BIOADSORPTION – TO CLEAN HEAVY METAL POLLUTION

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SUMMARY OF THE MINOR RESEARCH PROJECT

Heavy metal stress is one of the common stresses that limits plant growth and development. Plants absorb a number of elements from soil, some of which have no known biological function and some are known to be toxic at low concentration. Metals play a vital role in the growth and development of plants. They may act as co-factors of some enzymes or help in the formation of intermediate metabolites.

However, excess amount of metals, especially heavy metals when absorbed by plants become toxic, resulting in reduced germination of seeds, shoot and root growth inhibition, besides interfering with the biochemical reactions. Plants constitute the foundation of the food chain. Plants that grow in heavy metal contaminated soil can absorb these pollutants. Once absorbed, such toxic chemicals enter the animals that feed on the contaminated plants and are passed up the food chain, in many instances, to human beings.

In the present investigation, the heavy metals used namely arsenic and nickle have caused considerable reduction in the morphometric characteristics such as root length, shoot length, leaf area, fresh weight and dry weight in the experimental plant, *Vigna radiata* (L.) Wilczek compared to the control.

Photosynthetic pigments such as chlorophyll and carotenoid also showed similar declining trend. However, the accumulation of anthocyanin in the leaves with an increase in concentration of metals, indicates its antioxidant property and protective function against heavy metal pollutants. The total soluble sugar and the protein content in the leaves were found to decrease with the increase in the concentration of heavy metal treatment. Reduction in protein level can be directly correlated to the observed increase in the accumulation of free aminoacids. Proline accumulation was more in the stressed plants than control.

The *in vivo* nitrate reductase activity was found decreased with the increase in concentration of heavy metal application. This was paralleled with the observed increase in the leaf nitrate of metal treated plants. The antioxidant scavenging enzyme activities such as catalase and peroxidase were increased in *Vigna radiata* (L.) Wilczek when exposed to arsenic and nickle of different concentrations. Both arsenic and alunimium when applied to the soil have caused their accumulation in the plant system, which evident from the AAS study.

To overcome the problem posed by the phytotoxic effect of heavy metals, the 6 mM solution of both arsenic and nickle were treated with different amount such as 2 gm, 4 gm and 6 gm of *Sargassum wightii* and *Padina commersonni* (algal biomass), 2 gm, 4 gm and 6 gm of *Datura metel* and *Typha anguistifolia* (land plant biomass) and amended with 750 gm each of farm yard manure and vermicompost (organic amendments).

After the application of various biomass treated metal solutions and organic amendments, all the morphometric characteristics above mentioned were found to increase in the experimental plants compared with the plants applied with untreated metal solutions alone.

The biochemical characteristics such as chlorophyll *a*, chorophyll *b*, total chlorophyll, soluble sugar, protein and the activity of the enzyme nitrate reductase were found to be more in plants applied with algal, land plant biomass treated metal solutions and organic amendment supplied than in the plants treated with untreated metal solutions.

On the contrary, the levels of anthocyanin, free aminoacid, proline and the activities enzymes such as catalase and peroxidase were found to be less in plants applied with bioadsorbent treated metal solutions and provided with soil mixed with organic amendments.

Among the various bioadsorbents such as *Sargassum wightii*, *Padina comersonnii, Datura metel* and *Typha anguistifolia* and organic amendments namely farm yard manure and vermicompost, *Sargassum wightii, Typha angustifolia* and vermicompost were found to be potent bioadsorbents comparing to their respective counterparts and subsequently, restored the morphometric and biochemical characteristics suppressed due to metal toxicity.