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Amino acid profile of purple sea urchin shell (Salmacis Virgulata, L. Agassiz and Desor 1846)

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ABSTRACT

This study evaluated the presence of essential and non essential amino acids present in the purple sea urchin shell Salmacis virgulata. Sea urchins were collected and powdered for the amino acid analysis by HPLC. An HPLC method was used to analyse the amino acids in dried purple sea urchin. The resulting amino acids were chromatographed on an RP C18 column with UV detection at 254 nm. The mobile phase was a mixture of 0.14 M sodium acetate buffer, pH 6.2, containing 0.05% triethylamine and 6:4 (v/v) acetonitrile-water, at a flow rate of 0.9 ml min^{-1}.

Key words: Amino acids, HPLC, sea urchin

INTRODUCTION

Sea urchins support important fisheries in several areas of the world [1]. Demand for protein ingredients in aquaculture is expected to exceed supply in the next decade. The growth of the aquaculture industry will also raise the price of feedstuffs [2]. The amino acid composition, in general, is important in two aspects, namely nutrition and flavor [3]. The composition of total amino acids (TAA) affects the nutritional value of the food, while free amino acids (FAA) affect its flavor. In general, amino acids are precursors of many biological compounds, notably proteins, and may act as substrates for energy production. Deficiency or excess of one or more of the amino acids is known to limit protein synthesis, growth or both [4]. Therefore, amino acids should be present in proper balance in the body tissues in order to promote optimum growth, development and health. However, amino acids are not only the building blocks of proteins, but also occur in the free form, thus playing a major role in the taste and sensory aspects of numerous foods [5]. Some species of sea urchins are caught for obtaining their gonads for highly priced sushi foodstuff “Uni” in Japanese traditional cuisine. However, after removal of the edible gonads the residual shells with spines are generally discarded as food waste without further utilization. The shells are known to contain various polyhydroxylated naphtoquinone pigments, spinochromes [6, 7] as well as their analogous compound, echinochrome A, of which bactericidal effect was reported [8]. In the present report we described the amino acid profile from the sea urchin shell.

MATERIALS AND METHODS

Sample collection:
Sea urchins were collected in the month of April from Mudasal odai, Tamil Nadu, Southeast coast of India, and transported to the laboratory packed in ice. The soft body and spines were immediately removed and the shell was shade dried and coarsely powdered in a grinder.

Preparation of sample:
Powdered samples were weighed out (1-10 mg) and 50 ml 12%NaOCl per mg of powdered sample was added at room temperature. The powders were left to soak for 48 h and vortexed after 24 h to ensure complete penetration of

the bleaching agent. The 48 h bleaching step is effective for isolating the intracrystalline proteins. After the bleaching agent was removed by washing in ultrapure water and methanol. Then filtered through Whatman no. 1 filter paper to remove solids. The filtrate was diluted to 25 ml with ultrapure water in a volumetric flask and 1 ml of the resulting liquid was used for the amino acid analysis.

Amino acid analysis:

The amino acids profile was analyzed by using high performance liquid chromatography (Shimadzu's LC-20AT HPLC). Twenty µl of sample was injected manually in HPLC equipped with RP C18 column and UV-VIS detector was used. The mobile phase was a gradient prepared from two solutions, A and B. Solution A was 0.14 M sodium acetate buffer containing 0.05% (v/v) TEA (pH adjusted to 6.2 with glacial acetic acid). Solution B was 6:4 acetonitrile: water. The flow rate was 0.9 ml min^{-1} and the detection wavelength is 254 nm. The study was conducted in the month of May 2012 at A to Z labs Ambattur, Chennai, Tamilnadu, India.

RESULTS AND DISCUSSION

The amino acid profile of the standard (Table 1) compared with the amino acid profile of the purple sea urchin shell is revealed by the chromatogram. The chromatogram (Table 2) revealed the presence of essential amino acids are Isoleucine, Leucine, Lysine Methionine, Phenylalanine, Threonine, Tryptophan, Valine and Histidine are present in the sea urchin shell.

The ideal dietary AA profile can be defined as the one that will allow for optimal protein growth [9, 10, 11]. Therefore, this profile depends on the AA profile of the proteins being synthesized and which AA is used for energy dissipation or for other metabolic purposes [12, 13, 11]. Sea urchin shell is a good source of amino acids.

Table 1: Amino acid profile of standard

No.	COMPONENT NAME	R.T	AREA	AREA%
1.	ASPARTIC ACID	4.05	11576	0.196
2.	GLUTAMIC ACID	6.42	1964	0.0295
3.	ASPARAGINE	9.27	1162	0.021
4.	SERINE	10.25	104675	2.048
5.	GULTAMINE	11.74	83054	1.593
6.	GLYCINE	13.46	661248	15.66
7.	THREONINE	14.99	224752	3.568
8.	ARGININE	18.02	763457	12.864
9.	ALANINE	19.55	409452	7.204
10.	CYSTINE	21.72	429425	7.55
11.	TYROSINE	24.87	304541	5.33
12.	HISTIDINE	27.24	16572	0.521
13.	VALINE	29.95	512046	10.149
14.	METHIONINE	31.31	49952	0.981
15.	ISO-LEUCINE	36.6	487512	7.894
16.	PHENYL ALANINE	37.99	350642	4.861
17.	LEUCINE	39.33	991254	16.5
18.	LYSINE	43.5	1249	1.349
19.	PROLINE	45.13	349	0.657
20.	TRYPTOPHAN	46.14	562	0.685
21.	TAURINE	47.34	284	0.439
			5405728	100.100

