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Effect of Various Concentration of the Zinc on Chlorophyll, Soluble Sugars and Proline in Duckweed (Lemna Minor)

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Abstract **– *Lemna* is a genus of free-floating aquatic plants from the duckweed family. These rapidly growing plants have found uses as a model system for studies in community ecology, basic plant biology, in ecotoxicology, in production of biopharmaceuticals, and as a source of animal feeds for agriculture and aquaculture. Zinc is a one of micronutrients essential for plant growth and development, in addition, Zinc is heavy metals and too mach Zinc can cause a toxicity in most plants currently, environmental pollution, especially pollution from heavy metals due to industrial activities indiscriminate use of chemical fertilizers cause irreparable damage in the plants. In this study examined the effect of different concentration of Zn [control (zero), 0.003, 0.005, 0.01, 0.012, 0.015and 0.018 g] on chlorophyll, soluble sugars and proline in duckweed (Lemna minor). The results showed that high Zn concentration decrease of photosynthetic pigments such as chlorophyll a and chlorophyll b, however, soluble sugars and proline increased. These compounds are used in various stress for osmotic adjustment, preserve the enzymes and membranes in plant cells.**

Keywords **– Duckweed, Lemna Minor L, Zn Chlorophyl, Proline, Soluble Sugars.**

I. INTRODUCTION

Environmental metal pollution has become one of the most important problems in the world. This phenomenon increased in recent years due to the extensive use of heavy metals in agriculture, chemistry and industrial. Heavy metals often have harmful influences on the health of living beings, in particular human and direct and / or indirect harmful effects may occur from the molecular level to communities and ecosystems [1]Gra.

The term of Bioremediation refers to any biological processes removing industrial pollutants that contaminate the biogeochemical cycle of natural substances, is a beneficial option to reduce pressure on the environment. Bioremediation is the use of biological systems to reduce the level of pollution in the air, water or soil. [2].

Our work aims to study the effects of different concentrations of the Zn on the physiological and biochemical parameters of duckweed *Lemena minor L*. These organisms are a good experimental model because of their rapid growth and ease of cultivation and harvesting. Indeed, they have been widely used to evaluate the toxicity of pollutants, such as heavy metals [3] [2]. hydrocarbons [4].

II. MATERIAL AND METHODS

The study was conducted in research laboratory of El Tarf University of Algeria in 2013. Experimental dosing was completely randomized design with five repetitions

Ecotypes of *L. minor* used in this study were collected in Lake Tanga (Region of El Tarf, Algeria), harvested fronds are washed several times in distilled water before being separated 100 plants be planted in plastic pots containing a solution of water and the zinc (Zn), whose pH was adjusted to 6.8, and more witnesses; treatments were used corresponding to the following concentration gradient: 0.003, 0.005, 0.01, 0.012, 0.015 and 0.018g / L. Each treatment was repeated five times.

Measurement of chlorophyll a and chlorophyll b were performed using fresh leaves. The duckweed dried in the oven for 48 hours at 70ºC in order to measure the amount of soluble sugars. The average chlorophyll a and b are determined by the method of [5].

Total soluble sugars were determined by the method of [6]

Free proline content was measured by the method of[7]. Fresh tissue 100mg was homogenized in 3% (w/v) sulphosalycylic acid and centrifuged at 700g for 3min. after addition of ninhydrin reagent, mixtures were heated at 100ºC for 1h and cooled in an ice bath. The chromophore obtained was extracted from liquid phase with toluene and the absorbance of organic layer was read at 520 nm. Proline concentration was determined from calibration curve using L-Proline as standard and expressed as nmole $g^{-1}FW$

III. STATISTICAL ANALYSIS

The results were analyzed using the statistical software Minitab 13.31 for Windows (X 2000). The data are represented by the mean plus or minus standard deviation ($m \pm s$). Means were compared two by two by the Student t test. An analysis of variance with two criteria (dose, time) was performed. The significance level was $p \leq 0.05$ [8]

