

表 1 文献已报道的鲜味肽信息

肽类型与数量	肽序列	来源	滋味描述
二肽 (42)	Ala-Asp	合成肽 <sup>[1]</sup>	鲜味
	Ala-Glu	合成肽 <sup>[1]</sup>	鲜味
	Arg-Leu	合成肽 <sup>[2]</sup>	强鲜
	Asn-Tyr	热加工酵母提取物 <sup>[3]</sup>	鲜味
	Asp-Ala	酱油 <sup>[4]</sup>	鲜味
	Asp-Leu	合成肽 <sup>[1]</sup>	鲜味
	Asp-Asp	牛肉汤 <sup>[5]</sup>	鲜味
	Asp-Glu	牛肉汤 <sup>[5]</sup>	鲜味
	Cys-Glu	牛骨髓 <sup>[6]</sup>	鲜味, 酸味
	Glu-Ala	热加工酵母提取物 <sup>[3]</sup>	鲜味
	Glu-Asn	热加工酵母提取物 <sup>[3]</sup>	鲜味
	Glu-Asp	蛋白酶改性大豆蛋白 <sup>[7]</sup> , 鱼蛋白水解物 <sup>[8]</sup>	肉汤味、类似 MSG 味
	Glu-Glu	牛肉汤 <sup>[5]</sup> 和改性大豆蛋白 <sup>[7]</sup> , 鱼蛋白水解物 <sup>[8]</sup> , 鸡肉酶解液 <sup>[9]</sup>	肉汤味、鲜味
	Glu-Gly	鱼蛋白 <sup>[10]</sup>	鲜味
	Glu-Leu	合成肽 <sup>[1]</sup>	鲜味
	Glu-Lys	牛肉汤 <sup>[5]</sup>	鲜味
	Glu-Orn	合成肽 <sup>[11]</sup>	鲜味、酸味
	pGlu-Pro	小麦蛋白 <sup>[12]</sup>	类似 MSG 味
	Glu-Pro	花生酶解液 <sup>[13]</sup>	鲜味、涩味
	Glu-Ser	蛋白酶改性大豆蛋白 <sup>[7]</sup> 鱼蛋白水解物 <sup>[8]</sup> 热加工酵母提取物 <sup>[3]</sup>	肉汤味、类似 MSG 味
	Glu-Thr	蛋白酶改性大豆蛋白 <sup>[7]</sup>	鲜味
	Glu-Tyr	金华火腿和巴马火腿 <sup>[14]</sup>	鲜味
	Glu-Val	鸡肉酶解液 <sup>[9]</sup>	鲜味、甜味
	Gly-Asp	合成肽 <sup>[1]</sup>	鲜味
	Gly-Glu	合成肽 <sup>[1]</sup> 西班牙火腿 <sup>[15]</sup> 香菇水解物 <sup>[16]</sup> 酵母抽提物 <sup>[17]</sup>	鲜味
	Gln-Leu	热加工酵母提取物 <sup>[3]</sup>	鲜味
	Gln-Pro	小麦蛋白 <sup>[12]</sup>	鲜味
	Leu-Glu	合成肽 <sup>[1]</sup>	鲜味
	Leu-Val	热加工酵母提取物 <sup>[3]</sup>	鲜味
	Lys-Gly	牛肉汤 <sup>[5]</sup> 热加工酵母提取物 <sup>[3]</sup>	鲜味
	Lys-Gly*HCl	合成肽 <sup>[1]</sup>	鲜味、咸味
	Orn-Orn*2HCl	合成肽 <sup>[1]</sup>	鲜味
	Orn-Ala*HCl	合成肽 <sup>[1]</sup>	鲜味、咸味
	Pro-Glu	金华火腿和巴马火腿 <sup>[14]</sup>	鲜味

	Thr-Glu	鱼蛋白水解物 <sup>[8]</sup> 鸡汤 <sup>[18]</sup>	类似 MSG 味
	His-Ser	鸡肉酶解液 <sup>[18]</sup>	鲜味
	His-Val	酵母抽提物 <sup>[17]</sup> 热加工酵母提取物 <sup>[3]</sup>	鲜味
	Val-Asp	合成肽 <sup>[1]</sup>	鲜味
	Val-Glu	合成肽 <sup>[1]</sup>	鲜味
	Val-Gly	合成肽 <sup>[19]</sup>	鲜味
	Val-Val	合成肽 <sup>[19]</sup> 热加工酵母提取物 <sup>[3]</sup>	鲜味
	Val-Thr	鸡汤 <sup>[18]</sup>	鲜味
三肽 (46)	Ala-Glu-Ala	合成肽 <sup>[1]</sup>	鲜味
