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Research Article

Determination of Bioavaibility of Cr, Co, Ne, Fe, Se, As, Pb From *Sargassum Paniculatum*

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Abstract

Objective: This study is about the determination of bioavailability of Cr, Co, Ni, Fe, Se, As and Pb and Nutritional content of *Sargassum Paniculatum* including crude fat, moisture, crude fiber, carbohydrates and protein analysis. **Material and Method:** Physical properties including boiling point, color, density, odor, and solubility test was also determined. As for chemical properties, ash content was also determined. **Conclusion**: The researcher recommends introducing more study on chemical properties, and continued study on the procedure in medical application.

Introduction

For several centuries there has been a traditional use of seaweeds as food in China, Japan and the Republic of Korea. As people from these countries have migrated around the world, this custom has moved with them, so that today there are many more countries where the consumption of seaweed is not unusual. Coastal dwellers in tropical climates such as Indonesia and Malaysia have also eaten fresh seaweeds, especially as salad components. Seaweeds are photosynthesis organism important to their ecosystem since they release O_2 into seawater and contribute to carbon fixation and nutrient cycling. Seaweeds are major coastal resources which are valuable to human consumption and environment in many countries. Edible seaweeds were widely consumed, especially in Asian countries as fresh, dried, or ingredients in prepared foods. Compared to the land plants, the chemical composition of seaweeds has been poorly investigated and mostly of the information only deals with traditional Japanese seaweeds. The chemical composition of seaweeds varies with species, habitat, maturity and environmental conditions.

In recently years, seaweed called ancient super food and was our ancestor's secret to health and longevity. Seaweed draws an extraordinary wealth of mineral elements from the sea that can account for up to 36% of its dry mass. This food is high in iodine, calcium, magnesium, iron, vitamins C and A, protein, Vitamins B, fiber and, alpha linoleic acid, EPA, and so much more. Seaweeds do have some very specific characteristics. Whether they're microscopic organisms of massive of structures, many feet long, seaweeds don't have the same internal structures that land-dwelling plants have. Seaweeds may or may not have roots, but when they do these roots (holdfasts) are solely to anchor the plant to an underwater surface rather than to absorb any nutrients. Seaweeds absorb their nutrients through their leaf-like tissues.

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One of this, the S. Paniculatum, a genus of Sargassum belonging to the class Phaeophyceae in the order Fucales and a family of Sargassaceae. *S. paniculatum* is brown seaweeds, normally brown to yellowish with a length up to 10cm. It is an autotroph that uses energy from sunlight. The photosynthesis is facilitated thanks to aerial an vesicle which allows the algae to raise to the surface. S. Paniculatum found throughout tropical areas of the world and are often the most obvious macrophyte in near-shore areas where Sargassum beds often occur near coral reefs.

For this reason, the researcher is interested in determining of nutritional content of bioavaibility of Cr, Co, Ne, Fe, Se, As, Pb from S. Paniculatum .

METHODOLOGY

Preparation of Sargassum sample

The raw seaweeds were collected in Urdaneta beach, Lavezares, Northern Samar. The samples as washed in seawater and placed in plastic bags and was put on an ice box and then transported to the laboratory where the tests were conducted. At the laboratory, samples were washed with sea water to remove sands and other impurities, then, were washed with distilled water dry and group into two. One group of raw seaweeds were undergo dried and pulverization and the other were cooked before pulverize.

Seaweed Extraction

Freshly picked seaweeds washed with tap water and rinsed with distilled water to remove the visible dirt and other impurities then cut into pieces. 20 g of this finely incised seaweed was transferred to a 250 mL beaker with 200 ml distilled water in it and boiled for 20 min. The extracts were then filtered to obtain a clear solution and remove particulates, then put into 250 mL Erlenmeyer flask and refrigerate 4ºC for further experiments.

Determination of Physical Properties

For boiling point, 2 mL of S. Paniculatum extract was poured in a test tube. The test tube is submerged in an oil bath and the temperature was recorded as soon as the sample extract boils. Colour and odour of the sargassum extract were observed and identified by three respondents. The density was determined by weighing 2 mL of extract in an analytical balance. The weight of the extract was recorded and divided by the volume of S. Paniculatum extract used. The pH was determined using digital pH meter, it was done in three replicates. Solubility test of S. Paniculatum extract was tested in three different solvents namely hexane, water and ethanol. Two (2) mL of S. Paniculatum extract was poured in three different separated test tubes. Then, add 2ml of hexane, water, and ethanol in each separate test tube.

