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Phycoremiadation of Heavy Metals by Marine Macroalgae Collected from Olaikuda, Rameswaram, Southeast Coast of India

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Abstract : The industrial effluent with high amount of heavy metals is known to have adverse effects on the environment. For the removal of heavy metals from aqueous environment, different conventional treatment technologies had been applied gradually which are not economically beneficial and also produce huge quantity of toxic chemical sludge. So, bio-sorption of heavy metals by marine plant is an eco-friendly innovative and alternative technology for removal of these pollutants from aqueous environment. The aim of this study is to evaluate the capacity of heavy metals accumulation and removal by some selected marine macroalgae (seaweeds) from marine environment. Methods: Seaweeds Acanthophora spicifera (Vahl.) Boergesen, Codium tomentosum Stackhouse, Halimeda gracilis Harvey ex. J. Agardh, Gracilaria opuntia Durairatnam.nom. inval. Valoniopsis pachynema (Martens) Boergesen, Caulerpa racemosa var. macrophysa (Sonder ex Kutzing) W. R. Taylor and Hydroclathrus clathratus (C. Agardh) Howe were collected from Olaikuda (09°17.526'N-079°19.662'E), Rameshwaram, south east coast of India during post monsoon period (April'2016). Seaweeds were washed with sterilized and filtered in-situ seawater repeatedly to remove all the epiphytes and debris and clean seaweeds were kept for shade drying for one week. The dried seaweeds were grinded to powder, and one gm powder seaweeds were taken in a 250ml conical flask, and 8 ml of 10 % HNO3 (70 % pure) was added to each sample and kept in room temperature (28˚C) for 24 hours and then samples were heated in hotplate at 120˚C, boiled to evaporate up to dryness and 20 ml of Nitric acid: Percholoric acid in 4:1 were added to it and again heated to hotplate at 90˚C up to evaporate to dryness, then samples were kept in room temperature for few minutes to cool and 10ml 10 % HNO3 were added to it and kept for 24 hours in cool and dark place and filtered with Whatman (589/2) filter paper and the filtrates were collected in 250ml clean conical flask and diluted accurately to 25 ml volume with double deionised water and triplicate of each sample were analysed with Inductively-Coupled plasma analysis (ICP-OES) to analyse total eleven heavy metals (Ag, Cd, B, Cu, Mn, Co, Ni, Cr, Pb, Zn, and Al content of the specified species and data were statistically evaluated for standard deviation. Results: Acanthophora spicifera contains highest amount of Ag (0.1± 0.2 mg/mg) followed by Cu (0.16±0.01 mg/mg), Mn (1.86±0.02 mg/mg), B (3.59±0.2 mg/mg), Halimeda gracilis showed highest accumulation of Al (384.75±0.12mg/mg), Valoniopsis pachynema accumulates maximum amount of Co (0.12±0.01 mg/mg), Zn (0.64±0.02 mg/mg), Caulerpa racemosa var. macrophysa contains Zn (0.63±0.01), Cr (0.26±0.01 mg/mg), Ni (0.21±0.05), Pb (0.16±0.03) and Cd (0.02±00). Hydroclathrus clathratus, Codium tomentosum and Gracilaria opuntia also contain adequate amount of heavy metals. Conclusions: The mentioned species of seaweeds are contributing important role for decreasing the heavy metals pollution in marine environment by bioaccumulation. So, we can utilise this species to remove excess amount of heavy metals from polluted area.

Keywords : heavy metals pollution, seaweeds, bioaccumulation, eco-friendly, phyco-remediation
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