	Ala-Asp-Ala	合成肽 <sup>[1]</sup>	鲜味
	Ala-Pro-Ala	酵母抽提物 <sup>[17]</sup>	鲜味
	Asn-Asn-Pro	花生酶解液 <sup>[20]</sup>	鲜味、微甜
	Asp-Ala-Gly	鸡肉酶解液 <sup>[18]</sup>	鲜味
	Asp-Asp-Asp	合成肽 <sup>[21]</sup>	鲜味
	Asp-Asp-Glu	合成肽 <sup>[21]</sup>	鲜味
	Asp-Gln-Arg	花生酶解液 <sup>[20]</sup>	鲜味、酸味
	Asp-Glu-Asp	合成肽 <sup>[21]</sup>	鲜味
	Asp-Glu-Glu	合成肽 <sup>[21]</sup>	鲜味
	Asp-Glu-Leu	金华火腿和巴马火腿 <sup>[14]</sup>	鲜味
	Asp-Gly-Gly	金华火腿和巴马火腿 <sup>[14]</sup>	鲜味
	Asp-Cys-Gly	小麦面筋蛋白 <sup>[22]</sup>	鲜味
	Asp-Glu-Ser	鱼蛋白水解物 <sup>[8]</sup>	类似 MSG 味
	Glu-Asp-Asp	合成肽 <sup>[21]</sup>	鲜味
	Glu-Asp-Glu	鱼蛋白水解物 <sup>[8]</sup>	类似 MSG 味
	Glu-Asp-Phe	金华火腿和巴马火腿 <sup>[14]</sup>	鲜味
	Glu-Asp-Val	金华火腿和巴马火腿 <sup>[14]</sup>	鲜味
	Glu-Asp-Gly	花生酶解液 <sup>[20]</sup>	鲜味、酸味
	Glu-Gln-Glu	鱼蛋白水解物 <sup>[8]</sup>	类似 MSG 味
	Glu-Glu-Glu	黄酒 <sup>[23]</sup>	鲜味
	Glu-Glu-Asp	合成肽 <sup>[21]</sup>	鲜味
	Glu-Glu-Leu	合成肽 <sup>[24]</sup>	鲜味
	Glu-Gly-Phe	花生酶解液 <sup>[20]</sup>	鲜味、浓厚感
	Glu-Gly-Ser	蛋白酶改性大豆蛋白 <sup>[7]</sup> 鱼蛋白水解物 <sup>[8]</sup>	肉汤味；类似 MSG 味
	pGlu-Pro-Gln	小麦蛋白 <sup>[12]</sup>	类似 MSG 味
	pGln-Pro-Glu	小麦蛋白 <sup>[12]</sup>	类似 MSG 味
	pGln-Pro-Ser	小麦蛋白 <sup>[12]</sup>	类似 MSG 味
	Gly-Asp-Gly	合成肽 <sup>[1]</sup>	鲜味
	Gly-Glu-Gly	合成肽 <sup>[1]</sup>	鲜味
	Gly-Gly-Tyr	热加工酵母提取物 <sup>[3]</sup>	鲜味
	Gly-Phe-Pro	蚕蛹水解物 <sup>[25]</sup>	鲜味 (增鲜效应)
	Leu-Asp-Leu	合成肽 <sup>[1]</sup>	鲜味

	Leu-Glu-Glu	合成肽 <sup>[26]</sup>	鲜味
	Leu-Val-Gly	热加工酵母提取物 <sup>[3]</sup>	鲜味
	Pro-Ala-Ala	热加工酵母提取物 <sup>[3]</sup>	鲜味
	Pro-Ala-Gln	金华火腿和巴马火腿 <sup>[14]</sup>	鲜味
	Pro-Glu-Thr	酵母抽提物 <sup>[17]</sup> 热加工酵母提取物 <sup>[3]</sup>	鲜味
	Ser-Glu-Glu	鱼蛋白水解物 <sup>[8]</sup>	类似 MSG 味
	Thr-Ala-Tyr	蚕蛹水解物 <sup>[25]</sup>	鲜味 (增鲜效应)
	Thr-Pro-Glu	花生酶解液 <sup>[13]</sup>	微鲜
	Val-Ala-Val	热加工酵母提取物 <sup>[3]</sup>	鲜味
	Val-Asp-Val	合成肽 <sup>[1]</sup>	鲜味
	Val-Glu-Val	合成肽 <sup>[1]</sup>	鲜味
	Val-Gly-Gly	合成肽 <sup>[19]</sup>	鲜味
	Val-Pro-Tyr	蚕蛹水解物 <sup>[25]</sup>	鲜味 (增鲜效应)
