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Review paper

Taste producing components in fish and fisheries products: A review

Mohammed Golam Sarower*[1], Abul Farah Md. Hasanuzzaman[1], Bhabananda Biswas[1] and Hiroki Abe[2]

[1] Present address: Fisheries and Marine Resource Technology Discipline, Khulna University, Khulna 9208, Bangladesh
[2] Present address: Research Institute of Seafood Biochemistry, 3-23-20 Kamiigusa #205, Suginami, Tokyo 167-0023, Japan

***Email:** bhbiswas@yahoo.com

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Abstract

The extractive constituents, which are known as taste active components of fisheries products in many research works have been reviewed..This review found glutamate, glycine, alanine, arginine, proline, valine, methionine, phenylalanine, tyrosine, inosine 5'-monophosphate (IMP), adenosine 5'-monophosphate (AMP), guanosine 5'-monophosphate (GMP), trimethylamine, trimethylamine oxide (TMAO), glycine betaine, lactate, succinate as important contributors to the taste of raw and processed fisheries products. Sweet, salty, bitter, sour, and *umami* are the basic tastes, defined by these taste active components. Sweet taste is imparted by glycine, alanine, TMAO while bitter taste by arginine and other hydrophobic amino acids. Glutamate has a role in sour taste, and contributes to *umami* taste through synergetic effects in co-existence of IMP, GMP and AMP. The large amount of alanine or glutamate suppresses the sweetness effect of glycine through antagonistic effect. However, these taste-producing components vary with species, environments, various processing methods and relative quantities among them.

Keywords: Fish, fisheries products, taste, *umami*

Fish and fisheries products with unique and diverse tastes are very popular and delicious foodstuffs to human being around the world. People of different cultures, countries and continents take these items for their daily food, and use as luxurious food item in various festivals. Fish, shrimps, prawns, crabs, and various mollusk species are consumed in fresh and various processed forms such as smoked, canned, marinated, dried, fermented, and condiments (e.g. fish sauce). These fresh and processed fisheries products are unique with its taste, texture and palatability, which are solely related to the contributions of extractive components. These taste-active components include several free amino acids such as glutamate, glycine, alanine, arginine, and nucleotides such as inosine 5'-monophosphate (IMP), adenosine 5'-monophosphate (AMP), and guanosine 5'-monophosphate (GMP). Other than amino acids and nucleotides, several nucleosides and nucleic acid bases such as inosine, adenosine and uracil are found to be taste-active in salted salmon eggs (Hayashi *et al*. 1990). Fuke and Konosu (1990) evaluated creatinine and lactate in dried skipjack, and succinate in short-necked clam as taste-active components.

The contributions of extractive components to the sensory attributes and taste specificity of fish and fisheries products have been reported (Komata 1964; Konosu 1973; Hayashi *et al*. 1981; Konosu and Yamaguchi 1982; Konosu *et al*. 1988; Hayashi *et al*. 1990; Fuke and Konosu 1990, 1991; Fuke 1994; Shiau *et al*. 1996; Shirai *et al*. 1997 & 1996; Saito and Kunisaki 1998; Spurvey *et al*. 1998; Ninomiya 2002). These taste-active components differ with various processing methods, species, environments, and relative contents of taste-active components. Chiou *et al.* (2002) demonstrated the changes in extractive components such as adenosine 5'-triphosphate (ATP), -diphosphate (ADP), monophosphate (AMP), free amino acids in the foot muscle of live small abalone (*Haliotis diversicolor*) during different storage temperatures. The amount of AMP, which varies with different cooking conditions, has been reported to be a factor related to the taste preference for the prawn muscle (Hatae *et al.*, 1991) and soup of hard clam (Yamamoto and Kitao 1993). Fuke (1994) demonstrated that not only combinations of taste-active components but also the relative quantities among them are important in producing the specific flavor of specific seafood.

