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ASSESSMENT OF CADMIUM EFFECTS ON BIOMASS AND IONOME OF GREEN FRESHWATER MICROALGAE (CHLOROPHYCEAE)

VIOLANTE A.*, CHIAIESE P.*, RUIU F.*, DI SALVATORE M.*, AMORESANO A.**, FILIPPONE E.*

*) Department of Agricultural Sciences, University of Naples "Federico II", Via Università 100, 80055 Portici (Italy)
**) Department of Chemistry, University of Naples "Federico II"

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The use of microalgae has gained popularity due to their inexpensive growth requirements (solar light, CO2 and minerals) and the advantage of being utilized simultaneously for multiple purposes (e.g. carbon mitigation, biofuel production and bioremediation) making them microalgae suitable candidates for several eco-friendly technologies (Suresh Kumar et al., 2015). In addition, microalgae have an important role in biotransforming contaminants into non-hazardous substances or removing them from environment. Among inorganic pollutants, cadmium (Cd) generates serious changes in the ecosystem and bioaccumulates in living organisms, especially in humans that are at the top of the food chain (Ali et al., 2013). In this work, we studied the effects of Cd on the growth of 13 microalgae species, belonging to Chlorophyceae class. Three Cd concentrations were tested, along with the control: 150, 200 and 400 μM. After 7 days of culture in liquid medium, the microalgae growth was expressed as ratio with the proper control and the best performers in presence of Cd 400 μM resulted *Chlorella luteoviridis* (Clu; 129.7%), *Chlamydomonas reinhardtii* (Cre; 52.2%) and *Chlorella emersonii* (83.4%). The Clu cells were able to remove 20% Cd after 4 days of culture and 40% after 7 days. On the basis of these results and taking into account that Cre represents the model microalgae species, the further experiments were done on this latter along with Clu.

We investigated the variation in pigments content (carotenoids and total chlorophyll) in Cre and Clu cells when cultured into Cd-added (200 μM) medium. After 14 days of cultures, the chlorophyll content in Clu cells growth in presence of Cd was less than the carotenoids one, with an increase of 51% respect to the control one, suggesting that the oxidative stress induced by Cd interfered with the electron transport chain, leading to the increase of biosynthesis of antioxidant molecules such as carotenoids (Pinto et al., 2003).

Furthermore, we evaluated changes in ionomic profile induced by Cd in Cre and Clu cells. The content of 20 elements was determined by ICP-MS analysis. Cd affected mostly the adsorption of Zn, Cu and Fe in each microalgae species; in fact, it is reported that this heavy metal is transported into the cytoplasm by some transport proteins of these 3 elements, with a mechanism known as "ionic mimicry" (Bridges and Zalups, 2005). In Cre, the content of Zn was 10 times higher in treated culture than the control, while Cu and Fe were 5 or 2 times higher, respectively. The same behaviour was observed in Clu, but the concentration of Zn, Cu and Fe was 10, 4 and 2 times higher than to control, respectively. Furthermore, in this species, also the adsorption of Co was influenced by Cd and it was 2 times higher than in controls.

Further analysis is now in course to identify the major genes involved in Cd adsorption and organelle translocation.