四肽 (12)	Ala-Ala-Pro-Tyr	蚕蛹水解物 <sup>[25]</sup>	鲜味 (增鲜效应)
	Asp-Asp-Asp-Asp	啤酒酵母提取物 <sup>[27]</sup>	美味
	Leu-Tyr-Glu-Arg	暗纹东方鲀肌肉酶解液 <sup>[28]</sup>	微甜, 微鲜, 浓厚感
	Val-Arg-Ser-Tyr	暗纹东方鲀肌肉酶解液 <sup>[28]</sup>	微甜, 微鲜, 浓厚感
	Glu-Ser-Leu-Ala	合成肽 <sup>[29]</sup>	鲜味、其他滋味
	Gly-Gly-Gly-Glu	酱油 <sup>[30]</sup>	鲜味
	Gly-Gly-Pro-Gly	热酵母提取 <sup>[31]</sup>	鲜味
	Ile-Asn-Glu-Leu	Manchego 奶酪 <sup>[32]</sup>	鲜味
	Leu-Glu-Gln-Leu	Manchego 奶酪 <sup>[32]</sup>	鲜味
	Gln-Glu-Glu-Lys	Manchego 奶酪 <sup>[32]</sup>	鲜味
	Asn-Arg-Thr-Phe	合成肽 <sup>[33]</sup>	鲜味
	Val-Glu-Ala-Leu	酱油 <sup>[30]</sup>	鲜味
五肽 (12)	Ala-Phe-Asp-Glu-Lys	豆豉 <sup>[34]</sup>	增鲜风味
	Glu-Glu-Asp-Gly-Lys	合成肽 <sup>[21]</sup>	鲜味
	Glu-Ala-Gly-Ile-Gln	酱油 <sup>[35]</sup>	鲜味
	Glu-Gln-Gln-Gln-Gln	酱油 <sup>[35]</sup>	鲜味、咸味
	Leu-Pro-Glu-Glu-Val	酱油 <sup>[35]</sup>	鲜味、甜味
	Cys-Ala-Leu-Thr-Pro	暗纹东方鲀(100°C) <sup>[36]</sup>	鲜味、浓厚感
	Glu-Glu-Ser-Leu-Ala	合成肽 <sup>[29]</sup>	鲜味、其他滋味
	Glu-Gln-Glu-Glu-Lys	Manchego 奶酪 <sup>[32]</sup>	鲜味

	Val-Val-Gly-Glu-Thr	Manchego 奶酪 <sup>[32]</sup>	鲜味
	Ser-Ala-Glu-Gln-Thr	Manchego 奶酪 <sup>[32]</sup>	鲜味
	Asn-Gly-Lys-Glu-Thr	帕尔马火腿水解物 <sup>[37]</sup>	鲜味
	His-Cys-His-Thr-Asn	合成肽 <sup>[33]</sup>	鲜味
六肽 (17)	Ala-Leu-Pro-Glu-Glu-Val	酱油 <sup>[35]</sup>	鲜味
	Arg-Pro-Leu-Gly-Asn-Cys	暗纹东方鲀(100°C) <sup>[36]</sup>	鲜味、浓厚感
	Cys-Cys-Asn-Lys-Ser-Val	金华火腿 <sup>[38]</sup>	类似火腿水提物 鲜味
	Glu-His-Ala-Met-Leu-Asn	红鳍东方鲀(4°C) <sup>[39]</sup>	鲜味、浓厚感
	Glu-Phe-Lys-Glu-Tyr-Asn	红鳍东方鲀(4°C) <sup>[39]</sup>	鲜味、浓厚感
	Leu-Ser-Glu-Arg-Tyr-Pro	巴马火腿酶解液 <sup>[40]</sup>	类似巴马火腿酶解液的鲜味
	Lys-Gly-Arg-Tyr-Glu-Arg	暗纹东方鲀肌肉酶解液 <sup>[28]</sup>	微甜、微鲜、浓厚感
	Thr-Leu-Arg-Arg-Cys-Met*	暗纹东方鲀(4 °C) <sup>[41]</sup>	鲜味、浓厚感
	Thr-Glu-Ser-Ser-Ser-Glu	花生酶解液 <sup>[20]</sup>	鲜味、浓厚感
	Asp-Phe-Lys-Arg-Glu-Pro	白腐乳 <sup>[42]</sup>	鲜味
	Lys-Ala-Pro-Ser-Thr-Met	炒牛肉 <sup>[43]</sup>	鲜味
	Asp-Glu-Glu-Ser-Leu-Ala	合成肽 <sup>[29]</sup>	鲜味、其他滋味
	Glu-Asn-Ile-Asn-Glu-Leu	Manchego 奶酪 <sup>[32]</sup>	鲜味
