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Preparation and Standardization of Shrimp Head Masala Powder from *Parapenaeopsis stylifera* Head

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ABSTRACT

Freshly separated Shrimp heads of *P. Stylifera* (Kiddi Shrimp) were procured from peeling sheds during the period of January to April, 2024 near Mirkarwada Landing center, Taluka-Ratnagiri District-Ratnagiri, Maharashtra, India aimed at the development and standardization of a shrimp head flavorant powder and its use in a shrimp flavoured masala powder for noodles. Shrimp heads were boiled to obtain liquid flavorant, which was then developed into a powder using rice flour (13%, 15%, and 17%) as a carrier and dried at 45°C. The flavorant with 15% rice flour was found to have significantly higher scores in organoleptic evaluation and was selected for further standardization. The standardized shrimp flavorant powder was then mixed with a spice mix masala in various proportions (45:55, 50:50, and 55:45), and the 50:50 proportion had shown better overall acceptability. Further optimization of the shrimp flavoured masala powder in noodles indicated that a 10% level of addition gave the highest scores in all treatments. The optimized shrimp head flavorant powder had a yield of 14.17±0.06%, solubility of 54.32±0.10%, and bulk density of 0.46±0.01 g ml^{-1}. Proximate analysis revealed low moisture (4.06±0.20%), fat (1.3±0.20%), moderate protein (2.1±0.21%), high carbohydrate (73.08±0.12%), and high ash content (19.46±0.01%).

KEYWORDS: Shrimp head, flavorant, masala powder, ingredients, standardization

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1. INTRODUCTION

Aquaculture is a growing source of the world's food fish supply, which has increased the amount of fish available per person (Kamble et al., 2025). Globally, shrimp aquaculture and processing industries constitute the largest segment of the seafood economy, driven by high demand and market value (Bhaladhare et al., 2025). The kiddi shrimp (*Parapenaeopsis stylifera*) has emerged as a vital coastal resource in India, where it is predominantly harvested through shrimp trawling operations. Owing to its commercial significance, considerable research has been devoted to examining its biology and life cycle within Indian marine ecosystems (Suseelan et al., 1998). However, shrimp processing generates substantial quantities of waste, estimated at 50–60% of the total biomass (Nirmal et al., 2021). These by-products, comprising heads, shells, and tails, are rich in minerals, chitin, proteins, lipids, carotenoids, and other bioactive compounds. Such waste materials exhibit diverse bioactivities and can be utilized in food, feed, and functional food formulations (Nirmal et al., 2021). The extraction of biologically active compounds-including chitin, carotenoids, and protein hydrolysates-from shrimp processing residues has been widely investigated (Nirmal et al., 2021). Improper disposal of these nutrient-rich wastes, which account for nearly half of the raw material input, can lead to environmental challenges (Bassig et al., 2021). The processing of shrimp involves the removal of the head and hard carapace, which comprise around 40–60% of the animal and produce a lot of trash, creating a disposal problem for the shellfish industry (Dayakar et al., 2022). Land filling, incineration, and ocean dumping are the most popular ways to dispose of shrimp trash (Seethl et al., 2022). Conversely, shrimp waste offers promising applications in bioremediation, sustainable energy production, and bioplastic development, reflecting emerging trends in waste valorisation (Nirmal et al., 2021). Since shrimp is a secondary raw material that may be utilized to create high-end value-added by-products, creating value-added by-products is one strategy to manage waste from shrimp processing (Mathew, 2010). Since Thailand is a major producer of shrimp, there is an immense amount of shrimp waste that can be utilized as a raw material to make flavouring agents, which are now imported (Raksakulthai et al., 2002). A possible method to use shrimp manufacturing byproducts is to make natural flavor powder for savory dishes (Suprami et al., 2022). Aroma, taste, and oral stimulation are the three components that contribute to making up the food taste (Winarno, 2004). Flavouring agents are food additives formulated to intensify or modify the sensory characteristics of food products (Amran et al., 2020). Chronic and excessive exposure to chemical flavouring agents induces respiratory, dermal, and ocular irritation, and is clinically associated with hepatic dysfunction and hepatocarcinogenesis (Aprilia et al., 2020). According to the study carried out by Gopan et al., 2020 the nutritional value of native kiddi shrimp *P. Stylifera*, which may be used to create functional foods with additional value because these species have a high Ω-3 PUFA concentration. Similar research was carried out by Sedyaaw et al. (2023) in which shrimp head shell powder of 25% was selected and 75% of basal ingredients was finalised to prepare an edible product i.e., shrimp head chutney powder. This study focused on extracting flavorant from abundant P. stylifera heads to create a shrimp flavorant masala powder for noodles. By successfully developing this flavorant, the research advances the valorisation of shrimp waste into a value-added, ready-to-cook product. This innovation improves resource efficiency, reduces industrial waste, and mitigates environmental impacts. Ultimately, the powder serves as an effective flavor enhancer, transforming discarded materials into a sustainable ingredient for the food industry.

