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Study the accumulation of minerals and heavy metals in *Ulva algae, Cladophora, Polysiphonia* and *Laurencia algae* samples at eastern north region of Libya coast

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Abstract

Different minerals including (Na^+, K^+ and Ca^{++}) in addition to (iron and copper) were determined in different algae samples collected from some region at Al –Gabal Al –Khder coast region (Libya). The algae samples including (*Ulva algae, Cladophora algae, Polysiphonia algae and Laurencia algae*).The mineral contents were measured by Flamephotometer, while the (iron and copper) levels were estimated by spectrophotometeric method. The results showed variations between the contents of the studied algae samples. Where the results showed that the contents of sodium, calcium and potassium were fluctuated in the ranges of: (24 – 91 µg/ g) (4 – 13 µg/ g) and (3 – 16 µg/ g), respectively. While the contents of iron and copper were ranged between: (0.14 - 1.64 µg/ g) and (0.21 - 2.27 µg/ g), respectively.

Keywords: Minerals; *Ulva algae; Cladophora algae; Polysiphonia algae; Laurencia algae*

1. Introduction

Marine macroalgae are, commonly known as seaweed, one of nature's most biologically active resources, as they possess a wealth of bioactive compounds. Many marine macroalgae have been used as ingredients in both medicinal and food preparations, traditionally, in different regions across the world (Chandini et al., 2008).

Marine algae are known to be a source of healthy food due to their low content in lipids, high concentration in polysaccharides, richness in minerals, polyunsaturated fatty acids and vitamins (Kornprobst, 2005; Zubia et al., 2009). There are 250 macroalgal species which have been listed as commercially utilized worldwide, among which 150 are consumed as human food (Veena et al., 2007).

Macroalgae are a rich source of dietary fiber, of which water-soluble fiber constitutes approximately 50–85% (Jiménez-Escrig and Sánchez-Muniz, 2000). Soluble dietary fiber lowers digestion and absorption of nutrients, and lowers cholesterol and glucose in blood (Wong and Cheung, 2000). Insoluble dietary fiber increases fecal bulk and decreases intestinal transit time (Potty, 1996). Together with their low lipid content, seaweeds provide low energy (Jurkovic et al., 1995) and lower the incidence of diabetes, obesity, heart diseases, and cancers (Southgate et al., 1990).

Essential minerals needed for human nutrition are present in marine algae (Mabeau and Fleurence, 1993; Ortega et al., 1993). The content is ranged from 8 to 40%. This wide range is related to division, geographical location (Abbas et al., 1992; Rizvi et al., 2001), seasonal (Basson and Abbas, 1992), and physiological variations (Mabeau and Fleurence, 1993). In marine algae, mineral content is higher than that of land plants and animal products (Ortega et al., 1993). In most land vegetables, ash content ranges from 5 to 10% of dry weight (USDA, 2001).

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Publications (e.g. Abbas et al., 1992; Basson and Abbas, 1992; Rizvi et al., 2001) indicated that marine seaweeds contained high amounts of K, Ca, Mg, Fe, Zn, Mn, and Cu. According to Matanjun et al. (2009), these seaweeds contained 12.01–15.53% macro-minerals (Na, K, Ca and Mg) and 7.53–71.53 mg.100 g trace minerals (Fe, Zn, Cu, Se and I).

This work aimed to determinate the contents of some minerals (sodium, potassium and Calcium) and some heavy metals (iron and nickel) in some different marine algae samples collected from al – Gabal Al –KHDAR coast region during autumn 2018.

2. Materials and methods

2.1. Sampling

Four different types marine algae samples which collected from Al –Gabal Al –Khder coast. from beaches of Sousa and El - Hanieh tonus (Libya) during autumn 2018, the samples including (*Ulva algae*, *Cladophora algae*, *Polysiphonia algae* and Laurencia algae).Table (1).

Table 1 The studied algae samples

Samples	**Name sample**
1	*Laurencia algae*
2	*Polysiphonia algae*
3	*Cladophora algae*
4	*Ulva algae*

2.2. Glass wears

Before the starting in the experimental part of this all the glass wears which using in this study were washed several times with distilled water, then dried in oven, the glass wears including (conical flasks, measuring flasks and funnels)

2.3. Samples preparation

The samples were washed with distilled water several times and dried for many days at 95 ^{o}C and samples were than crushed, prepared before the analysis by designed method. Aliquot 0.5 gram of each sample was designed with 5 ml of concentrate nitric acid until dryness, than about 20 ml of distilled water was added, the samples were heated then filtered, the volume then completed in measuring flask (100 ml), Minerals and heavy metals: Ca, Na and K, were measured by used flamphotometer, while Fe and Ni were measured by spectrophotometer by using 1, 10 phenanatholien and di- methyl glycoxim, respectively, at central lab of faculty of science. Omar Al – Mukhtar University

3. Results and discussion

The classification and taxonomy of the studied algae samples were shown in Table (2) :

Table 2 The classification and taxonomy of the studied algae samples

Names / **Division**	***Ulva algae***	***Cladophora algae***	***Polysiphonia algae***	**Laurencia algae**
Division	Chlorophy	Chlorophyta	rhodophyta	rhodophyta
Order	Alvales	Cladophoraceae	ceramiales	ceramiales
Family	ulvaceae	Chlorophceace	cetamiceace	rhodomelaceae
Genus	Ulva	Cladophora	polysiphonia	laurencia

3.1. The Minerals

The results which recorded in this study showed that the levels of sodium of the selected samples were fluctuated in the range of (24 – 91 µg/ g), where the results recorded that all samples containing high levels of sodium. Also the results showed that the contents of calcium and potassium were fluctuated in the ranges of (4 – 13 µg/ g) and (3 – 16 µg/ g), respectively. The results of minerals were given in Table (3) and represented in Figures of (1, 2 and 3).