	Asn-Val-Val-Gly-Glu-Thr	Manchego 奶酪 <sup>[32]</sup>	鲜味
	Gly-Pro-Asp-Pro-Glu-Arg	大西洋鳕鱼 <sup>[44]</sup>	鲜味
	Ile-Asn-Lys-Pro-Gly-Leu	大西洋鳕鱼 <sup>[44]</sup>	鲜味
	Ser-Asp-Ser-Cys-Ile-Arg	大西洋鳕鱼 <sup>[44]</sup>	鲜味
七肽 (7)	Ala-His-Ser-Val-Arg-Phe-Tyr	巴马火腿 <sup>[38]</sup>	类似火腿水提物 鲜味

	Ala-Ser-Asn-Met-Ser-Asp-Leu	草菇 <sup>[45]</sup>	鲜味、增鲜
	Asp-Arg-Glu-Lys-Phe-Asp-Glu	白腐乳 <sup>[46]</sup>	微鲜
	Leu-Gln-Pro-Leu-Asn-Ala-His	草菇 <sup>[45]</sup>	鲜味、增鲜
	Pro-Gly-Gly-Val-Arg-Asn-Gly	红鳍东方鲀(4°C) <sup>[39]</sup>	微鲜、浓厚感、微酸
	Pro-Val-Ala-Arg-Met*-Cys-Arg	暗纹东方鲀(4°C) <sup>[41]</sup>	鲜味、浓厚感
	His-Leu-Gln-Leu-Ala-Ile-Arg	红鳍东方鲀 (100°C)	苦味、微鲜、浓厚感
八肽 (18)	Asp-Glu-Asp-Phe-Lys-Arg-Glu-Pro	白腐乳 <sup>[42]</sup>	兼具鲜味与酸味
	Ala-Gln-Ala-Leu-Gln-Ala-Gln-Ala	酱油 <sup>[35]</sup>	鲜味、甜味
	Lys-Gly-Asp-Glu-Glu-Ser-Leu-Ala	牛肉汤 <sup>[47]</sup>	美味
	Lys-Gly-Ser-Leu-Ala-Asp-Glu-Glu	合成肽 <sup>[21]</sup>	鲜味
	Ser-Leu-Ala-Asp-Glu-Glu-Lys-Gly	合成肽 <sup>[21]</sup>	鲜味
	Ser-Leu-Ala-Lys-Gly-Asp-Glu-Glu	合成肽 <sup>[21]</sup>	鲜味
	Ser-Ser-Arg-Asn-Glu-Gln-Ser-Arg	花生酶解液 <sup>[48]</sup>	鲜味
	Tyr-Gly-Gly-Thr-Pro-Pro-Phe-Val	暗纹东方鲀(100°C) <sup>[49]</sup>	鲜味、甜味
	Val-Ala-Pro-Glu-Glu-His-Pro-Thr	炒牛肉 <sup>[43]</sup>	鲜味
	Phe-Ala-Gly-Asp-Asp-Ala-Pro-Arg	炒牛肉 <sup>[43]</sup>	鲜味
	Pro-Glu-Cys-Gly-Leu-Val-Val-Gly	炒牛肉 <sup>[43]</sup>	鲜味
	Phe-Ala-Asp-Asn-Val-Phe-Ala-Leu	炒牛肉 <sup>[43]</sup>	鲜味
	Arg-Pro-Asn-Pro-Phe-Glu-Asn-Arg	文蛤 <sup>[50]</sup>	鲜味
	Asp-Pro-Leu-Arg-Gly-Gly-Tyr-Tyr	红鳍东方鲀 (100°C) <sup>[51]</sup>	微鲜、浓厚感
	Ala-Gly-Leu-Gln-Phe-Pro-Val-Gly-Arg	红鳍东方鲀 (100°C) <sup>[51]</sup>	苦味、微鲜、浓厚感
	Asp-Pro-Leu-Arg-	菊黄东方鲀 <sup>[52]</sup>	鲜味、浓厚感

	Gly-Gly-Tyr-Tyr Glu-Ser-Asp-Val- Val-Ser-Asp-Leu	糙米水解物 <sup>[53]</sup>	鲜味
	Gly-Ser-Gly-Val- Gly-Gly-Ala-Lys	糙米水解物 <sup>[53]</sup>	鲜味
九肽 (7)	Glu-Phe-Glu-Gly- Gly-Ser-Ile-Glu- His	葵花籽蛋白酶解液 <sup>[54]</sup>	鲜味
	Gly-Leu-Leu-Pro- Asp-Gly-Thr-Pro- Arg	文蛤 <sup>[50]</sup>	鲜味