2. MATERIALS AND METHODS

2.1. Preparation of shrimp head flavorant powder

Freshly separated Shrimp heads of *P. Stylifera* (Kiddi Shrimp) were procured from peeling sheds during the period of January, 2024 to April, 2024 near Mirkarwada Landing center, Taluka-Ratnagiri District- Ratnagiri. The shrimp heads selected for present research work of average length 2.74±1.77 cm and the average weight of 5.88±1.31 g was used. After washing, shrimp were packed along with crushed ice (1:1 ratio) in insulated boxes for transportation to Processing Hall of Department of Fish Processing Technology and Microbiology of College of Fisheries Ratnagiri. The flavour powder was prepared as per the method of Bhaladhare et al. (2025) with some modifications by replacing maltodextrin with rice flour. Freshly separated shrimp heads were chopped and washed thoroughly; after washing, heads were boiled in water (1:2 w/v). After boiling separate the shrimp heads and collect the liquid flavorant. Add 13%,15% and 17% rice flour in obtained liquid flavorant. Heat this flour added mixture with continuous stirring to get gelatinized. This gelatinized mixture poured into drying trays to for drying. These trays were dried at 45°C in industrial dryer. After drying this dried flavorant grinded to make fine powder called as shrimp flavorant powder.

2.2. Preparation of shrimp head masala powder

After preparation of flavorant powder a mix masala powder was prepared by modification of treatments M_1, M_2 and M_3 as shown in Table 1. Three treatments were formulated by mixing of shrimp head flavorant powder with mix masala powder, viz., 45:55,50:50,55:45 (Table 2)

Table 1: Ingredients for mix masala powder

Sl. No.	Ingredients	M_1	M_2	M_3
1.	Onion powder	24	24	24
2.	Chilli powder	18	20	22
3.	Garlic powder	16	15	14
4.	Coriander powder	5	5	5
5.	Turmeric powder	5	5	5
6.	Cummin powder	5	5	5
7.	Aniseed powder	5	5	5
8.	Black pepper powder	2	1.5	1
9.	Fenugreek powder	2	2	2
10.	Ginger powder	2	1.5	1
11.	Clove powder	2	2	2
12.	Nutmeg powder	2	2	2
13.	Cardamom powder	2	2	2
14.	Salt	10	10	10
15.	Hydrolysed coconut meal powder	-	-	-
	Total	100	100	100

Table 2: Concentration of mix masala powder and shrimp flavour powder

	T_1	T_2	T_3
Shrimp flavour powder	45%	50%	55%
Mix masala	55%	50%	45%

called as shrimp flavour masala powder (SFMP) as shown in Figure 1 and 2 and organoleptic evaluation was carried out with utilization on noodles with three concentrations as 8%, 10% and 12% (Table 3).

2.3. Organoleptic evaluation

The attributes such as colour, texture, taste, odour and consistency and overall acceptability were evaluated during the standardization by a group of '5' panellists using a '0 to 9' hedonic scale

2.4. Physical parameters of shrimp head flavorant powder

Physical parameters were analyzed before addition of mix masala powder into shrimp flavorant powder. Parameters analyzed were yield (Husna et al., 2017), bulk density (Kanpairo et al., 2012) and solubility (Kanpairo et al., 2012).

2.5. Proximate analysis of shrimp head flavorant powder

Proximate composition of shrimp head flavorant powder was analyzed for moisture, protein, fat, ash and carbohydrate. The moisture content was analyzed

Figure 1: Dried and palletized shrimp flavorant powder

Figure 2: Shrimp head flavorant powder mix

Table 3: Concentration of shrimp flavour masala powder added into noodles

	N_1	N_2	N_3
Shrimp flavour powder (%)	8%	10%	12%
Noodles quantity (g)	50	50	50

according to the method of Association of Official Analytical Chemistry, 2005 (Anonymous, 2005). Kjeldahl method was used for protein estimation as per the method of Anonymous, 2005. Soxhlet method was used for estimation of fat content (Anonymous, 2005). For ash content sample was weigh and burned in muffle furnace at 550°C until a white grey ash is obtained. For all estimation three replicants were carried out.