Among all the minerals calcium plays a vital role in maintaining structure of the body, calcium is most abundant mineral in human body and it is important for formation of bones, teeth, coagulation of blood. These minerals (Na, K) are responsible for the maintenance of body fluid balance.

The obtained results showed wide variations, where the sodium values were high compared with the other minerals. Also the results recorded variations between the studied alages, Laurenica algae species contained high values of sodium (91 µg/ g) followed by Polysiphnia algae (72 µg/ g). In contrast, the Ulva species record low values of sodium (24 µg/ g). Sodium is the most abundance element in aquatic environment, therefore, this may be was found in the algae samples in high content. The values of potassium of the studied algae samples showed small variations, where the high value was recorded in polysiphnia species (16 µg/ g), while the low values was recorded in Ulva species.

On the other side the high values of Calcium was recorded in Laurencia algae comparison with the low value which recorded in Ulva species. The results were given in Table (2) and representative and Figures (1, 2 and 3).

Table 3 The concentrations (µg/ g) of the minerals in the studied sample

Sample/ Metal	*Ulva algae*	*Cladophor algae*	*Polysiphonia algae*	**Laurencia algae**
Sodium	24	40	72	91
Potassium	3	10	16	14
calcium	5	6	4	13

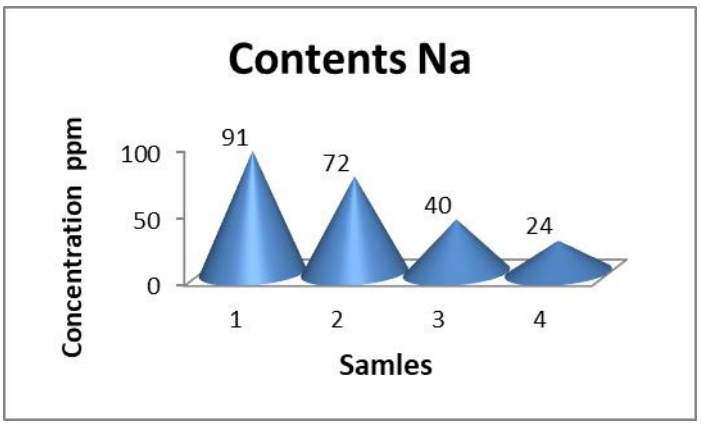

Figure 1 The distribution of sodium in the studied samples

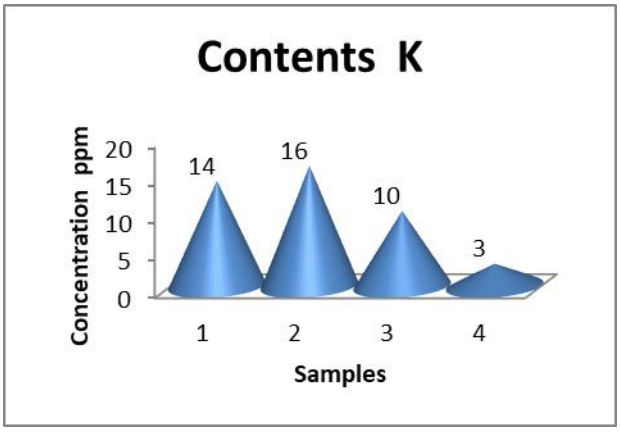

Figure 2 The distribution of potassium in the studied samples

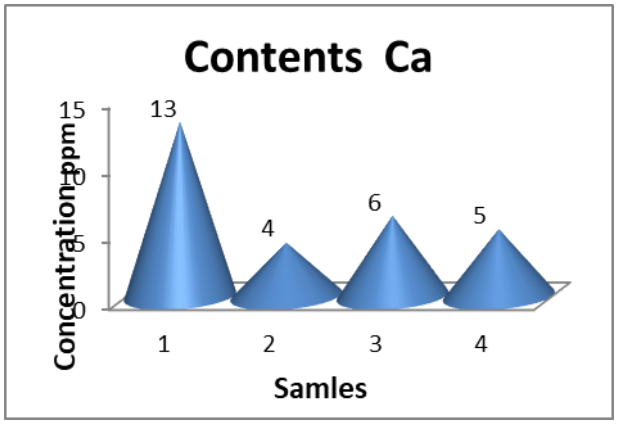

Figure 3 The distribution of calcium in the studied samples

3.2. Heavy Metals (Iron & Nickel)

The results of iron and nickel were shown in Table (4) and Figures(4 &5), The results indicated that the studied algae samples containing different values of iron and nickel, and ranged between (0.14 - 1.64 µg/ g) and (0.21 - 2.27 µg/ g), respectively, Table (4).

Table 4 The contents of iron and nickel in the algae samples.

Sample /Metal	*Ulva algae*	Cladophor algae	*Polysiphonia algae*	Laurencia algae
Iron	0.78	1.64	0.17	0.14
Nickel	0.21	0.24	0.23	2.27

The high content of iron was recorded in Cladphor algae sample, whereas the low content was recorded in laurencia algae, also the results showed that the highest value of nickel was recorded in launrenica species. while the other values of nickel were low. The presence of heavy is mainly coming from different sources as wastes of out let, ships or other sources of industries, also the presence high values of heavy metals is concern to the accumulation of these metals in the marine aquatic and it is source of pollution, in this study high values of nickel and iron give indication to pollution by the studied metals in the area under investigation, and mostly coming from the human activity at the susa and el Haniea tonus.

4. Conclusion

According to the results which recorded in this study, there are high contents of sodium in the studied marine algae samples, also small amounts of calcium and potassium were recorded in most of the studied samples. Also the results recorded that : high values of iron and nickel in some species of the studied algae.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest.

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