxyethoxy)	1645.87 $\pm$ 198.12 <sup>b</sup>	1914.49 $\pm$ 419.08 <sup>a</sup>	-	-
E2	Nonanal	23.56 $\pm$ 2.37 <sup>a</sup>	21.60 $\pm$ 6.90 <sup>ab</sup>	12.33 $\pm$ 2.10 <sup>c</sup>	20.61 $\pm$ 3.09 <sup>b</sup>
E3	Decanal	18.81 $\pm$ 4.06 <sup>c</sup>	26.16 $\pm$ 15.03 <sup>b</sup>	16.34 $\pm$ 4.23 <sup>cd</sup>	30.36 $\pm$ 3.39 <sup>a</sup>
E4	Benzaldehyde	12.29 $\pm$ 1.28 <sup>ab</sup>	14.48 $\pm$ 1.72 <sup>a</sup>	4.68 $\pm$ 1.23 <sup>b</sup>	15.34 $\pm$ 0.09 <sup>a</sup>
	<b>Total Aldehydes</b>	<b>1700.53</b>	<b>1976.73</b>	<b>33.35</b>	<b>66.31</b>
F1	2-Methoxy-4-vinyl phenol	38.06 $\pm$ 0.71 <sup>b</sup>	26.97 $\pm$ 3.43 <sup>c</sup>	125.93 $\pm$ 4.72 <sup>a</sup>	122.27 $\pm$ 11.60 <sup>a</sup>
	<b>Total phenols</b>	<b>38.06</b>	<b>26.97</b>	<b>125.93</b>	<b>122.27</b>
	<b>Totals</b>	<b>133642.66</b>	<b>106846.26</b>	<b>29572.83</b>	<b>97927.47</b>

- indicates no detection, different lowercase letters indicate significant differences among groups ( $p < 0.05$ ).