THE USE OF THE AQUATIC PLANT *LEMNA GIBBA* IN WATER –TOXICITY CONTROL: INVESTIGATION OF CADMIUM EFFECTS THROUGH CHEMICAL MODIFICATIONS IN AQUATIC SYSTEM WITH PLANT

S. SEMSARI, F. TALEB and K.TAHAR

University of Blida, Department of Industrial Chemistry, Laboratory of Chemical Engineering Road of Soumaa, POB 270, 09000 Blida, Algeria

Key words: Contaminants, Heavy metals, Bio monitoring, Aquatic Plants.

ABSTRACT:

The objective of this laboratory study was to examine the response of an aquatic plant, *Lemna gibba*, to simulated cadmium discharges. The principal purpose of this study was to present the composition of nitrogen and phosphate in uncontaminated and contaminated growth medium of *Lemna gibba* and to present results that demonstrate the relationship of these nutriments to the concentration of cadmium adsorbed by *Lema gibba*.

I-INTRODUCTION:

Among several species utilized for control of pollutant toxicity *Lemna gibba* was used. In another context, investigations were described that in vitro and field conditions, product of aquatic plants, such as duckeed, to recover nutrients from the wastewater has promise as an alternative technology to convert nutrients into potentially useful products and prevent excessive nutrients of the aquatic environment (Cheng et *al*., 2002).

II- MATERIEL AND METHODS:

Composition of the culture medium

Lemna gibba was cultured under sterilized conditions in a medium containing: 1.18 $g.L^{-1}$ $Ca(NO_3)_2$ $4H_2O$ 0.05 $g.L^{-1}$ KNO_3; 0.049 $g.L^{-1}$ $MgSO_4$ $7H_2O$; 6.8 $mg.L^{-1}$ KH_2PO_4; 3.037 $mg.L^{-1}$ $FeSO_4$ $7H_2O$; 2.86 $mg.L^{-1}$ H_3BO_4; $mg.L^{-1}$; 1.55 $mg.L^{-1}$ $MnSO_4$ $7H_2O$; $mg.L^{-1}$ 0.22 $mg.L^{-1}$ $ZnSO_4$ $7H_2O$; 0.079 $mg.L^{-1}$ $CuSO_4$ $5H_2O$; 0.078 $mg.L^{-1}$ $NiSO_4$ $7H_2O$ and 0.0179 $mg.L^{-1}$ Na_2WO_4 $2H_2O$; pH = 5 ± 0.5.

Cadmium concentrations ($mg.L^{-1}$)	10^{-3}	10^{-2}	10^{-1}

III- RESULTS AND DISCUSSIONS:

a. Experiments without sterlization of plant

- Table 1. Inhibition by cadmium of the ammonia-nitrogen contained in incubation medium; experiment without sterilization treatment of plant, each value of ammonia-nitrogen concentrations represents the means (n = 4) ± standard error;
- experimental period of 10 days

$[Cd^{++}]$ ($mg.L^{-1}$)	10^{-3}	10^{-3}	10^{-3}	10^{-3}
Inhibition of growth (%)	8.15	42.44	69.50	74.41
$[NH_4]$ ($mg.L^{-1}$)	7.74 ± 1.12	4.47± 0.9	2.36[a] ± 1.8	1.98[a] ± 1.0

(a): mean values of NH_4 in cadmium experiment significantly different from those of the control ($p < 0.05$)

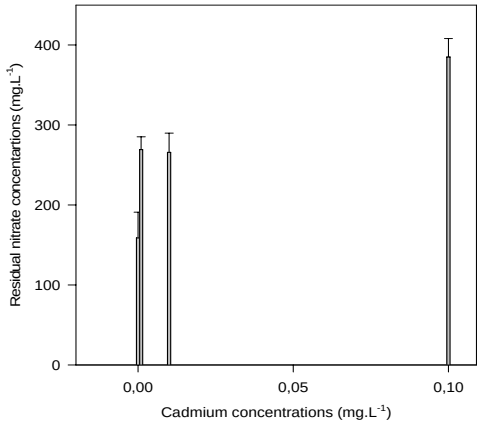

Figure 1 Influence of cadmium on residual nitrate-nitrogen of *Lemna gibba* content medium after 10-days experiments. Experiments with sterilized plant. Mean values ± standard errors of the means, n = 4

b. Evaluation of nitrate and phosphate concentrations: bioassays with sterlized plant

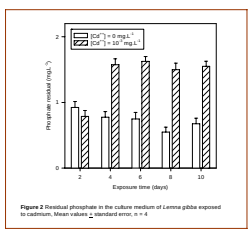

Figure 2 Residual phosphate in the culture medium of *Lemna gibba* exposed to cadmium, Mean values ± standard error, n = 4

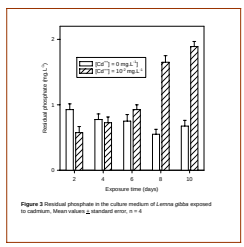

Figure 3 Residual phosphate in the culture medium of *Lemna gibba* exposed to cadmium, Mean values ± standard error, n = 4

Nitrate consumption indicates a siginficant decrease ($p < 0.05$) with increasing cadmium concntration from 0 to 10^{-1} $mg.L^{-1}$.
The increasing of phosphate in cadmium experiments is induced by the inhibition of phosphate uptake process. The increase was of 45% and 58% respectively at Cd concentrations of 10^{-3} $mg.L^{-1}$ (Figure 2) and 10^{-2} $mg.L^{-1}$ (Figure 3).
The inhibitory effect induce various metabolic in plant and the phosphate absorption is broken.

IV- CONCLUSION:

The reduction rate of the nitrate uptake process was dependent of the increasing cadmium concentrations. It's therefore suggested that the decreasing of nitrate concentrations in the growth medium could constitute a tool for detecting water metal contamination,
The cadmium inhibitory effect induce various metabolic in plant and the phosphate absorption is broken.

Ammonia in experiments wthout sterlization of plant results from microorganisms excretion.

Reference: Cheng, J., B. A. Bergmann, J. J. Classen, A. M. Stomp & J. W. Howard, 2002. Nutrient recovery from swine lagoon water by *Spirodela punctata*. Bioressource Technolgy 8: 81-85.