MOLECULAR ANALYSIS OF *VETIVERIA* PLANT TO ASSESS POTENTIALITY FOR ARSENIC PHYTOREMEDIATION

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ABSTRACT

Effective remediation of contaminated soil and water system using a specific plant species is an immensely complex task whose success depends on a multitude of factors which primarily depends on; the ability of the client plant to uptake, translocate, detoxify and accumulate the target contaminant in its biomass. The *Vetiveria* plant system has diverse utilities for soil water conservation measures and restoration of vegetation due to some of its extraordinary features. In addition to this, it is also reported to be tolerant to wide range of soil acidity, alkalinity, salinity, sodicity, elevated levels of Aluminium, Manganese, and prospective for remediation of heavy metals such as; Arsenic, Cadmium, Chromium, Nickel, Lead, Zinc, Mercury, Selenium and Copper. Any potential plant system have definite threshold limit for tolerance governed by its genetic potentiality and influenced by other practical issues encountered under field conditions such as; tolerance to other edaphic stresses, efficiency to function under seasonal alterations and extent of biomass formation etc. Although *Vetiveria* plant is envisaged to be prospective for remediation of As pollution, literature survey indicates no definite information to ascertain its potentiality and the extent of As tolerance. In order to define the As tolerance, extraction & accumulation potentiality of the *Vetiveria* plant a systematic study was carried out through treatment in pot culture, and hydroponics culture in Hoagland nutrient solution under laboratory condition. *Vetiveria* plants were grown in soils amended with sodium arsenate at 0 (control), 50, 100, 250 and 500 mg As Kg^{-1} soil and 0 (control), 25, 50, 100, 150 & 200 mg As L^{-1} of Hoagland solution. Aerial plant biomasses from the experimental plants were fixed at 2, 4, 6 & 8 weeks after treatment. As estimation in the aerial biomass showed low accumulation in the above ground biomass although, growth performance of the plants in different concentration of As was similar to control plants. However, the accumulation was much less in comparison to the As accumulator *Pteris vittata* plant. This finding indicate that there is less As extraction by *Vetiveria* from the soil/water matrix and the growth sustenance of the plant under As stress could be due to avoidance of As intake to the biomass rather than As intake and detoxification through defined biochemical mechanisms. To ascertain the premise, the *Vetiveria* system was investigated for presence of the *arsC* gene, which encodes arsenate reductase that reduces As (V) to As (III) as a mechanism for As detoxification, established in other As tolerant biological and plant systems. The primer designed for amplification of the *arsC* gene of the *ARS* operon in PCR did not amplify the *arsC* cistron with *Vetiveria* genomic DNA. The results indicate that

Vetiveria system may be efficient for establishing vegetation in As contaminated soil but, may not be suitable for phytoextraction of As from the site.

Keywords: Arsenic accumulation, Arsenate reductase, *ARS* operon, Phytoextraction, PCR