Environmental pollution, especially the pollution of water bodies, is a serious concern for developed as well as for developing countries. Water bodies get polluted with the accumulation of many pollutants including toxic heavy metals. Bioremediation of heavy metals is considered to be economically viable alternative to conventional methods of remediation. Few of the microorganisms such as algae including cyanobacteria, fungi and bacteria have a tendency to grow in heavy metal contaminated waters indicating that these are able to resist metal toxicity. Thus the present study was directed to study heavy metal bioremediation potential of algae growing in polluted water.

During the present study, collections were made from three polluted sites i.e. Sutlej river being polluted with Buddha Nullah, Ludhiana; a polluted stream at Bilaspur, H.P. and Badi Nadi being polluted by Diesel Loco Modernization Works, Patiala. Sixty one algal isolates were purified and screened for heavy metal (Cd\(^{2+}\), Cu\(^{2+}\) and Ni\(^{2+}\)) removal potential. Five isolates with highest metal removal efficiency were selected and employed during the present study. These were *Synechocystis pevalekii*, *Lyngbya spiralis*, *Oscillatoria chlorina*, *Phormidium molle* and *Anabaena torulosa*. At fixed concentration of 5 µg ml\(^{-1}\) for each metal, the optimum conditions for removal of metals by all the test organisms were contact time: 60 min, pH: 6.0, biomass load: 0.15 mg protein ml\(^{-1}\) and temperature: 28±2 °C. Under optimum conditions *L. spiralis* removed maximum 78.4% of Cd\(^{2+}\) and 75.8% of Cu\(^{2+}\) while maximum amount of Ni\(^{2+}\) (38.4%) was removed by *S. pevalekii* from solution containing 5 µg ml\(^{-1}\) of each metal. Data for metal removal fitted better in Freundlich isotherm (R\(^2\) > 0.97) compared to the Langmuir isotherm (R\(^2\) > 0.95) indicating heterogeneous nature of groups metal(s) binding. FTIR spectral analysis revealed that mainly two functional groups i.e. hydroxyl (–OH) and carboxylic (C=O and C-O) groups appear to be involved in metal (Cd/Cu/Ni) adsorption process. All the test organisms showed higher metal removal efficiency when heat killed cells, cultures from stationary phase of growth or after treatment with were used. Studies on metal removal from bimetallic solutions revealed that metal removal efficiency of the test organisms remained almost same indicating that presence of two metals in a solution did not affect the metal removal efficiency of the test organisms. Immobilization of biomass in alginate or agar beads did not affect metal removal efficiency of the test organisms. *S. pevalekii* and *L. spiralis* which proved to be more efficient in metal removal in batch experiments used to study their metal removal efficiencies in laboratory scale continuous flow bioreactor. The results revealed that both the organisms removed Cd/Cu/Ni efficiently. After desorbing metal with EDTA, biomass was reused in the bioreactor and it was observed that there was no significant change in metal removal efficiency of the test organisms up to two cycles. Of all the test organisms, *L. spiralis* and *S. pevalekii* were found to be most efficient in removing Cd\(^{2+}\), Cu\(^{2+}\) and Ni\(^{2+}\) from metal solution. Maximum Cd\(^{2+}\) and Ni\(^{2+}\) removal by these organisms was 86-87% and 51-54%, respectively, from solution containing 5 µg metal ml\(^{-1}\), when KOH treated biomass organisms was used. However, maximum Cu\(^{2+}\) removal was observed by CH\(_3\)OH treated biomass of *S. pevalekii* (84% removal) and heat killed biomass of *L. spiralis* (86% removal). The results suggest *L. spiralis* and *S. pevalekii* have good potential to be exploited for bioremediation of Cd/Cu/Ni containing industrial effluents before their discharge into water bodies.