3. RESULTS AND DISCUSSION

3.1. Organoleptic evaluation

3.1.1. Organoleptic evaluation of 13%, 15% and 17% of rice flour added shrimp head flavorant powder

ANOVA of organoleptic evaluation of rice flour added flavorant indicated that the three treatments, i.e., 13%,15%, and 17% were significantly different from each other (Table 4). The Tukey test indicated that the 15% treatment was significantly different from 13% and 17% treatments. Organoleptic evaluation carried out with panellists indicated 15% showed better score compared with other treatments. As per the Post hoc analysis 15% was significantly different from other treatments. Hence, 15% treatment was finalized for further study.

Table 4: Average organoleptic evaluation of shrimp flavorant powder added with different percentage of rice flour

Characteristics	13%	15%	17%
Appearance	7.50±0.52^{a}	8.00±0.67^{a}	7.60±0.52^{a}
Colour	7.60±0.70^{a}	8.10±0.73^{a}	7.70±0.48^{a}
Odour	7.30±0.67^{a}	7.90±0.57^{a}	7.60±0.52^{a}
Texture	7.30±0.48^{a}	8.10±0.31^{b}	7.50±0.53^{a}
Taste	7.30±0.48^{a}	8.00±0.47^{b}	7.50±0.53^{a}
Overall acceptability	7.30±0.67^{a}	8.20±0.42^{b}	8.10±0.57^{b}

Mean±SD^{a,b} of mean in the same row followed by different superscript are significantly different (p<0.05) (n=10)

3.1.2. Organoleptic evaluation of mix masala powder utilized on noodles

ANOVA of organoleptic evaluation indicated that the four treatments, i.e., M_1, M_2, M_3 were significantly different from each other (Table 5). The Tukey test indicated that the M_2 treatment was significantly different from control, M_1 and M_3 among the three different treatments. Organoleptic evaluation carried out with panellists indicated M_2 showed better score compared with other treatments. As per the Post hoc analysis M_2 was significantly different from other treatments. Hence, M_2 treatment was finalized for further study. The final quantity of different ingredients after standardization of mix masala powder was given in Table 6.

Table 5: Average organoleptic evaluation of mix masala powder (Control) prepared by using four different compositions on noodles

Characteristics	M_1	M_2	M_3
Appearance	7.70±0.82^{a}	8.30±0.67^{a}	7.70±0.82^{a}
Colour	7.70±0.67^{ab}	8.30±0.48^{b}	7.50±0.53^{ab}
Odour	7.50±0.53^{ab}	8.20±0.42^{b}	7.60±0.70^{ab}
Texture	7.70±0.48^{a}	8.30±0.48^{a}	7.70±0.67^{a}
Taste	7.70±0.67^{a}	8.60±0.52^{b}	7.80±0.92^{ab}
Overall acceptability	7.70±0.48^{a}	8.50±0.53^{b}	7.60±0.70^{a}

Mean±SD^{a,b} of mean in the same row followed by different superscript are significantly different (p<0.05) (n=10)

Table 6: Standardization of different ingredients used for mix masala powder (Control) preparation

Sl. No.	Ingredients	Quantity (%)
1.	Onion powder	24
2.	Chilli powder	20
3.	Garlic powder	15
4.	Coriander powder	5
5.	Turmeric powder	5
6.	Cummin powder	5
7.	Aniseed powder	5
8.	Black pepper powder	1.5
9.	Fenugreek powder	2
10.	Ginger powder	1.5
11.	Clove powder	2
12.	Nutmeg powder	2
13.	Cardamom powder	2
12.	Salt	10
	Total	100

3.1.3. Organoleptic evaluation of shrimp flavour masala powder (SFMP) on noodles

ANOVA of organoleptic evaluation indicated that the four treatments, i.e., mix masala with shrimp flavorant powder 100:00 (w/w) (Control), 60:40 (w/w) (T_1), 50:50 (w/w) (T_2) and 40:60 (w/w) (T_3) were significantly different from each other (Table 7). The Tukey test indicated that the T_2 treatment was significantly different from control, T_1 and T_3 among the three different treatments. Organoleptic evaluation carried out with panellists indicated T_2 showed better score compared with other treatments. As per the Post hoc analysis T_2 was significantly different from other treatments. Hence, T_2 treatment was finalized for further storage study.