Chemical property determination

Ash content

To determine the ash content of S. Paniculatum, three crucibles were marked, with five grams of the said sample in each test tube. The sample was heated in an oven for almost 3 hours. After heating the three crucibles placed in a desiccator for 30 minutes and weighed. The crucible containing sample was heated in Bunsen burner until ash resulted. This was removed placed in a desiccator for 30 minutes and reweighed. The Ash content was computed using the formula (Horwitz et al, 2000):

$$\text{Ash content } \% = \frac{W3-W1}{W2-W1}\ x\ 100$$

Nutritional content determination

Carbohydrates

Calculation of carbohydrates for S. Paniculatum extract was determined by adding the moisture content, protein, fat and result was subtracted from 100% carbohydrates content of S. Paniculatum extract was calculated using the equation *(*Wang, et al, 2006):

Total carbohydrates= 100 - (% fat + % moisture + % protein)

Moisture Content

To determine the moisture content of S. Paniculatum, (10) g of sample was placed in the preheated, cooled and weighed crucibles in the

drying oven for 12 hours at 105ºC. The crucibles were cooled in desiccator for 30 minutes and were weighed. Three trials were made **(Cockerell et al, 2000)**.

Moisture content was calculated by the following formula:

$$\text{Moisture Content \%} = \frac{g\ sample\ before\ drying - g\ sample\ after\ drying}{g\ sample\ before\ drying} x\ 100$$

Crude Fat

To determine the fat content of S. Paniculatum the researcher used Soxhlet method. Crude fat content was determined by extracting the fat from the sample using a solvent. The flask was washed with hexane and dry in oven for 30 minutes at 102^0C. The flask was cooled, weighed and recorded. Afterwards, it was placed with 100 mL benzene. Twenty grams of powder S. Paniculatum was weighed.

The solvent was continued to heat in the flask for six hours, maintained by high temperature that the solvents dripped from condenser into sample. The flask was placed in the oven at 120ºC for one hour, then placed in the desiccator and weighed. The fat content of the sample was measured using the:

$$\text{Crude Fat \%} = \frac{W2-W1}{S} \times 100$$

Protein

The crude protein content (N X 4.38) of the samples was determined and analyzed at the University of the Philippines- Los Baños, Laguna.

Fiber (Cockrell et, al, 2000)

The determination of Crude fiber has two steps. The first step, the sample was defatted using soxhlet method. Five grams of defatted sample was weighed. In the step two, it was placed in the flask and was added with 67mL boiling sulfuric acid solution. It was boiled for 30 minutes, maintaining the volume of distilled water at constant and swirling the flask periodically to remove the particles adhering to the side of the flask. Buchner funnel was lined with the filter paper, and preheated by boiling water. At the same time, at the end of boiling period, the flask was removed, cooled for one minute and the contents were filtered and carefully suction in the Buchner funnel with filter paper. Filtration was carried out in less than ten minutes. The filter paper was washed with the residue of boiling water. The residue was transferred to the flask using retort containing 67 mL of boiling NaOH solution and boiled for 30 minutes as in step 2.

The crucible was carefully preheated with boiling water. Hydrolyzed mixture was filtered after cooling for one minute. The residue was washed with boiling water, with HCl solution, and then washed again with boiling water. Finishing with 3 washes of hexane, the crucible with sample content was placed in drying oven at 105^0C for one hour, cooled in at the desiccator. The crucible was weighed quickly with the residue. It was burned for three hour, then placed in the desiccator for 30 minutes and weighed. Crude fiber content was calculated by the following formula;

$$\text{\% fiber} = \frac{weight\ of\ ash\ obtained}{weight\ of\ original\ sample} x100$$

Elemental determination

Total metal determination was performed using Energy Dispersion X-ray (EDX) and Atomic Absorption Spectroscopy (AAS). Seven elements have been quantified and standard solutions were used to correct possible matrix effects and signal drift.