	Ser-Thr-Met-Leu- Leu-Glu-Ser-Glu- Arg	文蛤 <sup>[50]</sup>	鲜味
	Tyr-Lys-Cys-Lys- Asp-Gly-Asp-Leu- Arg	暗纹东方鲀肌肉酶解液 <sup>[28]</sup>	浓厚感、鱼鲜香
	Leu-Leu-Leu-Pro- Gly-Glu-Leu-Ala- Lys	红鳍东方鲀 (100℃) <sup>[51]</sup>	鲜味、甜味
	Lue-Leu-Leu-Pro- Gly-Glu-Leu-Ala- Phe	菊黄东方鲀 (100℃) <sup>[52]</sup>	鲜味、甜味
	Ser-Ser-Val-Gly- Gly-Gly-Ser-Ala- Gly	糙米水解物 <sup>[53]</sup>	鲜味
十肽 (8)	Asp-Val-Asn-Asn- Pro-Ala-Asn-Gln- Leu-Asp	葵花籽蛋白酶解液 <sup>[54]</sup>	鲜味
	Ala-Asn-Pro-Gly- Pro-Val-Arg-Asp- Leu-Arg	文蛤 <sup>[50]</sup>	鲜味
	Gln-Val-Ala-Ile- Ala-His-Arg-Asp- Ala-Lys	文蛤 <sup>[50]</sup>	鲜味
	Ala-Gly-Phe-Ala- Gly-Asp-Asp-Ala- Pro-Arg	红鳍东方鲀 (100℃) <sup>[51]</sup>	鲜味、甜味、浓厚感
	Gly-Tyr-Ser-Phe- Thr-Thr-Thr-Ala- Glu-Arg	红鳍东方鲀 (100℃) <sup>[51]</sup>	鲜味、甜味
	Ala-Gly-Phe-Ala- Gly-Asp-Asp-Ala- Pro-Arg	菊黄东方鲀 (100℃) <sup>[52]</sup>	鲜味、甜味

	Ala-Asn-Pro-Gly- Pro-Val-Arg-Asp- Leu-Arg Gly-Phe-Ser-Phe- Thr-Thr-Thr-Ala- Glu-Arg	菊黄东方鲀 (100℃) [52]	鲜味、甜味
		菊黄东方鲀 (100℃) [52]	鲜味、甜味
十一肽 (4)	Asn-Asn-Glu-Asn- Gln-Leu-Asp-Glu- Tyr-Gln-Arg Glu-Gly-Ser-Glu- Ala-Pro-Asp-Gly- Ser-Ser-Arg Val-Leu-Pro-Thr- Asp-Gln-Asn-Phe- Ile-Leu-Arg Ala-Gly-Gly-Gly- Gly-Gly-Gly-Val- Val-Ala-Gly	葵花籽蛋白酶解液 <sup>[54]</sup> 花生酶解液 <sup>[48]</sup> 文蛤 <sup>[50]</sup> 糙米水解物 <sup>[53]</sup>	鲜味 鲜味 鲜味 鲜味
十二肽 (2)	Val-Thr-Ala-Asp- Glu-Ser-Gln-Gln- Asp-Val-Leu-Phe Asp-Ala-Gly-Val- Ile-Ala-Gly-Leu- Asn-Val-Leu-Arg	文蛤 <sup>[50]</sup> 红鳍东方鲀 (100℃) [51]	鲜味 鲜味、甜味、浓厚感
十四肽 (2)	Arg-Gly-Glu-Asn- Glu-Ser-Glu-Glu- Glu-Gly-Ala-Ile- Val-Thr Arg-Gly-Glu-Asn- Glu-Ser-Asp-Glu- Phe-Gly-Ala-Ile- Val-Thr	花生酶解液 <sup>[20]</sup> 花生酶解液的美拉德反应产物 <sup>[13]</sup>	鲜味、浓厚感 鲜味、涩味
十五肽 (1)	Gly-Glu-Asn-Glu- Glu-Glu-Asp-Ser- Gly-Ala-Ile-Val- Thr-Val-Phe	豆豉 <sup>[55]</sup>	鲜味

#### 参考文献

- [1] Ohyama S, Ishibashi N, Tamura M, et al. Synthesis of bitter peptides composed of aspartic acid and glutamic acid[J]. Agricultural and biological chemistry, 1988, 52(3): 871-872.
