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Determination Of Proximate Composition And Crude Yeild Of Shrimp Shells (*Peneaus Semisulcatus*)

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Abstract:

The present study was carried out to determine the proximate composition of green tiger prawn and to select the suitable solvent system for carotenoid extraction. Samples (*P. semisulcatus*) were purchased from the landsites and transported to the laboratory in an ice box. The whole shrimp were peeled manually, and the residues, consisting head, tail and shells are separated. The moisture content, total lipid, protein, and ash content were quantified using standard methods. Weight of extracted crude of shrimp shells and retention factor (Rf) for the shrimp shell powder were determined using different pure and mixed organic solvents. Moisture content of the fresh shrimp shells was found to be 76.40 ± 0.92 %. In the present study, quantification showed that the shrimp shells are significantly rich in ash content (25.52 ± 0.06 % in dry weight). Significantly ($p < 0.05$) the highest crude yield of 10.24 ± 0.02 % was obtained from shrimp shells, when the dried shrimp shells powder was dissolved with the mixture of acetone and ethanol (1:1) than the other solvents. The lowest crude yield (2.32 ± 0.01 %) was extracted with ether. The highest Rf was obtained when the shrimp shell crude was dissolved with the mixture of acetone and ethanol (1:1). It can be recommended from our findings that the dried shrimp shells of *Peneaus semisulcatus* would be directly utilized for formulations of poultry animal feeds and sea cucumber juvenile feeds due to its high ash content. The mixture of the acetone and ethanol (1:1) would be the better choice for obtaining the highest crude yield from the shrimp shells.

Keywords: Crude yield, *Peneaus semisulcatus*, Proximate composition

1. Introduction

Vast quantities of shrimp wastes generated in the processing industries all over the world are about 40–50% of its total weight depending on the species (Ogawa et al., 2007). The shrimp aquaculture production has undergone dramatic increase in recent years, which was 6,028 metric tons for the year 2016, showing a growth rate of 50% between 2012 and 2016 (NARA, 2016). The discarded waste gave many environmental pollution problems and these wastes are preferable substrate for microbial growth.

The shrimp waste contains several bioactive compounds, such as chitin, pigments, amino acids, and fatty acids. These bioactive compounds have a wide range of applications including medical, therapies, cosmetics, paper, pulp, and textile industries, biotechnology, and food applications (Kandra et al., 2012).

Due to the increased global production and consumption of shrimp, the seafood industry is focused on an appropriate destination and/or reuse for this waste, since its improper disposal, without any attempt to use it causes a serious environmental problem.

This study mainly focuses on determination of proximate composition of the green tiger prawn and to selection of suitable solvent for the extraction of carotenoid.

2. Methods

Samples (*P. semisulcatus*) were purchased from land site, Jaffna, Sri Lanka and transported to the laboratory in an ice box. The whole shrimp were peeled manually and the residues, consisting head, tail and shells were separated.

2.1. Proximate composition

A portion of the raw waste were dried to find moisture content. According to the AOAC (2006) methods, moisture was quantified by oven-drying at 105 ^{o}C (AOAC, 950.46). Rest of the raw waste was dried in an oven at 80 °C for 8 hours and then ground using grinder. Total fat, crude protein, and crude ash was determined by using the Soxhlet extraction (AOAC, 991.36), micro-Kjeldahl procedure (AOAC, 928.08) and incineration in a muffle furnace at 550^{0}C (AOAC, 920.153) , respectively for dried shrimp shell powder.

2.2. Selection of solvents for carotenoid extraction

Different organic solvents, such as acetone, hexane, ether and ethanol were selected to identify the suitable solvent for carotenoid extraction from the shrimp shell powder. The selected solvents were mixed in different ratio. One gram of shrimp shell powder was dissolved separately with the solvents/solvent mixture using vortex mixture and filtered using filtration apparatus. The filtrate was then allowed to evaporate in a fume hood. Final weight of crude was measured. Then the TLC experiment was performed by spotting the crude was on a TLC plate to determine the Retention factor (Rf).

2.3. Data analysis

All data on proximate compositions, crude weight, and retention factor of shrimp shell power are expressed as means ± SD. All statistical tests are performed using the R 3.6.1. statistical software.