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RESULTS AND DISCUSSION

Physical properties Determination

Table 1. Physical properties of the S. Paniculatum extract

Properties	Trial 1	Trial 2	Trial 3	Average
Boiling point	88℃	90℃	95℃	91℃
Color	Brown	Light brown	Light brown	Light brown
Odor	Unpleasant	Unpleasant	Unpleasant	Unpleasant
Density (g/mL)	4.44	4.46	4.52	4.47
pH	6.72	6.73	6.70	6.72
Solubility:				
Hexane	Immiscible	Immiscible	Immiscible	Immiscible
Water	Miscible	Miscible	Miscible	Miscible
Ethanol	Miscible	Miscible	Miscible	Miscible

Chemical property determination

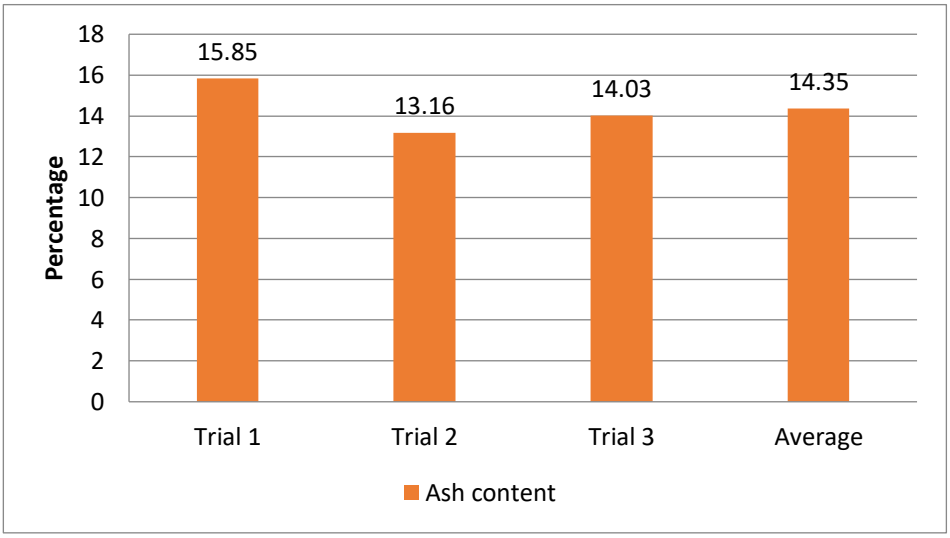

Figure 1. Ash content of S. Paniculatum *extract*

The ash content of S. Paniculatum determined by burning a given quantity of samples under prescribed condition and measuring residue. The table shows that the average ash content of S. Paniculatum is were found 14.35%. The ash content represents the total mineral content in food and it implies that S. Paniculatum has high mineral content.

Determination of Nutritional Content

Table 2. Nutritional content of the S. Paniculatum extract

Properties	Trial 1	Trial 2	Trial 3	Average
Moisture content	20.7%	20.5%	20.1%	20.4%
Crude fiber	22%	23%	25%	23%
Crude fat	0.645	0.633	0.637	0.638
Crude Protein	0.645	0.633	0.637	0.638

The determination of Crude fiber was found an average of 23% in S. Paniculatum. Fiber helps lower cholesterol and blood sugar regulation (The Journal of the American Board of family medicine). The fats determined of S. Paniculatum after the extraction of the solvent was evaporated, the residue weighed and reported as percent of crude fat. The average fat of S. Paniculatum was found 0.638.

Carbohydrates

Carbohydrate content was calculated based on difference calculation [% Carbohydrate = 100% - (% moisture + % ash + % crude fibre + % crude protein + % fat)] (Wang et. al., 2006) and the result showed in table 3.

Table 3. Percent of Carbohydrates Control in *S. Paniculatum*

Total % fat	Total % fiber	Total % Moisture	Total % Protein	Total % Carbohydrates
0.05%	23%	20.4%	0.64%	55.52%

Vitamin C

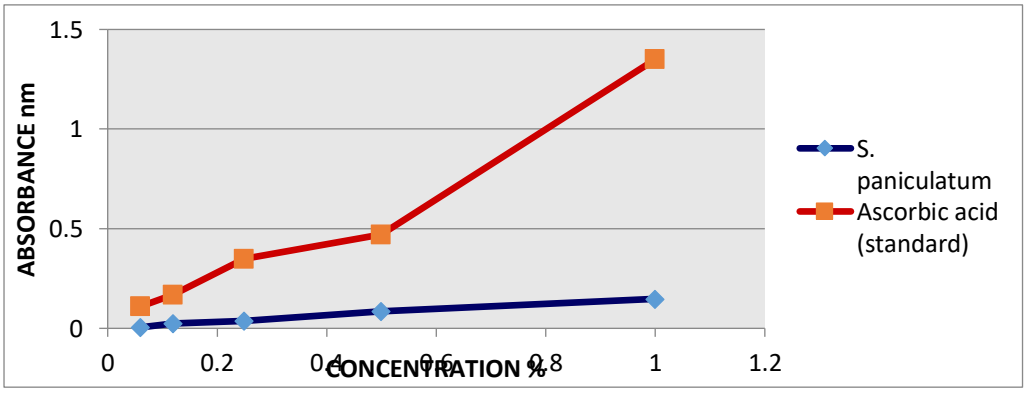

Figure 2. Absorbance of Vitamin C.