Composition of taste active components

The specific taste of each food relies on extractive components which are defined as water-soluble, low molecular weight components, and classified into nitrogenous compounds (free and combined amino acids, nucleotides and related compounds, organic bases etc.) and non-nitrogenous compounds (sugars and organic acids) with the exception of vitamins, pigments and minerals. Noguchi *et al.*, (1975), Miyazawa *et al.* ,(1979), and Hessel (1999) reported the effects of dipeptides on taste characteristics. According to Park *et al.*, (2002b), peptides in fish sauce characterizing sour taste include Asp-Glu, Tyr-Pro and Val-Pro-Glu; peptides having rather flat taste are Gly-Pro-Orn-Gly, Asp-Phe, Glu-Phe and Glu-Met-Pro. Peptide having sweet taste is only Val-Pro and that having *umami* taste also includes only Asp-Met-Pro. Bitter peptides include Tyr-Pro-Orn, Val-Pro-Orn, Ala-Pro, Gly-Phe, Gly-Tyr and Phe-Pro (Table 1).

Amino acids usually contribute a sour, bitter or sweet taste. Glycine and alanine impart pleasant sweet taste (Fuke and Konosu 1991; Spurvey *et al.*, 1998, Chen and Zhang 2007). Arginine is a bitter sensation producing amino acid with weak sweetness (Michikawa and Konosu 1995; Chen and Zhang 2007). Aspartate and glutamate have a sour taste but give *umami* taste in the presence of sodium salts (Yamaguchi *et al*. 1971). The *umami* taste of the Chinese mitten crab's meat is significantly contributed by glutamate, IMP and AMP (Chen and Zhang 2007). According to Yamaguchi (1991), *umami* taste in association with monosodium glutamate (MSG) is elicited by glutamate. IMP and GMP are intensely flavor-enhancers of the *umami* taste, and have much stronger *umami* flavor enhanching capacitythan MSG (Yamaguchi *et al.*, 1971).) AMP imparts *umami* taste to the muscle of squid (Kani *et al*. 2007; Shirai *et al.* ,1997). According to Lioe *et al.* (2004), phenylalanine and tyrosine are aromatic amino acids with a bitter taste, which are known to be important components of the savory taste of soy sauce in addition to glutamate. Phenylalanine is also found to enhance significantly the *umami* taste (Chen and Zhang 2007).

The organic acids in fish and fisheries products are detected as lactic, acetic, malic, succinic acids, and fumarate (Storey and Storey 1983; Yamanaka *et al.* 1995; Itou *et al.*, 2006; Kani *et al.* 2007). Glucose contributes a pleasant sweet taste to food (Chen and Zhang, 2007). Shirai *et al.*, (1997) and Kani *et al.* (2007) reported trimethylamine oxide (TMAO) and trimethylamine (TMA) as taste-active components in squids. These TMAO and TMA contribute to sweetness and an agreeable characteristic squid flavor, respectively (Shirai *et al.* 1997). Glycine betaine is also identified as a taste-active

Table 1: Taste characteristics of oligopeptides identified in fish sauce and chemically synthesized (modified from Park *et al.* 2002b)

Peptidesidentified	Taste Reported	In the absence of NaCl	In the presence of 0.3% NaCl	Concentration (mM) Reference value	Tasted value
Tyr-Pro-Orn‡		Bitter	Sweet/umami		5
Val-Pro-Orn‡		Bitter	Umami/sweet		5
Gly-Pro-Orn-Gly‡		Flat	Sweet/umami		5
Ala-Pro†	Flat	Bitter/Flat	Sweet/umami		5
Asp-Glu†	Umami	Sour/umami	Sweet/umami	7.6	5
Asp-Pro‡	Sour				
Asp-Phe†	Sour	Flat	Sweet/umami		5
Glu-Pro‡	Flat				
Glu-Phe‡	Sour, bitter	Flat	Sweet/umami		5
Gly-Phe†	Bitter	Bitter	Sweet/umami	15-17	5
Gly-Tyr†	Bitter	Bitter	Sweet	3	5
Val-Pro†	Flat	Sweet	Sweet/umami		5
Tyr-Pro†	Bitter	Sour	Sweet/umami	19	5
Phe-Pro†	Biter	Bitter	Sweet/umami	1.5	5
Val-Pro-Glu²”		Sour	Sweet/umami		5
Glu-Met-Pro²”		Flat	Umami/sweet		5
Asp-Met-Pro²”		Umami	Sweet/umami		5