3. Results and Discusion

3.1. Proximate composition

Table 1: Proximate chemical composition of shrimp (Peneaus semisulcatus) shell powder

Components	Composition (%) (mean ± SD)
Moisture	76.40 ± 0.92
Ash (in DW)	25.52 ± 0.06
Total Lipid (in DW)	0.85 ± 0.03
Total Protein (in DW)	5.44 ± 0.69

DW : Values on a dry weight basis

Table 1 shows the chemical composition of the shrimp shells. Moisture content of the fresh shrimp shells was found to 76.40 ± 0.92 %. Ash (25.52 ± 0.02 %) obtained showed that the shrimp shells were significantly rich which is in good agreement with the values reported in the literature. Emmanuel et al. (2008) reported 28.50% of ash in the shells of *Penaeus notabilis* shrimp collected from Lagos lagoon. In contrast, Nargis et al. (2006) found protein in highest composition (49.47 %) in a mixture of residues of the shrimp shells from the species *Penaeus monodon* and *Macrobrachium rosenbergii*. Even though the composition of the ash was not analyzed, various other studies suggest that the predominant macro elements in the shells of northern pink shrimp (*Pandalus borealis*) are calcium, phosphorous, sodium, potassium and magnesium, plus some other minerals in smaller amounts, such as iron, nickel, zinc and manganese (Heu et al., 2003; Rødde et al., 2008).