3.1.4. Organoleptic evaluation of mix masala added shrimp head flavorant powder on noodles

ANOVA of organoleptic evaluation indicated that the four treatments, i.e., mix masala with SFMP 8% (N_1), 10% (N_2) and 12% (N_3) were significantly different from each other (Figure 3). The Tukey test indicated that the N_2 treatment was significantly different from N_1 and N_3 among the three

Table 7: Average organoleptic evaluation of shrimp flavour masala powder prepared by using four different compositions

Characteristics	T_1	T_2	T_3
Appearance	7.80±0.78[a]	8.40±0.70[a]	8.00±0.94[a]
Colour	8.00±0.67[ab]	8.70±0.48[b]	8.00±0.67[ab]
Odour	8.10±0.88[ab]	8.50±0.52[b]	8.20±0.63[ab]
Texture	7.70±0.48[a]	8.30±0.48[a]	7.90±0.74[a]
Taste	7.50±0.71[a]	8.60±0.51[b]	7.70±0.82[ab]
Overall acceptability	7.80±0.42[a]	8.50±0.53[b]	7.90±0.57[ab]

Mean±SD[a,b] of mean in the same row followed by different superscript are significantly different (p<0.05) (n=10)

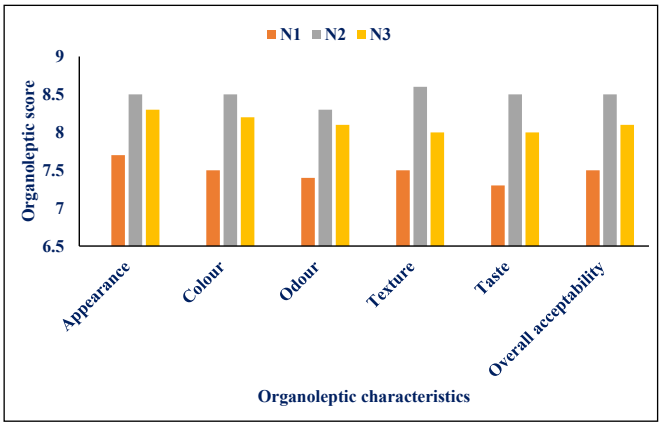

Figure 3: Average organoleptic evaluation of addition of different percentage of shrimp flavour masala powder in noodles by using three compositions

different treatments. Organoleptic evaluation carried out with panellists indicated N_2 showed better score compared with other treatments. As per the post hoc analysis N_2 was significantly different from other treatments. Hence, N_2 treatment was finalized for further study. In similar study carried out by Amran et al., 2020, the same proportion of tenggiri fish head flavour was utilised in crackers made of tapioca which suggested that the results of this study were aligned with the Amran et al., 2020.

3.2. Physical parameters of shrimp head flavorant powder added with rice flour

3.2.1. Yield

Yield of shrimp head flavorant powder was observed 12.22±0.06, 14.17±0.06 and 16.42±0.06% with three treatments of 13%, 15%, and 17% addition of rice flour in shrimp head flavorant extracted respectively. ANOVA of yield of rice flour added flavorant indicated that the three treatments, i.e., 13%, 15%, and 17% were significantly different from each other. Similar study was conducted by Arnesih et al. (2018) during the preparation of flavour powder from liquid tuna mackerel waste with addition of wheat flour shows higher yield ranged from 18.52% to 21.04%. Yield affected by type and addition of flour in liquid flavorant.

3.2.2. Solubility

Solubility of shrimp head flavorant powder was observed 56.53±0.07, 54.32±0.10 and 52.22±0.11% with three treatments of 13%, 15%, and 17% addition of rice flour in shrimp head flavorant extracted respectively. ANOVA of yield of rice flour added flavorant indicated that the three treatments, i.e., 13%, 15%, and 17% were significantly different from each other. These results partially agreed with the Kanpairo et al. (2012) documented the solubility of maltodextrin added tuna precooking flavour powder in the range of 60–70 %. Arnesih et al. (2018) recorded solubility in the range of 54% to 42% suggesting that solubility decreases as the addition of wheat flavour increases in liquid flavorant of tuna mackerel.