- [2] Dang Y, Hao L, Zhou T, et al. Establishment of new assessment method for the synergistic effect between umami peptides and monosodium glutamate using electronic tongue[J]. Food Research International, 2019, 121: 20-27.
- [3] Alim A, Yang C, Song H, et al. The behavior of umami components in thermally treated yeast

- extract[J]. *Food Research International*, 2019, 120: 534-543.
- [4] Oka S N K. Isolation and characterization of acidic peptides in soy sauce[J]. *Agricul Biol Chem*, 1974, 38(6):1195-202.
- [5] Tamura M N T, Tada M, Et Al. The relationship between taste and primary structure of "delicious peptide"(Lys-Gly-Asp-Glu-Glu-Ser-Leu-Ala) from beef soup[J]. *Agricultural and biological chemistry*, 1989, 53(2): 319-325.
- [6] Xu X, You M, Song H, et al. Investigation of umami and kokumi taste-active components in bovine bone marrow extract produced during enzymatic hydrolysis and Maillard reaction[J]. *International Journal of Food Science & Technology*, 2018, 53(11): 2465-2481.
- [7] Arai S, Yamashita M, Fujimaki M. Glutamyl oligopeptides as factors responsible for tastes of a proteinase-modified soybean protein[J]. *Agricultural and Biological Chemistry*, 1972, 36(7): 1253-1256.
- [8] Noguchi M, Arai S, Yamashita M, et al. Isolation and identification of acidic oligopeptides occurring in a flavor potentiating fraction from a fish protein hydrolysate[J]. *Journal of agricultural and food chemistry*, 1975, 23(1): 49-53.
- [9] Maehashi K, Matsuzaki M, Yamamoto Y, et al. Isolation of peptides from an enzymatic hydrolysate of food proteins and characterization of their taste properties[J]. *Bioscience Biotechnology and Biochemistry*, 1999, 63(3): 555-559.
- [10] Noguchi M, Arai S, Yamashita M, et al. Isolation and identification of acidic oligopeptides occurring in a flavor potentiating fraction from a fish protein hydrolysate[J]. *Journal of Agricultural and Food Chemistry* 23, (1): 49 53,1975.
- [11] Tamura M N T, Tada M, Et Al. The relationship between taste and primary structure of "delicious peptide"(Lys-Gly-Asp-Glu-Glu-Ser-Leu-Ala) from beef soup [J]. [J]. *Agricultural and Biological Chemistry*,, 1989, 53(2): 319-325.
- [12] Schlichtherle-Cerny H, Amadò R. Analysis of taste-active compounds in an enzymatic hydrolysate of deamidated wheat gluten[J]. *Journal of agricultural and food chemistry*, 2002, 50(6): 1515-1522.
- [13] Zhang J, Sun-Waterhouse D, Feng Y, et al. The umami intensity enhancement of peanut protein isolate hydrolysate and its derived factions and peptides by Maillard reaction and the analysis of peptide (EP) Maillard products[J]. *Food Research International*, 2019, 120: 895-903.
- [14] Dang Y L, Gao X C, Ma F M, et al. Comparison of umami taste peptides in water-soluble extractions of Jinhua and Parma hams[J]. *Lwt-Food Science and Technology*, 2015, 60(2): 1179-1186.
- [15] Sentandreu M A, Stoeva S, Aristoy M C, et al. Identification of Small Peptides Generated in Spanish Dry-cured Ham[J]. *Journal of Food Science*, 2003, 68(1): 64-69.
- [16] Kong Y, Zhang L-L, Zhao J, et al. Isolation and identification of the umami peptides from shiitake mushroom by consecutive chromatography and LC-Q-TOF-MS[J]. *Food Research International*, 2019, 121: 463-470.