† Purchased from Bachem, Co.; ‡ Synthesized with a peptide synthesizer; ²” Synthesized by a liquid-phase method.

component of *G. borealis* muscle (Shirai *et al.* 1997) and of Loliginidae squids (Kani *et al*. 2007). Michikawa *et al.* (1995) reported glycine betaine to impart only a weak sweetness but intensify thickness, fullness, and aftertaste of the synthetic extract of the whelk, *Neptunea plycostata*. Hayashi *et al*. (1978, 1979, 1981a,b) and Konosu *et al.*, (1978) reported the contribution of sodium and chloride ions to the taste of snow crab. In addition to these, some inorganic ions such as Potassium and sodium could contribute salty taste to Chinese mitten crab meat flavor (Chen and Zhang 2007)

Taste evaluation

Generally basic taste characteristics are classified as sweet, salty, bitter, sour and *umami*. The evaluation of taste-active components in relation to taste characteristics includes both omission and addition test. These tests with synthetic extracts simulating natural extracts are employed to identify the taste-active components and to disclose their roles in producing the specific taste.

In this type of tests, the triangle difference test is usually employed, but the paired difference test is also used to make sure the role of each taste-active component. The panel members are asked to answer to the difference between the synthetic extract and the synthetic extract from which one component or a group of components is omitted or added. At the same time, they are asked to evaluate the extracts usually by five-point rating scale for the items of basic tastes (sweetness, sourness, saltiness, bitterness and *umami*) and flavor characteristics (e.g., fullness, complexity, thickness, overall preference and so on), which are selected before sensory tests by an open panel discussion (Fuke and Konosu 1991). Apart from this commonly used evalution method, some other methods for fish taste preference have been addressed in the review by Kasumyan and Doving (2003).

Taste-active components of fish and fisheries products

The taste-active components of fresh sea foods have been identified from abalone, scallop, short-necked clam, sea urchin, snow crab, salmon roe (Hayashi *et al*. 1990), Chinese mitten crab (Chen and Zhang 2007), Japanese spiny lobster and shovel-nosed lobster (Shirai *et al*., 1996), yellowtail (Kubota *et al*., 2002), and boreo-pacific gonate squid (*Gonatopsis borealis*) (Shirai *et al***.,** 1997), and other squids (Hatae *et al.* 1995a; Kagawa *et al.*, 1999; Kani *et al.*, 2007, 2008). There are also some research works on taste-active components in processed fisheries products such as dried skipjack (Fuke and Konosu 1991), fish sauce (Park *et al.*, 2002a,b). Glutamate, proline, glycine, leucine, isoleucine, alanine, arginine, valine, methionine, IMP, GMP, AMP, TMAO and glycine betaine have been believed to be the taste active components in these fish and fisheries products.

According to Konosu (1973), extractive components such as glutamate, glycine, AMP, and glycine betaine are the taste-active components of abalone. Betaine, glycine and alanine impart sweetness and intensify *umami* as well. Chiou and Lai (2002) reported the contribution of glycine, glutamate and AMP to the taste of small abalone. Glycine, glutamate, alanine, valine, methionine, IMP and GMP are taste-active components in sea urchin. Valine is necessary for producing bitterness intrinsic of the gonad of sea urchin. Methionine was essential to afford the characteristic flavor, which changed to crab- or prawn-like flavor without methionine (Komata 1964; Komata *et al.* 1962). Alanine, glutamate, glycine, arginine, glycine betaine, AMP in snow and mud crab (Chiou and Huang 2003; Hayashi *et al.* 1981a), and cytosine monophosphate, GMP and sodium, potassium, chloride, and phosphate ions in snow crab (Hayashi *et al*., 1981a) are the taste-active components. Arginine, glycine, alanine, glutamate, IMP and AMP had strong taste impacts on the crab's meat flavor. Glycine and alanine contributed major sweet taste, while glutamate, IMP and AMP contributed a strong *umami* taste (Chen and Zhang 2007). Konosu *et al*. (1987, 1988) and Watanabe *et al.* (1990) have reported the role of glutamate, glycine, alanine, arginine, AMP, sodium, potassium and chloride ions in the *umami* taste of scallop.

