Survey of Typha Latifolia for Phytoremediation of Cadmium in International Shadegan Wetland

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ABSTRACT

Heavy metals are important inorganic pollutants that are entered to aquatic ecosystems by municipal, agricultural and industrial wastewater. Heavy metals can transport and accumulate throughout the food chain. Accumulation of heavy metals in organism's tissues is called biomagnification (1). These elements are not biodegradable, therefore we have to remove or immobilize them for cleaning up the polluted environment (2). In this research, macrophytes potential for remediating of Cd by phytoextraction process was investigated. For this research, Typha latifolia and bottom sediment at 3 polluted stations and 1 control station in summer and winter seasons were sampled. Generally 72 macrophyte and 24 bottom sediment samples were taken. Preparing and chemical digestion was preformed according to the standard methods and Cd concentration in samples was measured by using flame atomic absorption spectrophotometery. Then with utilizing Dunkan test and Varians Analysis (%95 precision), bioconcentration of Cd in the organs of studied macrophyte and sediment were compared by statistical tests. Samples analysis results in the summer season showed the average of Cd concentrations in sediments 3.97 (ppm) and roots and stems of Typha latifolia respectively were 2.6 (ppm) and 1.25 (ppm). Also in the winter season average of Cd concentrations in sediments roots and stems of Typha latifolia, respectively 4.25 (ppm), 2.67 (ppm) and 1.17 (ppm) were obtained. The achieved results demonstrated bed sediments of Shadegan International Wetland have Cd pollution and Typha latifolia capable for phytoextraction and accumulation of Cd in the macrophyte organs.

Key words: Typha latifolia, Cadmium, Phytoremediation, Shadegan International Wetland.

Introduction

The ability of green plants to remove organic pollutants and toxic heavy metals from wastewater and contaminated soils is described, with its limitations and advantages Sediments that surround and are influenced by plant roots. Phytoremediation has several advantages. It is inexpensive compared to conventional technology and could prove cost effective for contaminated water and sediments [3]. Metals in the environment are commonly absorbed and concentrated by plants and animals, this can be dangerous to humans if they eat the plants and animals. On the other hand, this characteristic is useful to some environmental restoration projects. After plants absorb metals that contaminate soils, the plants can be harvested and disposed of in a way that removes the absorbed metals from the environment [2]. International Shadegan wetland area is 537700 hec that 29600 hec of has been allocated as wild life refuge. Shadegan wetland is locate in the Eastern longitude 48° 50', 48° 17' and Northern latitude 30° 58', 30° 17' in south western of Iran. Urban, mining, agricultural and industrial waste water such as steel industries, oil refinery are threatening factors of the Shadegan wetland [3].

Materials and Methods

According to survey of studied area 4 sampling stations based on aggregation and distribution of Typha latifolia and entrance of pollutants sources were selected. Coordinate of selected stations have been presented in follow table:

<table>
<thead>
<tr>
<th>Site Position</th>
<th>Station Name</th>
<th>Station Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shoger site (Hlank)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Rogbeh</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Khoor doragh</td>
<td>3</td>
<td></td>
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<tr>
<td>Mansoreh</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

Table 1: characteristics of site position studied stations.

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Fig. 1: distribution of Iran wetlands.

Fig. 2: satellite imaging of site position studied station.
Bed sediments were sampled by van vin grab and studied macrophyte were taken manually, then preparation and chemical digestion of samples for injecting to flame atomic absorption spectrophotometry according to standard methods was done. At first macrophyte samples by urban treated water and then with distilled water were washed carefully. For determining of Cd concentrations in roots, stems and leaves of Typha latifolia, The organs were separated and put them separately in Aven 105 within 48 hr, then organs were grinded and powdered by an electric mill separately. Also for drying of sediment samples, they were put in Aven 105°C within 48 hr and by using the china mortar were homogenized and fine, then for separating of particles diameter less 63 (micrometer) in sediment samples was used sieve 230. Then 1 g, of each sediment and organs samples were taken, and we were put them on PE dishes on Benmary Aqueous bath. Also for chemical digestion process of sediment and macrophyte samples, Choloridric acid 5 ml and Nitric acid 15 ml added. Before beginning of chemical digestion process, 7 ml Hydrofluoric acid was added to sediment samples [4]. Digested samples was filtered by wattman45 filtration paper, and distilled water was added digested samples to 30 ml, then for determining of concentrations of Cd in samples, they were injected to calibrated Flame atomic absorption spectrophotometry [4,5]. All of utilized dishes in this study, before preparating and chemical digestion, were washed by Nitric acid, then were washed by distilled water and were dried carefully [4]. To determing of Cd concentrations in all of samples flame atomic absorption spectrophotometry Philips 9400 PU model was used. Also for each group of samples a blank (control) and with the other samples were analyzed and the results were reported zero. All of chemicals were analytical regent [6].

Analysis of Results:

Instrumental and statistical analyses of sediment samples and Typha latifolia, At 4 station have been presented in diagrams. Average Cd concentration in sediment, root and stem of phragmites sp., in summer (natal season) respectively were determined 3.97 (ppm), 2.6 (ppm) and 1.25 (ppm), Also average Cd concentrations in sediment, root and stem in winter (propinquity season) were defined respectively 4.25 (ppm), 2.67 (ppm) and 1.17 (ppm). Maximum of average concentration of Cd were measured in bed sediment equal 4.25 (ppm), then root organ had maximum average concentration of Cd uptake, equal 2.67 (ppm).

Discussion and Deduction:

Results of sediment instrumental analysis demonstrated that maximum Cd concentration of sediment was found in Khoor Douragh. In order to impressing of oil refinery, Abadan power plant, oil leakage from oil transmission pipeline and vicinity to Persian Gulf and in order to Cd is the index of oil pollution, we expected concentration of Cd in Khoor Douragh station sediments would be more than the other stations. Generally maximum bioaccumulation of Cd in root organ of Typha latifolia, was found. Because of studied macrophyte has perennial roots in sediments but stems and leaves are not perennial root organ had more average concentration of Cd than the other organs.

Instrumental and statistical result demonstrated that bed sediments of Shadegan wetland have Cd pollution. Also this survey showed that Typha latifolia is capable to absorption and accumulating of Cd in organs. Therefore Typha latifolia can utilize for remediating of Cd in contaminated soil and water.

Fig. 3: average concentrations of Cd in sediment and organs in summer season.
Fig. 4: average concentrations of Cd in sediment and organs in winter season.

Arrival:

1. Entrance reduction of municipal, agricultural and industrial waste water, to Shadegan wetland.
2. Constructing of artificial wetlands that encompass Typha latifolia, as before influxing of waste water to Shadegan wetland, discharge to constructed wetland and then after decreasing of Cd to maximum permissible concentration.

References

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