- [17] 阿衣古丽·阿力木, 宋焕禄, 刘野, et al. 酵母抽提物在热反应中鲜味的变化及肽的鉴定[J]. *食品科学*, 2019, 40(03): 9-15.
- [18] Kong Y, Yang X, Ding Q, et al. Comparison of non-volatile umami components in chicken soup and chicken enzymatic hydrolysate[J]. *Food Res Int*, 2017, 102: 559-566.
- [19] Ishibashi N, Ono I, Kato K, et al. Role of the hydrophobic amino acid residue in the bitterness of peptides[J]. *Agricultural and Biological Chemistry* 52, (1): 91 94,1988.
- [20] Zhang J, Zhao M, Su G, et al. Identification and taste characteristics of novel umami and umami-enhancing peptides separated from peanut protein isolate hydrolysate by consecutive chromatography and UPLC-ESI-QTOF-MS/MS[J]. *Food Chemistry*, 2019, 278: 674-682.



- [21] Nakata T, Takahashi M, Nakatani M, et al. Role of basic and acidic fragments in delicious peptides (Lys-Gly-Asp-Glu-Glu-Ser-Leu-Ala) and the taste behavior of sodium and potassium salts in acidic oligopeptides[J]. *Bioscience, Biotechnology, and Biochemistry* 59, (4): 689-693, 1995.
- [22] 崔春, 钱杨鹏, 彭皖皖, et al. 谷朊粉发酵液中鲜味肽的分离、鉴定与呈味分析[J]. *现代食品科技*, 2015(9): 175-179.
- [23] Han F L, Xu Y. Identification of Low Molecular Weight Peptides in Chinese Rice Wine (Huang Jiu) by UPLC-ESI-MS/MS[J]. *Journal of the Institute of Brewing*, 2012, 117(2): 238-250.
- [24] Monastyrskaya K. L K, Plahl D., Acuna G., Schweitzer C., Malherbe P., Mutel V. . Effect of the umami peptides on the ligand binding and function of rat mGlu4a receptor might implicate this receptor in the monosodium glutamate taste transduction.[J]. *Brit. J. Pharmacol.*, 1999, 128: 1027-1034.
- [25] Yu Z, Jiang H, Guo R, et al. Taste, umami-enhance effect and amino acid sequence of peptides separated from silkworm pupa hydrolysate[J]. *Food Research International*, 2018, 108: 144-150.
- [26] Frerot E E S D. Flavored products and a process for their preparation[J]. U.S. Patent 5,780,090[P]. 1998, 1998-7-14.
- [27] Matsushita A, Ozaki S. Purification and sequence determination of tasty tetrapeptide (Asp-Asp-Asp-Asp) from beer yeast and its enzymic synthesis[J]. *Pept. Chem*, 1995, 32: 249-252.
- [28] 苗晓丹. 养殖暗纹东方鲀呈味肽酶法制备及构效关系研究[D]. 上海: 上海海洋大学, 2015.
- [29] Yamasaki Y M K. Synthesis of a peptide with delicious taste.[J]. *Agric Biol Chem (Japan)*, 1980. , 44(1):93-7.
- [30] Zhu X, Sun-Waterhouse D, Chen J, et al. Comparative study on the novel umami-active peptides of the whole soybeans and the defatted soybeans fermented soy sauce[J]. *J Sci Food Agric*, 2020.
- [31] Alim A, Song H, Zou T. Analysis of meaty aroma and umami taste in thermally treated yeast extract by means of sensory-guided screening[J]. *European Food Research and Technology*, 2020, 246(10): 2119-2133.
- [32] Gómez-Ruiz J Á, Taborda G, Amigo L, et al. Sensory and Mass Spectrometric Analysis of the Peptidic Fraction Lower Than One Thousand Daltons in Manchego Cheese[J]. *Journal of Dairy Science*, 2007, 90(11): 4966-4973.
- [33] Dang Y L, Hao L, Zhou T Y, et al. Establishment of new assessment method for the synergistic effect between umami peptides and monosodium glutamate using electronic tongue[J]. *Food Research International*, 2019, 121: 20-27.
- [34] Ding Y L X, Kan J. . Isolation and identification of flavor peptides from douchi (traditional Chinese soybean food)[J]. *International Journal of Food Properties*, 2017, 1-13.
- [35] Zhuang M Z, Lin L Z, Zhao M M, et al. Sequence, taste and umami-enhancing effect of the peptides separated from soy sauce[J]. *Food Chemistry*, 2016, 206: 174-181.
