

**SUMMARY  
AND  
CONCLUSIONS**

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## 6. Summary

Heavy metals pollution represents an important environmental problem. The sorption by algae has emerged as a cheaper and an efficient alternative for the removal of heavy metals from low strength wastewaters.

So, in this investigation we studied the bioremediation of low quality water by algae, and the change that might take place in germination, growth and some related physiological activities of wheat and faba bean after being subjected to low quality water (drainage water and synthetic solution) and algal treated water.

Therefore, part of this work conducted in laboratory and the other part as pots experiments:

### Laboratory experiments:

A- Four marine algal species i.e. *Ulva lactuca* (green), *Pterocladia capillacea*, *Jania rubens* and *Corallina mediterranea* (red) were collected and prepared to determine the optimum conditions for biosorption.

The obtained results could be summarized as follows:

- 1- Little biosorption of heavy metals occurred under highly acidic and alkaline conditions. The highest removal percentage of heavy metals by almost algal biomass was occurred at pH 5-7.
- 2- The percent of heavy metals removal increased with rise in contact time up to 60 min and after that there was no

considerable change in adsorption percentage with further increase in contact time.

- 3- The maximum biosorption efficiency of the metal ions was attained at about biomass dosage 40 g/L.

B-According to the preliminary experiments, three species (*U. lactuca.*, *P. capillacea* and *J. rubens*) were selected for treatment of low quality water to study its effect on seed germination and the seedling enzymes activity of wheat and faba bean.

- 1- The final percentage germination of wheat grains and faba bean seeds decreased gradually with increasing heavy metals concentration in low quality water. While, the percentage improved and increased with algal treatment.
- 2- The enzyme activities of growing seedlings concerning to peroxidase and catalase were found to be variable among the two plant species with respect to heavy metals concentration in both algal treated and non- treated water

#### **Green house pot experiments.**

- 1- Considerable decrease in the growth criteria in the two test plant organs (shoot, root, leaf) at two different stages of growth induced by heavy metals stress compare to control. However, algal treatment enhanced the different growth parameters when compared with non-algal treated water.
- 2- The biosynthesis of the photosynthetic pigments (chlorophyll a, chlorophyll b and carotenoids) was markedly decreased with increasing heavy metals concentration. But algal treatment induced a considerable increase in the

various pigment content in both tested plants when compared with those of non-algal treated water

- 3- Increasing heavy metals concentration in low quality water caused an inhibitory effect on the accumulation of estimated metabolites (carbohydrates and protein) in the two test plant seeds. On the other hand, algal treatment caused a stimulatory effect on the above mentioned parameters when compared with those of non- algal treated water
- 4- An increase of heavy metals content in poor quality water induced an increase in the accumulation of heavy metals in wheat grains and faba bean seeds. But algal treated water induced decrease in heavy metals concentration compared with those of non-algal treated water.

Marine algal species *U. Lactuca*, *J. Rubens* and *P. capillacea* are good and efficient biosorbents for heavy metals from waste and low quality water, and reduce the effect of heavy metals stress on plant growth. Thus they may constitute a cheap and a renewable natural source of biosorbent that can be used in water treatment technology applications.

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