Table 2: Sea urchin shell amino acid profile

No.	COMPONENT NAME	R.T.	AREA	AREA %
1	ASPARTIC ACID	4.06	98154.3	5.366
2	GLUTAMIC ACID	6.41	3346.6	0.2064
3	ASPARAGINE	9.2	185	0.0078
4	SERINE	10.21	432	0.004
5	GULTAMINE	11.56	1320	0.125
6	GLYCINE	13.3	25494	1.368
7	THREONINE	14.96	197242	7.277
8	ARGININE	18.06	346452	18.686
9	ALANINE	19.5	288	0.002
10	CYSTINE	21.7	382412	19.322
11	TYROSINE	24.99	1688	0.102
12	HISTIDINE	27.21	879	0.121
13	VALINE	29.91	336542	20.513
14	METHIONINE	31.44	1182	0.079
15	ISO-LEUCINE	36.33	35152	1.672
16	PHENYL ALANINE	37.92	38654	1.879
17	LEUCINE	39.33	3015	0.145
18	LYSINE	43.45	48254	2.589
19	PROLINE	45.2	96	0.002
20	TRYPTOPHAN	46.2	384564	20.532
21	TAURINE	17.33	105	0.002
			1905456.9	100.000

Figure 1: Standard amino acid profile chromatogram

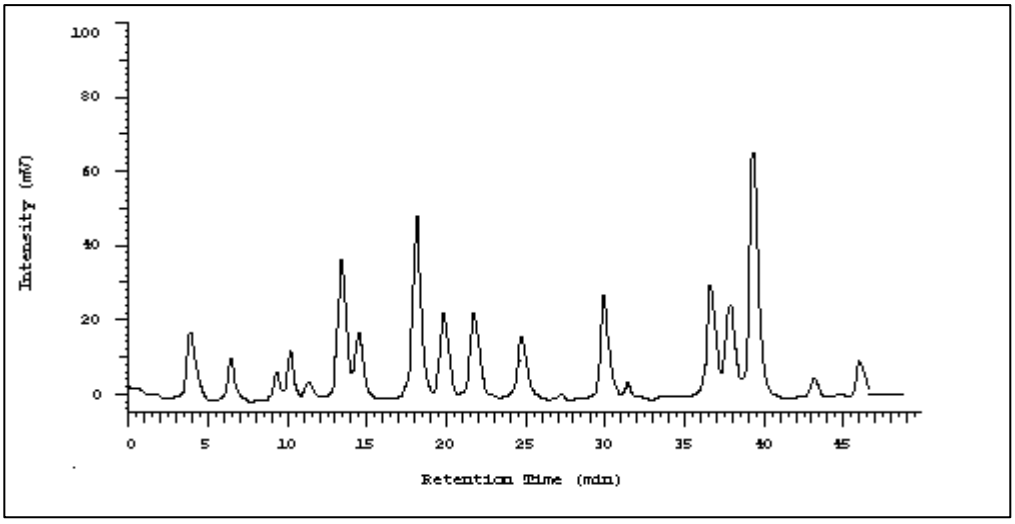
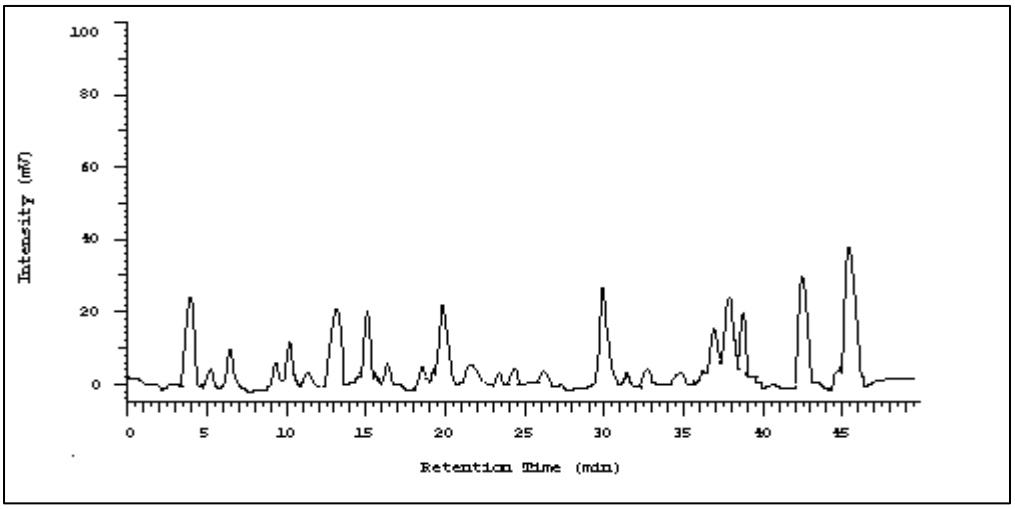


Figure 2: Sea urchin shell amino acid profile chromatogram



CONCLUSION

If there is a increasing in the protein levels of sea urchin, it promotes the crucial to reproductive performance and the development of specific tissues then this should be an important consideration. The present study revealed that sea urchin shell will be a good feed in the aquaculture industry due to the presence of essential amino acids.

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