The taste-active components in short-necked clam are glutamate, glycine, arginine, taurine (Tau), AMP, succinic acid, sodium, potassium and chloride ions (Fuke and Konosu 1990). Succinic acid has been reported to be one of the main taste-active components in some seafood, such as clam (Spurvey *et al*., 1998). Glycine, alanine, proline, arginine, glutamate, serine, threonine, AMP, glycine betaine, TMA and TMAO, NaCl, KCl, and KH_2PO_4- have been identified as taste-active components of boreo pacific gonate squid. Threonine and serine have been known to be a taste-active component only in boreo pacific gonate squid (Shirai *et al.*, 1997). Glycine, alanine, proline, arginine, glutamate, AMP, TMAO, glycine betaine, potassium, sodium, and chloride ions are identified as taste-active components in squid species, *Sepioteuthis lessoniana* (Kani *et al*., 2008). Taurine, proline, glycine, alanine, and arginine are the main free amino acids commonly found in the muscle of these four squid species *Sepioteuthis lessoniana*, *Loligo bleekeri*, *L. edulis*, and *Todarodes pacificus* (Kani *et al*., 2007). Shirai *et al*., (1996) identified IMP and phosphate ions as taste-active substances in spiny lobster *P. japonicus*. Valine and methionine have been revealed to be taste-active only in sea urchin and shovel-nosed lobster (Shirai *et al*., 1996). Glutamate, IMP, inosine, adenosine, guanosine, uracil, trimethyl-amine, glucose, sodium, potassium, chloride and phosphate ions have been found to be taste-active in salted salmon eggs (Hayashi *et al*., 1990), and in yellowtail muscle (Kubota *et al*., 2002).

In fish sauce, glutamate, threonine, alanine, valine, histidine, proline, tyrosine, cystine, methionine and pyroglutamate have been proven to have a major contribution to its taste (Park *et al.*, 2002a). The most effective compound for recreating the characteristic flavor of fish sauce is glutamate, followed by pyroglutamate and alanine. Proline and methionine contribute to sweetness. Threonine, alanine and histidine have been found to be responsible for the characteristic fish sauce-like taste by the omission test (Park *et al*., 2002a). Taira *et al*., (2007) identified free amino acids, which are mainly accumulated in the mashes of flyingfish (*Cypselurus agoo agoo*), the small dolphinfish (*Coryphaena hippurus*), and the deep-sea smelt (*Glossanodon semifasciatus*), during fermentation as leucine, lysine, valine, and alanine, methionine and isoleucine. The deep-sea smelt was found to contain a large amount of glutamate. Glutamate, histidine, lysine, carnosine, IMP, inosine+hypoxanthine, creatinine, lactic acid, sodium, potassium and chloride ions are evaluated as taste-active components of dried skipjack (Fuke *et al.* 1989). Kodama (1913) first identified IMP as a responsible substance of the savory taste of "Katsuobushi" stock (dried and molded skipjack). According to Fuke and Konosu (1991), lactic acid has been evaluated to be a taste-active component in dried skipjack tuna.

Factors affecting taste characteristics

Tastes are specific and varied with respect to species, different concentrations of taste-producing components in different parts of the body, chemical structure and relative portion of taste-active components, season and species-habitat as well.

Variation in taste: It is notable that differences in the concentrations of these taste-active components lead to the characteristic tastes of different species. Kani *et al*., (2008) have demonstrated that saltiness and *umami* are weaker in *Loligo* sp. than in *Sepioteuthis lessoniana* but sweetness, sourness, and bitterness are evaluated to be stronger in *L. bleekeri* than in *S. lessoniana*. In *Todarodes pacificus*, *umami* taste is significantly stronger, while sweetness, sourness, and saltiness are all weaker than in *S. lessoniana*. There is also difference in taste of body portion due to varied contents of taste-active components such as free amino acids, nucleotide and related compounds, organic acids, and inorganic ions. The muscle of Loliginidae squid species, *S. lessoniana*, *L. bleekeri*, and *L. edulis* is considered to have a much sweeter taste than that of *T. pacificus* and *G. borealis* on account of the high contents of sweet amino acids, glycine, alanine, and proline. Compared with muscle, squid liver with high contents of taurine, glutamate, bitter amino acids, succinate, propionate, TMA, and glycine betaine, and with low contents of sweet amino acids, arginine, nucleotides, malate, and TMAO are characterized by a complicated taste containing *umami*, bitterness, sourness, fishy flavor, and less sweetness. Liver may have more complicated flavor than muscle. If squid liver is mixed with muscle during cooking, it may give the muscle a more complicated taste than the sweetness and *umami* taste of muscle (Kani *et al*., 2007). They also reported higher phosphate ion in muscle than in liver; highest in the muscle of *S. lessoniana*, and lowest in that of *T. pacificus*.

