

Effects of factory recirculating aquaculture on muscle nutrient composition and volatile flavor compounds of *Micropterus salmoides*

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Abstract



In this study, compared with the traditional largemouth bass culture in the pond, the volatile odor substances of largemouth bass muscle in the factory circulating water with different culture periods were analyzed, in order to scientifically evaluate the impact of industrial recirculating aquaculture on the volatile odor substances of largemouth bass muscle, and provide a theoretical basis for the promotion and deep processing of industrial recirculating aquaculture of largemouth bass.

Materials and Methods

Taking the pond cultured largemouth bass (LY1) as a control, the muscle nutrient components and volatile flavor compounds were identified and analyzed on the 10th (LY2), 20th (LY3) and 40th (LY4) days after the traditional pond cultured largemouth bass was put into the factory circulating aquaculture system, and the fingerprints of the volatile flavor compounds of the muscle of four groups largemouth bass were established.

Results

Table 1 Muscle amino acids of *Micropterus salmoides* (g/100g, wet weight)

amino acids	LY1	LY2	LY3	LY4
TAA	19.89±0.03 ^{ab}	19.92±0.05 ^{bc}	19.77±0.06 ^a	20.06±0.05 ^c
EAA	8.30±0.01 ^b	8.28±0.07 ^b	8.13±0.01 ^a	8.35±0.02 ^b
NEAA	9.89±0.03	9.93±0.01	9.93±0.04	9.98±0.03
DAA	9.01±0.01	9.03±0.03	9.04±0.05	9.09±0.01
W _{EAA} /W _{TAA} (%)	41.71±0.09	41.55±0.25	41.12±0.07	41.64±0.01
W _{EAA} /W _{NEAA} (%)	83.87±0.28	83.40±0.69	81.85±0.24	83.66±0.01
W _{DAA} /W _{TAA} (%)	45.28±0.09	45.34±0.04	45.71±0.10	45.32±0.15

Table 3 Muscle fatty acids profiles of *Micropterus salmoides* (%)

fatty acids	LY1	LY2	LY3	LY4
C14:0	1.57±0.01 ^a	2.02±0.02 ^c	1.76±0.01 ^b	2.17±0.02 ^d
C16:0	19.79±0.03 ^b	21.24±0.02 ^d	21.05±0.05 ^c	19.35±0.03 ^b
C18:0	4.45±0.02 ^c	4.36±0.01 ^b	4.88±0.03 ^d	3.81±0.04 ^a
C23:0	1.07±0.01 ^b	1.05±0.01 ^a	1.10±0.01 ^c	1.14±0.01 ^d
ΣSFA	27.64±0.02 ^b	29.48±0.03 ^c	29.57±0.01 ^d	27.21±0.05 ^a
C16:1n-7	4.03±0.01 ^a	4.69±0.02 ^c	4.36±0.01 ^b	5.87±0.01 ^d
C18:1n-9c	24.03±0.02 ^a	26.01±0.01 ^c	25.81±0.03 ^b	28.33±0.02 ^d
ΣMUFA	29.74±0.05 ^a	32.39±0.02 ^c	31.96±0.06 ^b	36.10±0.01 ^d
C18:2n-3	2.12±0.02 ^d	1.88±0.02 ^c	1.72±0.03 ^b	1.44±0.01 ^a
C20:5n-3(EPA)	1.39±0.00 ^a	1.82±0.01 ^c	1.72±0.03 ^b	2.60±0.03 ^d
C22:6n-3(DHA)	13.39±0.01 ^a	12.89±0.01 ^b	12.34±0.01 ^a	15.16±0.01 ^d
Σω3PUFA	17.09±0.02 ^a	16.77±0.04 ^b	15.94±0.02 ^a	19.32±0.03 ^d
C18:2n-6c	24.45±0.02 ^a	20.51±0.03 ^b	21.53±0.03 ^c	16.61±0.02 ^a
Σω6PUFA	25.53±0.02 ^a	21.36±0.01 ^b	22.50±0.01 ^c	17.36±0.01 ^a
ΣPUFA	42.62±0.05 ^d	38.13±0.03 ^b	38.44±0.11 ^c	36.68±0.02 ^a
EPA+DHA	14.78±0.02 ^a	14.71±0.01 ^b	14.06±0.02 ^a	17.76±0.02 ^d
Σω3/Σω6	66.94±0.03 ^a	78.50±0.23 ^c	70.87±0.14 ^b	111.27±0.24 ^d

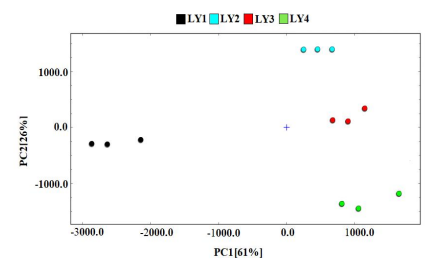


Fig2. Principal component analysis in volatile compounds of *Micropterus salmoides* muscle under different groups.

