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*Full Length Research Paper*

# Comparison of East African and Iran natural feeding condition based on the chemical and biochemical properties of lake algae

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**In the present world where pollutants like chemical fertilizers affect environmental conditions, a kind of organic fertilizer with enough micro and macro elements is very important. African soil is reported by many researchers to be important and having large capacity due to its nutrition materials. The possible effect of variety soils transported through atmosphere besides sunlight and cloud to the chemical and biochemical compositions of *Cladophora Glomerata* alga is determined for the first time in the scientific world in this study. *C. Glomerata* is one of the important algae that grow in Iran's condition; it has a good content of carbohydrates and lipids. In this scientific work, we used soils from Zanzibar (Tansania region east African), Guilan (north of Iran), Tehran (center of Iran) and two type of soils from Zabol and Saravan regions (southeastern of Iran) in a condition simulated like atmospheric ones. The amounts of reduced Fe, Mn, Cu, Zn, pH, Ec, carbohydrate and lipid were examined. Talaghan Dam water and soil were used as our control. We studied the chemical and biochemical composition of *C. Glomerata* in 5 different feeding conditions, using comparison method. This alga best adapts to Zanzibar, Saravan and Zabol soil feeding conditions as fertilizer compared to other soils.**

**Key words:** *Cladophora glomerata*, biochemical properties, Iran soils, African soils, feeding condition.

## INTRODUCTION

Health and diet are two factors which have acquired particular significance along with scientific and technological advances in medicine. This opens the doors for further discussion on the benefits of nutritional and dietary supplements. The *Cladophora glomerata* is a great example of a dietary supplement (Guiry et al., 2008); studies on effect of macro elements on nutritional values have been reported in Chaetomorpha linum alga (Menendez et al., 2004). Algae are significant source of human food, especially in Asia and are cultivated for nutrition and pigments for supplemental use as human food and animal feed (Promya et al., 2008). Factors such as cell size and shape, rate of ingestion, digestibility and biochemical composition determine the nutritional quality of algae and their utility as food (Whyte, 1987; Doroudi et al., 2003).

Cladophora is a genus of reticulated filamentous Ulvophyceae (green algae). The genus, Cladophora contains many species that are very hard to differentiate and classify mainly because of the great variation in their appearance which is affected by habitat age and environmental conditions. Unlike Spirogyra, the filaments of Cladophora branch and do not undergo conjugation. There are two multicellular stages in its life cycle: a

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**Figure 1.** *Chladophora Glomerata*.

haploid gametophyte and a diploid sporophyte which are highly similar. The only way to differentiate the two stages is to either count their chromosomes or examine their offspring. The haploid gametophyte produces haploid gametes by mitosis and the diploid sporophyte produces haploid spores by meiosis. The only visible difference between the gametes and spores of *Cladophora* is that the gametes have two flagella and the spores have four. The *Cladophora* species can be a major nuisance, causing major alteration to benthic conditions linked particularly to increased phosphorus loading (Taweesak, 2007).

## Scientific classification

Algae grow on underwater rocks and thrive in clear spot water in river basin (Figure 1) (Traichaiyaporn et al., 2010).

A large number of algae are used for human food in their larval stages as crustaceans and some fish species and for zooplankton used in mariculture food chains as live feeds (Brown et al., 1997). Carbohydrates are one of the most important components in many foods. Carbohydrates may be presented as isolated molecules or they may be physically associated or chemically bound to other molecules. Individual molecules can be classified according to the number of monomers that they contain like monosaccharides, oligosaccharides or polysaccharides. Molecules in which the carbohydrates are covalently attached to proteins are known as glycoproteins, whereas those in which the carbohydrates are covalently attached to lipids are known as glycolipids. Some carbohydrates are digestible by humans and therefore provide an important source of energy, whereas others are indigestible and therefore do not provide energy. Indigestible carbohydrates form part of a group of substances known as dietary fiber, which also includes lignin. Consumption of significant quantities of dietary fiber has been shown to be beneficial to human nutrition, reduces the risk of certain types of cancer, coronary heart disease, diabetes and constipation. As well as being an important source of energy and dietary fiber, carbohydrates also contribute to the sweetness, appearance and textural characteristics of many foods. It is important to determine the type and concentration of carbohydrates in foods for a number of reasons (Bellis et al., 2007). The amount of chrbohydrate in algae structure can increase when atmospheric nutrient full of dust is up taken by algae (Ezzati and Iranmanesh, 2011).

