Contribution to the study of heavy metals removal by various algal species

The re-use of treated waste water in agriculture is now a practice used widely in the Mediterranean basin, particularly in the countries affected by water scarcities. In actual fact, the treated waste water is an additional water storage and a significant potential in phytonutrients (N, P, K and trace elements); essential for plant growth.

In Algeria, the wastewater treatment is mainly made using activated sludge. At the plant exit, the purified water may convey a significant quantity of metal pollutants.

For a less restrictive and a hygienically safe use, a tertiary treatment is necessary. This complementary treatment may be provided by certain algal species that accumulate these metal cations using a biosorption mechanism.

These technological processes are currently one of the hubs of many researches. They are a very inexpensive and an efficient alternative with regard to conventional physical and chemical methods such as ion exchange, membrane processes, etc.

In such context, we performed a study that focuses on heavy metals biosorption by microalgae (scenedesmus quadrilla, chlorella vulgaris and diatoms) grown in the laboratory under controlled conditions (T = 18 ° C - 22 ° C; pH = 6.5-7.5; 3000 lux illumination and agitation by bubbling air), and their impact on algal species. For this study, we chose two heavy metals: the zinc which is, at low doses, an essential trace element and the cadmium which is a non-essential and a highly toxic element. Thus, we examined the sorption kinetics of cadmium-zinc mixture by the aforementioned algal species.

Furthermore, we studied the effect of culture medium and CO2 on algae chlorella's growing medium: two essential parameters for microalgae growth optimization.

From this work, it appears that complete nutrition medium and CO2 are deciding factors for algae growth. Zinc sorption is better than algal culture No.1 (mixture of scenedesmus, algae chlorella and diatoms) (70% to 84%), and less important than algae chlorella (from 40% to 48%) and scenedesmus (36 % to 50%). For cadmium, the sorbent is effective for scenedesmus (from 73% to 81%) and lowest for algal

culture No.1 (60% to 75%) and chlorella algae (from 46% to 55%). Accordingly, we noticed that biosorption is remarkable for cadmium-zinc mixture as for the cadmium alone (synergistic effect).

Algal cells susceptibility to heavy metals differs between species; the results show that scenedesmus and chlorella algae are more resistant to zinc and cadmium than diatoms. The very high toxicity has been shown by the more significant rate of mortality for algal cells. Nevertheless, the presence of zinc along with cadmium indicated an antagonistic effect, so that the rate for algal density reduction using zinc-cadmium mixture is less than that caused by the individual effect of cadmium.