3.2.3. Bulk density

Bulk density of shrimp head flavorant powder was observed 0.41±0.02 g ml^{-1}, 0.46±0.01 g ml^{-1} and 0.50±0.01 g ml^{-1} with three treatments of 13%, 15%, and 17% addition of rice flour in shrimp head flavorant extracted respectively. ANOVA of yield of rice flour added flavorant indicated that the three treatments, i.e., 13%,15%, and 17% were significantly different from each other. These results agreement with Kanpairo et al. (2012) observed bulk density in the range of 0.39 to 0.44 g ml^{-1} in various concentration of total soluble solids of tuna precooking juice added with different concentration of starch. Similar results were observed by Arnesih et al. (2018) in the range of 0.36–0.46 g ml^{-1} with addition of wheat flour in liquid flavour of tuna mackerel waste. Higher bulk densities indicated that the particles have a tendency to stick together (Kanpairo et al., 2012).

3.4. Proximate analysis of shrimp head flavorant powder

The proximate composition of shrimp head flavorant on dry weight basis was moisture, protein, fat, carbohydrate and ash were recorded 4.06±0.2, 2.1±0.21, 1.3±0.2, 73.08±0.12, 19.46±0.01% respectively.

Moisture content of the shrimp head flavour powder was observed 4.06% in present study. A study carried out by Junianto et al. (2020b) on chemical composition of fish head flavour crackers, found that the moisture content of crackers produced with addition of maltodextrin was 4.17%. The results obtained in this study were completely agreed with Junianto et al. (2020b).

In present study, protein content of the shrimp head flavour powder was found as 2.1±0.21%. Fadhallah et al. (2023) examined protein of liquid broth extracted from freshwater and marine shrimp shell waste and recorded 1.97% protein. In present study it was also found low concentration of protein in proximate composition in shrimp head flavorant

powder developed by making broth of heads boiling in water for 30 minutes. It was because of mixing of nutrients into water. As stated by Fadhallah et al. (2023) protein content of liquid broth was affected by the period of boiling time, also solubility of protein was increased as the processing temperature increases. Junianto et al. (2020a) studied about the composition of cilok added with mackerel fish head flavour powder and observed that protein content in flavour powder was ranged from 0.15% to 0.21%. Protein content of the flavour powder could be affected by the raw material used for flavour powder production.

Fat content of the shrimp head flavorant powder was obtained as 1.3%. Fadhallah et al. (2023) examined fat of liquid broth extracted from marine shrimp shell waste and recorded in 0.10% to 0.50% fat. Kanpairo et al. (2012) obtained fat in the range of 0.87% to 1.00% in dried tuna flavour powder, which was less than the results obtained in this study. According to Fadhallah et al. (2023) fat content in the broth could be influenced by period of boiling time. Fat will leach out of the tissue and flow into water media. The longer the boiling process break down more fat components and dissolve them into boiling water, this process causes hydrolysis which breaks down fat into glycerol, soluble in water and fatty acid and also significantly changed the saturated and unsaturated fatty acids profile.

In present research, carbohydrate concentration of shrimp head flavour powder obtained 78.08% highest in the proximate composition. The flavour powder was developed by mixing shrimp head flavorant broth and rice flour which resulted in increasing the carbohydrates concentration in shrimp head flavorant powder. A study carried out by Deepika et al. (2021) reported carbohydrate ranged from 77.04% to 80.37% which was agreed the result obtained in present research which was affected by the amount of addition of starch. Carbohydrates were also called as sugar molecules or carbs which were essential for body in the form of glucose to produce energy. In fish, carbohydrates were low in concentration but in value added products these gets increase with increase of various forms of starches added as gelatinizing agent for processing of value-added products.

In the current study, ash content of shrimp head flavour powder was recorded as 19.46%. According to Jeyasanta et al. (2017) ash content of dried shrimp head waste powder was 19.2% which was similar to the obtained results of current study. Ash content referred to the minerals and inorganic substances left after heating to extremely high temperatures to remove moisture, volatile compounds and all organic materials.

4. CONCLUSION

Extracting flavorant from *P. stylifera* heads showed significant potential for creating value-added food products. When blended with spices, the flavorant exhibited desirable organoleptic properties, successfully enhancing the sensory attributes of noodles. This application not only improved flavor but also promoted sustainability by utilizing an underexploited resource, effectively reducing industrial food waste. Consequently, shrimp head masala powder served as a viable, flavor-enhancing ingredient for noodle formulations, demonstrating a successful model for waste valorisation in the food industry.

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