Lipids are one of the major constituents of foods and are important in our diet for a number of reasons. They are a major source of energy and provide essential lipid nutrients. Nevertheless, over consumption of certain lipid components can be detrimental to our health like cholesterol and saturated fats. In many foods, the lipid component plays a major role in determining the overall physical characteristics, such as flavor, texture, mouth-feel and appearance. For this reason, it is difficult to develop low fat alternatives of many foods because once the fat is removed some of the most important physical characteristics are lost. Finally, many fats are prone to lipid oxidation which leads to the formation of off flavors and potentially harmful products.

## MATERIALS AND METHODS

This report analyzes the breeding methodology and production rate of *C. glomerata* utilizing common feeding conditions and various soil growth media. The proper growth media applied in this research partly constitute soils collected from East Africa and different regions of Iran; the sources of soil were from Zanzibar (Tansania), Saravan (Iran), Tehran (Iran), Zabol (Iran) and Guilan (Iran), as well as Taleghan Dam (Iran) which is a common and suitable location to grow algae.

The *Chladophora* samples used in this research were provided by the team of Kharazmi University Biological Science Faculty in June 2012. Algae samples were grown in different feeding conditions within the dimensions of 45 by 55 cm.

The soil samples collected from the Tansania around Zanzibar city (6° 9′ 57″ S, 39° 11′ 57″ E), Zabol, Saravan, Tehran and Guilan regions are individually added to bi-distillate water, centrifuged under 2500 rpms for a period of 15 mins, passed through a 0.50 µm membrane filter; and then placed in feeding chambers.

Some biochemical and chemical parameters for example carbohydrate and lipid were determined by standard AOAC (2000) methods and reduced iron, magnasium, zinc, pH and EC were determined by in-house method based on Tee et al. (1991). Laboratory of Environmental Engineering in Kharazmi University Faculty of Biological Sciences was used.

For all analyses, the mean and standard deviation were calculated. Analysis of variance (ANOVA) and Duncan's Multiple Range Test (DMRT) were adopted for statistical analyses and comparative studies of proximate compositions and micro elements under different natural feeding conditions.

## RESULTS

In this study, the value of the physical texture of soil and electrical conductivity were determined (Table 1). In the result, Guilan soils have a large part of sandy soil; Saravan soils texture were determined as clay type and

**Table 1.** Texture properties and electrical conductivity of soils sample

| Soil sample location | Soil texture | Electrical conductivity (µS/cm) |
|---|---|---|
| Guilan (Iran) | Clay%27-Sand%42-Silt%25 | 452 |
| Tehran (Iran) | Clay%46-Sand%31-Silt%23 | 894 |
| Saravan (Iran) | Clay%48-Sand%28-Silt%24 | 11569 |
| Zabol (Iran) | Clay%44- Sand%30-Silt%26 | 15780 |
| Zanzibar (Tanzania) | %28Clay-Sand%39-Silt%23 | 12027 |

**Table 2.** The level of pH at different sample.

| Parameter \ Soil sample | Guilan (Iran) | Tehran (Iran) | Saravan (Iran) | Tansania (Tanzania) | Zabol (Iran) |
|---|---|---|---|---|---|
| pH | 6.7 | 7.8 | 8.4 | 8.6 | 8.5 |

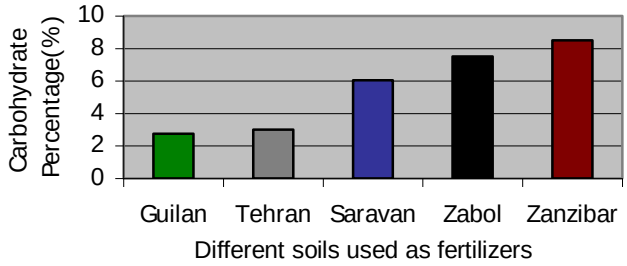


**Figure 2.** Displays algae carbohydrate rate during day 25.

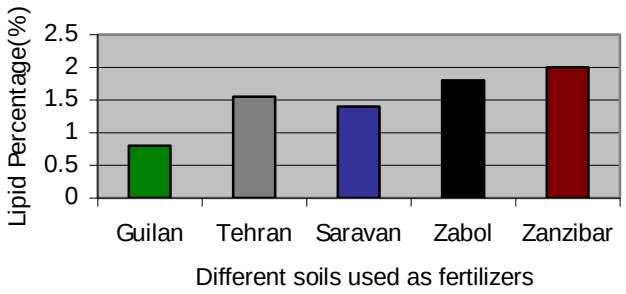


**Figure 3.** Displays algae lipid rate during day 25.

Zabol soils contain 26% silt.

The final step of this research uses 5 feeding conditions, all placed within laboratory condition. Table 2 displays Chladophora's carbohydrate rate during day 25 in various feeding conditions. Carbohydrate rate in Chladophora fed by Tansanian soil is about 8.77%, although Guilan soil carbohydrate level was measured to be about 2.68% (Figure 2).