Diets with different composition may cause variation in taste specificity. Many studies showed the effect of different diets on muscle yield (Mercer *et al*. 1993) and proximate composition (Mercer *et al*., 1993; Watanabe *et al*. 1993; Britz and Hetch 1997), lipid composition (Dunstan *et al*., 1996), extractive components (Watanabe *et al*. 1993; Mai *et al.* 1994; Bewick *et al.*, 1997), and glycogen (Watanabe *et al.*, 1993) in the tissues of abalone. Chiou and Lai (2002) reported the differences in taste preference and the levels of extractive components and glycogen in cooked meats of small abalone *Haliotis diversicolor* fed *gracilaria* sp. and artificial diet. The contents of glutamate, glycine, and AMP are determined to vary considerably among muscle of abalone fed different diets (Chiou *et al.*, 2001). In addition to diet, seasonal variation is also a factor causing changes in the composition of extractive components, and thus taste preferences of seafood. According to Konosu and Yamaguchi (1982), season is one of the factors influencing the contents of extractive components and glycogen of seafood. It has been reported that the extractive components and glycogen in oyster (Takaki and Simidu 1963; Sakaguchi and Murata 1989), ascidian (Watanabe *et al*., 1983, 1985; Park *et al.*, 1990), clams (Hirano 1975; Chiou *et al.*, 1996a, 1996b), scallop (Kawashima and Yamanaka 1996) and abalone (Weber 1970; Hirano 1975; Watanabe *et al.*, 1992a; Hatae *et al*. 1995b; Hwang *et al*., 1997; Chiou *et al.*, 2001) show marked seasonal changes, and that in most cases the season for higher palatability coincides with a higher contents of taste components. The levels of non-protein nitrogenous compounds in the fish and shellfish, such as milkfish (Chiou *et al*., 1995), ayu (Hirano and Suyama 1980), and yellowtail (Endo *et al.*, 1974) are well determined to show seasonal variations. Chiou and Huang (2003) observed the increased total free amino acid and individual free amino acid such as glycine, alanine, and arginine in female crab (*Scylla serrata*) during August and November, while those in male crab in January, March, and August. The total ATP-related compounds in both crabs have been lower in the crabs collected from winter than in other seasons whereas higher glycine betaine in winter and early spring. Glycogen in female crab is reported to be higher in October and August, while in male crab muscle increased level of glycogen is observed from August through January, but decreased in spring. The levels of total taste active components including glycine, alanine, arginine, GMP, IMP, and AMP have been found to differ greatly in the muscle of puffer (*Takifugu rubripes*) between the season, and probably, the geographical location (Hwang *et al.,* 2000). The level of these compounds is lower in the spawning season (March-May), but much higher from July to January when the puffer is more palatable.

The storage condition and the methods of processing could change the level of taste-active components of fish and fisheries products, and thus influence the taste characteristics. Watanabe *et al.,* (1992b) demonstrated slightly increased amount of total free amino acid in the muscle of disk abalone after one day of storage at 5 ^{o}C and 10 ^{o}C and after 5 days of storage at 0 ^{o}C, and thereafter decreased markedly. Wongso and Yamanaka (1996) have shown that the total amount of free amino acid in the adductor muscle of noble scallop increases gradually during storage at 0 ^{o}C and 5 ^{o}C prior to the initial decomposition stage. Chiou *et al*., (2002) have reported that the total amount of free amino acids in small abalone increases markedly during storage at 5 ^{o}C, 15 ^{o}C, and 25 ^{o}C. The dominant free amino acids, such as taurine, glutamate, glycine, alanine, and arginine are found to be increased after storage. The pH decreases and the volatile basic nitrogen and *K*-value increase during the storage in different temperature, while changes were prominent with the course of rising of temperature (Figure 1).