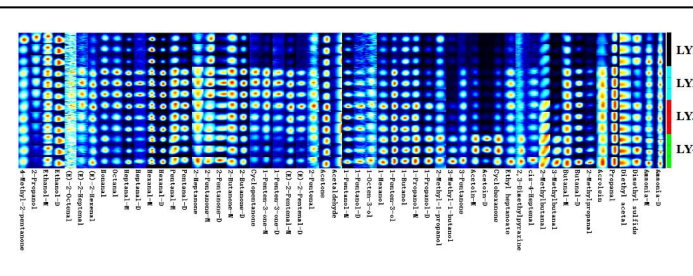


Fig3. Gallery Plot of volatile organic compounds in GC-IMS spectra of *Micropterus salmoides* muscle under different groups.

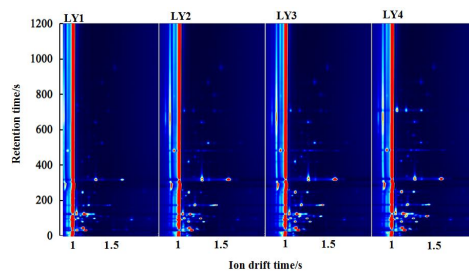


Fig1. GC-IMS spectra of *Micropterus salmoides* muscle under different groups.

Conclusions

Our study showed that: the total amino acid content and EPA + DHA content in muscle of largemouth bass were the highest in LY4 group; The main component analysis (PCA) of volatile flavor compounds in muscle of largemouth bass showed that the contribution rates of two variables were pc1:61% and pc2:26%; Compared with the traditional pond culture group, the factory circulating aquaculture increased the content of 2-heptanone, 2-pentanone, 2-butanone, cyclopentanone, 1-octene-3-ol, 1-hexanol and other substances in the muscle of largemouth bass, which has the potential to improve the volatile flavor compounds of largemouth bass muscle.

Table 2 Muscle evaluation of EAA of *Micropterus salmoides* (mg/g, on N basis)

essential amino acids	FAO evaluation mode	egg protein	LY1		LY2		LY3		LY4	
			AAS	CS	AAS	CS	AAS	CS	AAS	CS
Ile	250	331	**0.94±0.01 ^b	0.71±0.01 ^B	**0.92±0.04 ^a	0.69±0.03 ^{AB}	**0.86±0.00 ^a	0.65±0.00 ^A	**0.95±0.02 ^b	0.72±0.02 ^B
Leu	440	534	1.00±0.01 ^b	0.82±0.01 ^B	0.99±0.00 ^b	0.81±0.00 ^B	0.95±0.00 ^a	0.78±0.00 ^A	1.00±0.01 ^b	0.82±0.01 ^B
Lys	340	441	1.54±0.00 ^{ab}	1.19±0.00 ^{AB}	1.55±0.01 ^b	1.19±0.01 ^B	1.51±0.01 ^a	1.17±0.01 ^A	1.55±0.02 ^b	1.20±0.01 ^B
Met+CyS	220	386	1.05±0.01 ^b	*0.60±0.01 ^B	1.06±0.00 ^b	*0.60±0.00 ^B	0.99±0.00 ^a	*0.57±0.00 ^A	1.04±0.01 ^b	*0.59±0.01 ^B
Phe+Tyr	380	565	1.10±0.01 ^b	0.74±0.01 ^B	1.10±0.01 ^b	0.74±0.01 ^B	1.06±0.01 ^a	0.71±0.00 ^A	1.09±0.00 ^b	0.74±0.00 ^B
Thr	250	292	1.00±0.01 ^b	0.86±0.01 ^B	0.99±0.01 ^b	0.85±0.01 ^B	0.93±0.01 ^a	0.79±0.01 ^A	0.99±0.01 ^b	0.85±0.01 ^B
Val	310	410	*0.86±0.00 ^b	**0.65±0.00 ^B	*0.85±0.01 ^b	**0.64±0.01 ^B	*0.80±0.01 ^a	**0.60±0.00 ^A	*0.86±0.01 ^b	**0.65±0.01 ^B
essential amino acid index			77.55±0.17 ^b		77.20±0.53 ^b		73.24±0.17 ^a		77.66±0.33 ^b	