The lipid in Chladophora grown in different conditions is also measured during day 25 (Figure 3). As shown in Table 2, Tansanian soil has a big potential to accumulate about 34.69% lipid in the Cladophora, but Guilan soils' capacity is about 27.14%.

In this kind of soil, the amount of reduced Iron absorbed by Chladophora showed different ranges between 27.14 to 34.17%. The Tansanian soil has 34.17% lipid (Figure 4).

Same results are seen in Figures 5 and 6. In these figures, the amount of Mn absorbed by algae that were fed by Tansania soil solution is more than the ones in other soils. Guilan soil has not shown a good performance to up take Mn by algae. The value of Zn was same as Mn. All of soil pH properties were weak alkaline but Guilan soil pH properties were in neutral condition.

## DISCUSSION

This scientific performance like previous researches has shown that some kind of soil in the atmosphere with the appropriate sunlight and cloud can be used as a natural fertilizer for plant and algae. This study has shown again the ability of some soil to have plant nutrition. Zanzibar, Zabol and Saravan soils by having a large capacity for reducing $Fe^{3+}$ to $Fe^{2+}$ are better than Guilan and Tehran soils; and also absorption of Mn and Zn is same as Iron. Absorption of Fe, Mn and Zn by culturing of an edible freshwater *C. glomerata* depends on using different natural feeding condition of algae in laboratory. This situation is the same for the amount of carbohydrate and lipid. As we have shown Tansania, Zabol and Saravan soils with a large capacity of absorb different elements can act as organic fertilizer. The results show that by

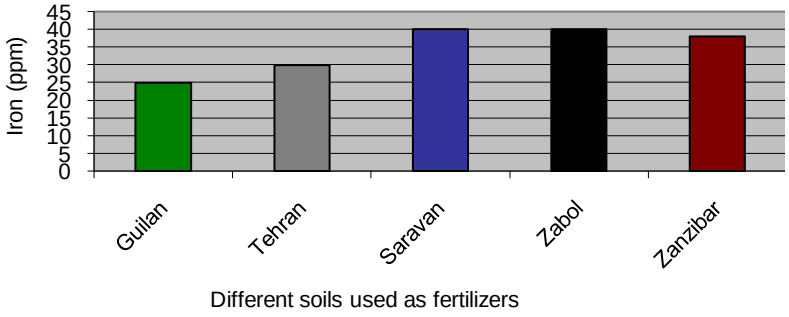


**Figure 4.** The level of algae Iron during day 25.

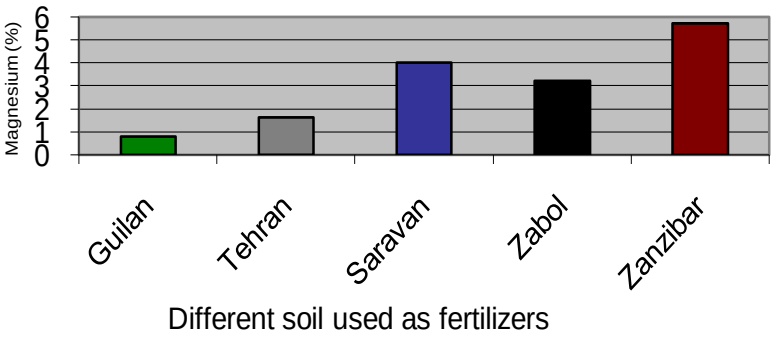


**Figure 5.** The level of Magnesium algae during day 25.

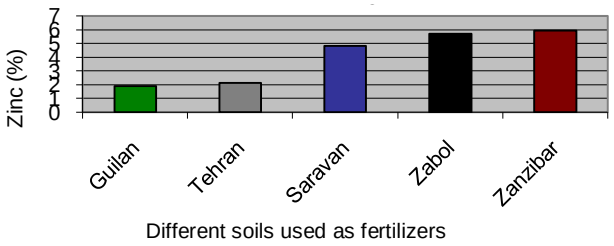


**Figure 6.** The level of algae zinc during day 25.

using Tansania, Zabol and Saravan natural feeding conditions instead of Tehran and Guilan soils, carbohydrate, lipid, Fe, Mn and Zn contents increased in *C. glomerata* structure.

By transferring this technology and through the exchange of Iranian and African scientist, we can gain a huge potential of natural macro and micro elements as nutrient materials from Zanzibar, Zabol and Saravan soils, and also by using this soils as complex we can gain a good potential of nutrient material for aquaculture plant like seaweed and algae which have suitable potential value of nutrient for human and we can protect our world from pollutant.

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