Elemental analysis of seaweed sample

The bioavailability of elements evaluated in the different species of seaweeds reveals that for the seven elements quantified in different species of seaweeds, results have shown that the collected species contain a considerable amount of essential elements, but some species was also accumulated.

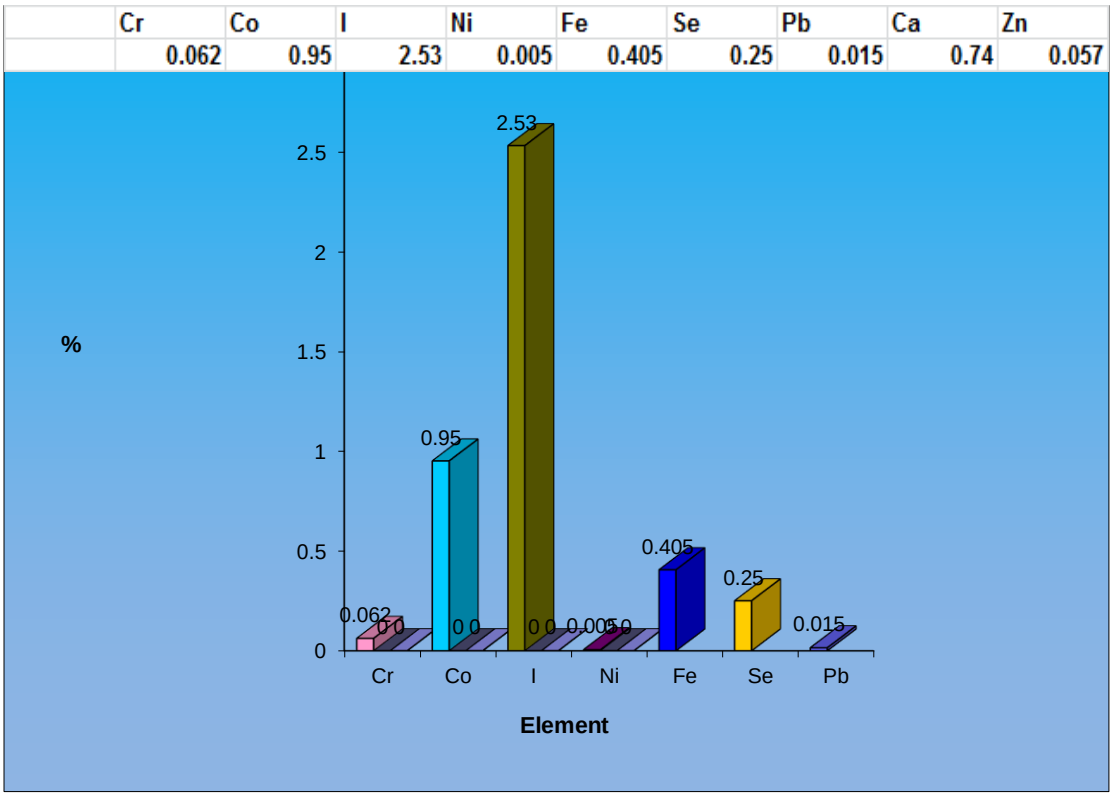

Figure 3. Elemental Analysis

CONCLUSION

This study, answer the physical, chemical, nutritional and bioavailability of Cr, Co, Ni, Fe, Se, As, and Pb, of S. Paniculatum that was collected at Lavezares, Northern Samar. The result showed that the *S.* P*aniculatum* have a high percentage of essential elements were Iodine which is required for synthesis of thyroid hormones, thyroxine and triiodothyronine. Cobalt which is required in the synthesis of several vitamins. Calcium, which is needed for muscle, heart, bones and function of blood cells. Iron, is required for many proteins and enzymes and haemoglobin to prevent anemia. Selenium which is essential to activity of antioxidant enzymes like glutathione peroxidase and Zinc which is pervasive and required for several enzymes such as carboxypeptidase, liver alcohol dehydrogenase, and carbonic anhydrase. And was fund to have metals Chromium, Nickel and Lead which are known to have hazardous effects on humans.

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