3.2. Selection of solvents for carotenoid extraction

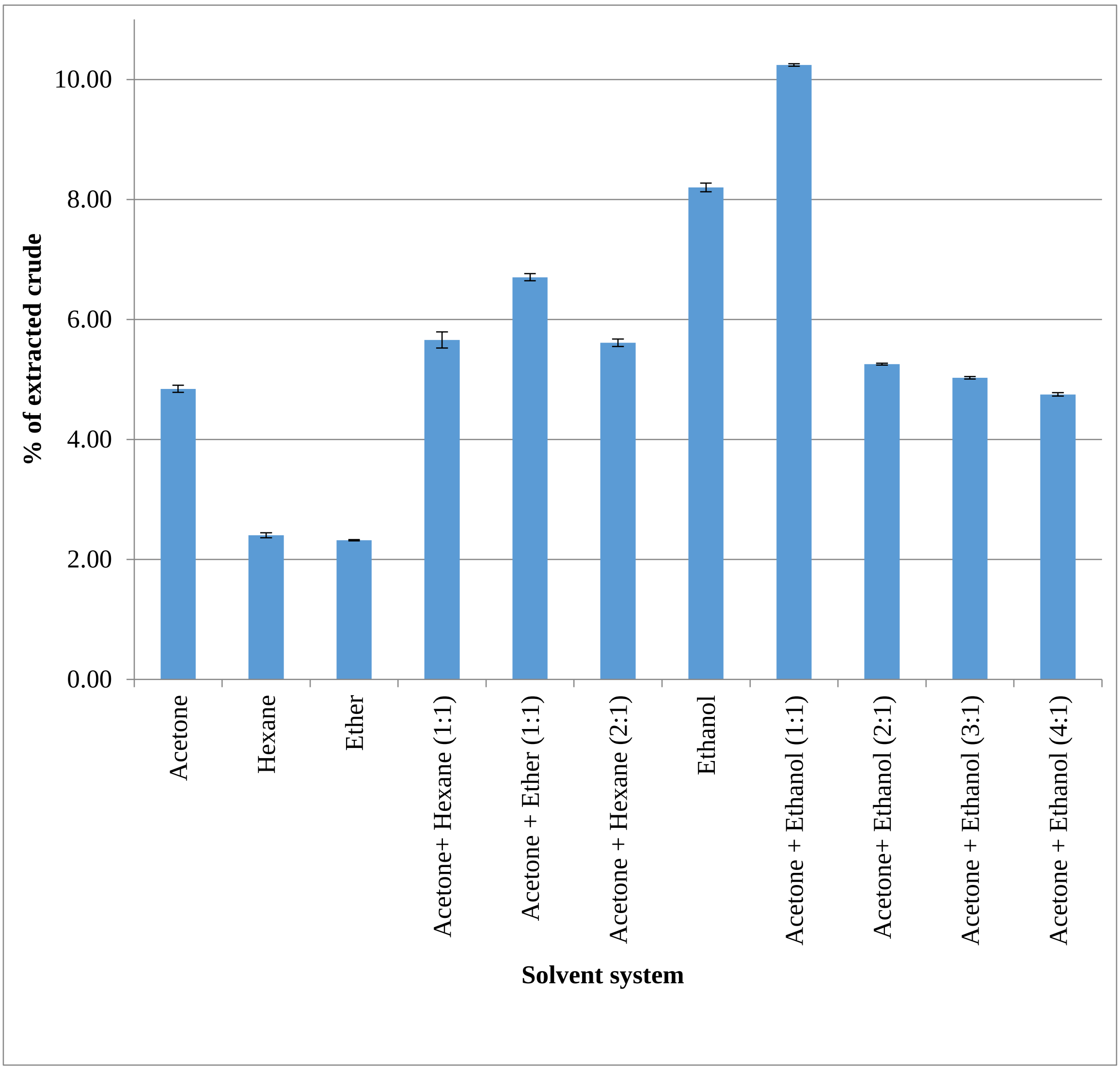

Figure 1: Percentage of crude extracted using different solvent system

Significantly ($p < 0.05$) the highest crude yield (10.24 ± 0.02 %) was obtained from shrimp waste when the dried shrimp shells powder was dissolved with the mixture of acetone and ethanol (1:1) than the other solvents (Figure 1). The lowest crude yield of 2.32 ± 0.01 % was attained when ether was used as solvent (Figure 1). Similar results reported by Sachindra et al. (2006) showed that the extraction of carotenoids from shrimp wastes (*Penaeus indicus*) can be done by different organic solvents. In addition, the authors showed that polar solvents, such as

IPA/hexane (43.9 mg/g), acetone (40.6 mg/g), and IPA (40.8 mg/g) lead to a better result compared to nonpolar solvents.

Although Britton (1985) recommended polar organic solvents particularly acetone for the carotenoid extractions from dried tissues, this study reveals that mixture of acetone and ethanol (1:1) is the best solvent system, when compared with the acetone used for the extraction.

Table 2 : Retention factor (mean ± SD) calculated for crude of shrimp shell powder using different solvents

Solvents	Acetone	Hexane	Ether	Acetone+ Hexane (1:1)	Acetone + Ether (1:1)	Acetone + Hexane (2:1)	Ethanol	Acetone + Ethanol (1:1)	Acetone+ Ethanol (2:1)	Acetone + Ethanol (3:1)	Acetone + Ethanol (4:1)	Acetone + Hexane (1:1)	Acetone+ Ether (4:1)
Rf	0.87 ± 0.03	0.28 ± 0.17	0.76 ± 0.03	0.84 ± 0.00	0.93 ± 0.01	0.93 ± 0.00	0.95 ± 0.02	0.91 ± 0.00	1.00 ± 0.00	0.87 ± 0.00	0.98 ± 0.02	0.83 ± 0.01	0.95 ± 0.01

In the present study, TLC of the crude extract showed different distinct bands. The highest Retention factors (Rf) were obtained for the shrimp shell crude dissolved with the mixture of acetone and ethanol (Table 2), which were being 1 and 0.91 for the mixture of acetone and ethanol (2:1) and the mixture of acetone and ethanol (1:1), respectively.

4. Conclusions:

In the present study, the proximate analysis of the dried shrimp shells showed it to be an important source of minerals (ash). The highest crude yields obtained from dried shrimp shell powder were achieved using the mixture of acetone and ethanol (1:1).

5. Recommendations:

It is recommended from the findings of this study, the dried shrimp shells of *Peneaus semisulcatus* would be directly utilized for formulations of poultry animal feeds and sea cucumber juvenile feeds due to the high ash content of the shrimp shells. The mixture of the acetone and ethanol (1:1) would be the best solvent choice for obtaining the highest crude yield from the shrimp shells.

6. Acknowledgement

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