- [36] Yuan L, Lei M, Chun-Yang Q, et al. Isolation, identification, and taste characteristics of flavor peptides from cooked puffer fish (*Takifugu obscurus*)[J]. *Modern Food Science and Technology*.
- [37] 党亚丽, 张中健, 闫小伟, et al. 巴马火腿酶解物中呈味肽的分离纯化及其结构研究[J]. *食品科学*, 2010, 31(13): 127-131.
- [38] Dang Y, Gao X, Ma F, et al. Comparison of umami taste peptides in water-soluble extractions of Jinhua and Parma hams[J]. *Lwt-Food Science and Technology*, 2015, 60(2): 1179-1186.
- [39] 马垒. 养殖红鳍东方鲀水溶性风味构成研究[D]. 上海: 上海海洋大学, 2016.
- [40] 党亚丽, 张中健, 闫小伟, et al. 巴马火腿酶解物中呈味肽的分离纯化及其结构研究[J]. *食品科学*, 2010(13): 127-131.
- [41] 仇春泱. 养殖暗纹东方鲀呈味肽分离鉴定及其呈味特性研究[D]. 上海: 上海海洋大学, 2014.

- [42] 胡雪潇. 腐乳与虾酱中呈味肽的分离与鉴定[D]. 暨南大学, 2016.
- [43] Huang Y, Duan W, Wang L, et al. Orthogonal optimization of beef stir-fried process followed by isolation and identification of the umami peptides by consecutive chromatography and LC-Q-TOF/MS[J]. *International Journal of Food Properties*, 2019, 22(1): 1773-1785.
- [44] Zhu W, He W, Wang F, et al. Prediction, molecular docking and identification of novel umami hexapeptides derived from Atlantic cod (*Gadus morhua*)[J]. *International Journal of Food Science & Technology*, 2020.
- [45] Xu X, Xu R, Song Z, et al. Identification of umami-tasting peptides from *Volvariella volvacea* using ultra performance liquid chromatography quadrupole time-of-flight mass spectrometry and sensory-guided separation techniques[J]. *Journal of Chromatography A*, 2019.
- [46] Liao Shun H X, Jin Erqing, Peng Cong, Wu Jianzhong. Isolation and Identification of Flavor Peptides from White Sufu (Fermented Tofu)[J]. *FOOD SCIENCE*, 2017, 38(9): 113-118.
- [47] Yamasaki Y, Maekawa K. A peptide with delicious taste[J]. *Agricultural and biological chemistry*, 1978, 42(9): 1761-1765.
- [48] Su G W, Cui C, Zheng L, et al. Isolation and identification of two novel umami and umami-enhancing peptides from peanut hydrolysate by consecutive chromatography and MALDI-TOF/TOF MS[J]. *Food Chemistry*, 2012, 135(2): 479-485.
- [49] Zhang M-X, Wang X-C, Liu Y, et al. Isolation and identification of flavour peptides from Puffer fish (*Takifugu obscurus*) muscle using an electronic tongue and MALDI-TOF/TOF MS/MS[J]. *Food Chemistry*, 2012, 135(3): 1463-1470.
- [50] Li X, Xie X, Wang J, et al. Identification, taste characteristics and molecular docking study of novel umami peptides derived from the aqueous extract of the clam *meretrix meretrix* Linnaeus[J]. *Food Chem*, 2019, 312: 126053.
- [51] Liu Z, Zhu Y, Wang W, et al. Seven novel umami peptides from *Takifugu rubripes* and their taste characteristics[J]. *Food Chemistry*, 2020.
- [52] Liu Z, Zhu Y, Wang W, et al. Seven novel umami peptides from *Takifugu rubripes* and their taste characteristics[J]. *Food Chemistry*, 2020, 330(20): 31066-9.
- [53] Selamassakul O, Laohakunjit N, Kerdchoechuen O, et al. Bioactive peptides from brown rice protein hydrolyzed by bromelain: Relationship between biofunctional activities and flavor characteristics[J]. *J Food Sci*, 2020, 85(3): 707-717.
- [54] 付娅男. 呈鲜味的葵花籽蛋白酶解肽的制备及其结构表征[D]. 内蒙古农业大学, 2018.
- [55] Amin M N G, Kusnadi J, Hsu J L, et al. Identification of a novel umami peptide in tempeh (Indonesian fermented soybean) and its binding mechanism to the umami receptor T1R[J]. *Food Chem*, 2020, 333: 127411.