IV. RESULTS

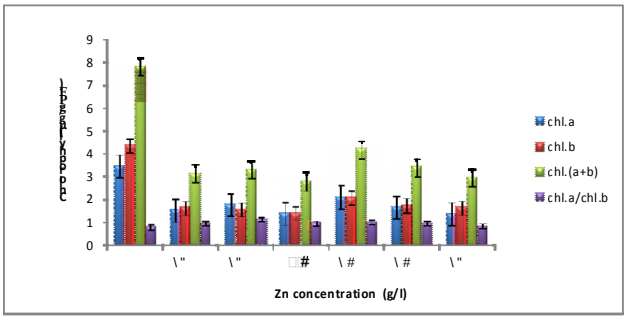

Figure1. effect of ZnO on chlorophyll a and b on lemna minor

Determination of soluble sugars

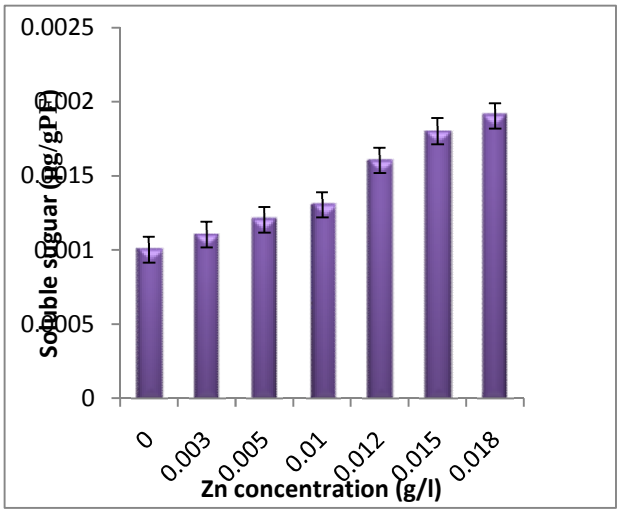

Fig.2. Effect of Zn on the soluble sugars in *Lemna minor*

Determination of the rate proline

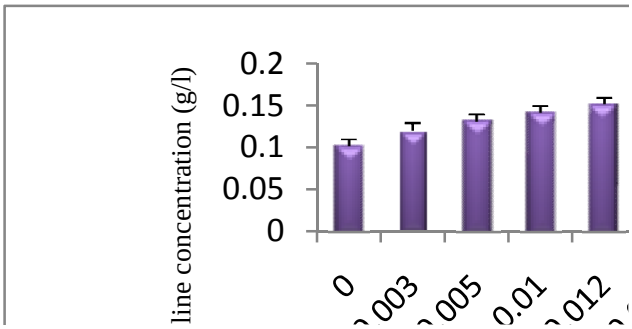

Fig.3. Effect of Zn on proline content in *Lemna minor*.

V. DISCUSSION

In this study it was observed with increasing zinc, the amount of chlorophyll a and chlorophyll B decreased. This work confirms the results of [9] who demonstrated the inhibition of chlorophyll in the presence of heavy metals. Studies show that the influence of heavy metals on chlorophyll and other they though direct inhibition of the enzyme and induced deficiency of essential nutriments that interfere with the synthesis of photosynthetic pigments [10].

The results of measurement of soluble sugars in duckweed with the right amount of zinc concentration, research indicates that the salinity, water logging, frost and heavy metal increase soluble sugars helps regulate osmotic stress in plant cells and leads to preservation of biological molecules and membrane [11] also the accumulation of soluble sugars is a means adopted by plants under stress at the end to withstand environmental stresses [12].

In this treatment, there is a relative relationship of increasing concentrations of Zn and the accumulation of proline, that the accumulation of proline is also an effective mechanism of stress tolerance [13].

It seems that our plants underwent metabolic disturbance because according to another viewpoint, the accumulation of proline is an adaptive response to stress, but a sign of metabolic disturbance ([14]; [15]).

VI. CONCLUSION

In this study it was found that high zinc concentration decrease of photosynthetic pigment such as chlorophyll a and chlorophyll b. however, soluble sugars and proline increased. These compounds are used for osmotic adjustment, preserve the enzymes and membranes in duckweed, but also same what different defense /adaptative strategies of duckweed in response to the tested heavy metals. The results of the study suggest that, combined with advisable harvesting Lemna minor can be used for the phytoremediation of low-level Zn contaminated waterways.

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