Several reports have demonstrated that increased levels of extractive components after cooking can be attributed to flavor in abalone and kuruma prawn meats (Hatae *et al.,* 1996; Matsumoto *et al*.,1991), as well as soup of hard clam (Yamamoto and Kitao 1993). During fermentation, increased free amino acids and organic acids are determined in fish sauces produced from three fish species, the flyingfish *Cypselurus agoo agoo*, the small dolphinfish *Coryphaena hippurus*, and the deepsea smelt *G. semifasciatus*. It is found these products to have lower smell, saltiness, and bitterness, and higher sweetness and *umami* taste than a Vietnamese fish sauce, *Nuoc mam* (Taira *et al.,* 2007). It has been reported that glutamate, aspartate, glycine, alanine, leucine, and isoleucine, and organic acids in fermented mackerel and rice product, *narezushi*, get increased which implicate the contribution of these components to the *umami* taste and the sour taste of *narezushi* (Itou *et al.*, 2006). Itou and Akahane (2000) observed markedly increased glutamate, leucine, lysine, aspartate, and alanine in fermented mackerel with rice bran, *heshiko*. A lightly fermented mackerel with rice, *sabazushi*, is also reported to contain alanine, leucine, and valine abundantly (Chang *et al.*, 1992).

Intensification and/or suppression of taste**:** It has been known that the taste strength and quality of an original extract can be easily changed or improved by the addition and/or omission of extractive components. There is also synergistic or antagonistic effect observed among several taste-active components. The results from Kani *et al.,* (2008) showed that the addition of glycine increases sweetness and *umami* tastes of squid. The incorporation of alanine, serine, and proline with glycine would lead to a further increased difference in the concentration of sweet amino acids in cooked abalone meats (Chiou and Lai 2002). Kani *et al*., (2008) have also reported that arginine intensifies the sweetness and suppresses the bitterness and *umami* of the squid (*L. bleekeri)* extract. Addition of chloride ion improves the taste of an unpalatable squid, *T. pacificus*. There is a synergistic effect between creatine and creatinine when they were found to be coexisting in fish sauce (Park *et al*., 2002a). Yamaguchi *et al.,* (1971) reported a synergistic effect between MSG and IMP, GMP or AMP, which together in certain ratios produce a strong *umami* taste.

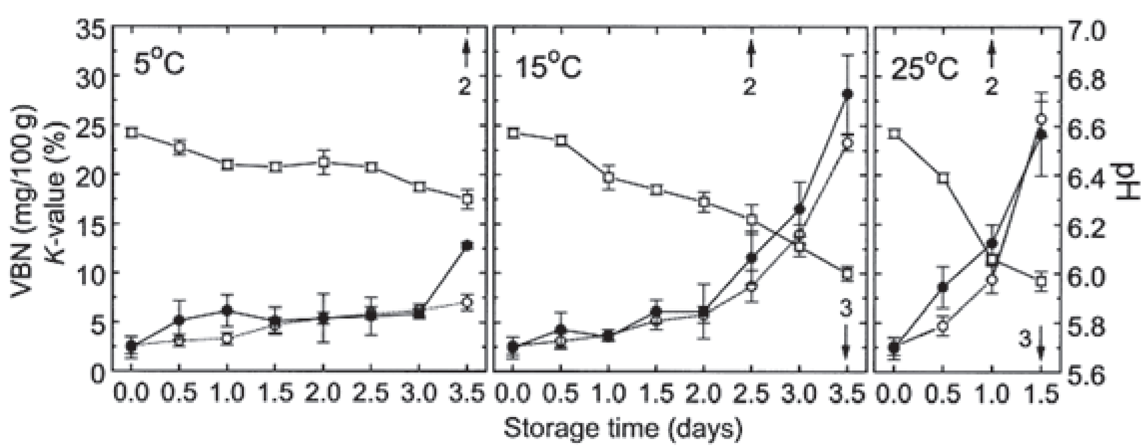

Figure 1: Changes in levels of (¡%) pH, (Ë%) volatile basic nitrogen (VBN), and (Ï%) *K*-value in the foot muscle of abalone during storage at different temperature (Chiou *et al*. 2002).

According to Lioe *et al.* (2004, 2005) free aromatic amino acids such as phenylalanine and tyrosine play an important role in enhancing savory or *umami* taste at their sub-threshold concentrations in the presence of salt and free acidic amino acids.

Kani *et al.,* (2007) speculated improved *umami* taste of squid muscles through synergistic effect between AMP and glutamate. This effect provides the muscle with not only *umami* taste but also such taste sensory attributes as continuity, complexity, mouthfulness and palatability (Komata 1990; Fuke 1994). According to Konosu (1973), *umami* and characteristic flavor almost disappear when either glutamate or AMP is omitted from extract, whereas the absence of glycine results in reduced sweetness and *umami* taste. The sweetness of glycine may be masked by large amounts of alanine and/or glutamate (Park *et al.,* 2002a). In the case of the omission of threonine, slightly increased *umami* taste is found but the overall taste decreases. *Umami* and sweetness decrease slightly and bitterness and astringent taste increase a little with the omission of alanine. Another taste-active component is valine, of which omission decreased *umami* and sweetness, and slightly increased sourness are reported. The omission of tyrosine and cystine impart a little sweetness to food taste (Park *et al.,* 2002a). The bitterness of arginine can be masked by NaCl, glutamate, and/or AMP (Michikawa and Konosu 1995). The organic acid omitted solution show a clear decrease of *umami* and sweetness in fish sauce and a slight decrease of mouthfulness. The pyroglutamate-omitted solution showed a decrease of sweetness and gave a flat taste (Park *et al*., 2002a). The omission of potassium, sodium, and chloride ion is found to lead to a large change in taste of squid, including a decrease in sweetness, saltiness, and *umami* (Kani *et al.*, 2008). Sodium ion is well known to intensify saltiness and sweetness and suppresses sourness and bitterness. If chloride ion is omitted from an extract, sweetness and *umami* tastes disappear, bitterness is significantly increased, and the quality of taste gets significantly declined in boiled snow crab meat (Hayashi *et al*., 1981b). Although glycogen is tasteless, it has been reported previously that the addition of glycogen to synthetic extracts of abalone and scallop improved flavor characteristics and overall taste preference (Konosu *et al*., 1988; Konosu 1973).

Conclusion

In summary, the taste of fish and fisheries products as well as by-products is the function of the taste effects of many taste-active components such as glutamate, glycine, alanine, arginine, proline, valine, methionine, phenylalanine, tyrosine, IMP, AMP, GMP, TMAO, TMA, glycine betaine, inosine, adenosine, uracil, creatine, lactate, succinate. The taste is also found to be varied with the existence of sodium, chloride, potassium, and phosphate ions in fisheries products. Usually, glycine, alanine, TMAO and glycine betaine impart sweet taste in invertebrates while arginine contribute bitter test. Glutamate gives *umami* taste through synergetic effects in co-existence of IMP, GMP, AMP. On the other hand, there is also evidence of antagonistic effect among several taste-active components. Large amounts of alanine or glutamate mask the sweetness effect of glycine, and NaCl, glutamate, and/or AMP suppress the bitterness of arginine. Thus, the tastes can be modified by simply addition or omission of taste extractive components. However, the taste strength of taste-active components coincides well with species, environments, various processed methods, and proportion of taste-active components in the products. We believe that, though we recognize the taste of fish and fisheries products with five sensory flavour, still there are lots of scope to find out the modifications and even novelty of taste. We have shown in this short review that a little change in biochemical compositions, sex, storage time, temperature could change the taste of fish and fisheries products. The future works, therefore, should draw the scientists' attention to work on it with the climate changes, genetic inheritance using advanced tools such as molecular applications in the cellular level and biochemistry of the taste-active components of fish and fisheries products.

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