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RESEARCH ARTICLE

Survey of Phragmites Australis for Phytoremediation of Nickel in International Shadegan Wetland

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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 Nickel by phytoextraction process was investigated. For this research, Phragmites australis and bottom sediments at 3 polluted stations and 1 control station in summer and winter seasons were sampled. Generally 72 macrophytes and 24 bottom sediment samples were taken. Preparing and chemical digestion was preformed according to the standard methods and Nickel concentration in samples was measured by using flame atomic absorption spectrophotometery.Then with utilizing Dunkan test and Varians Analysis (%95 precision), bioconcentration of nickel in the organs of studied macrophyte and sediment were compared by statistical tests. Samples analysis results in the summer season showed the average of nickel concentrations in sediments 42.25 (ppm) and roots and stems of phragmites australis respectively 27.5 (ppm) and 17.75 (ppm) were defined. Also in the winter season average of nickel concentrations in sediments, roots and stems of Phragmites sp., respectively 46.57 (ppm), 29.5 (ppm) and 23 (ppm) were determined. The achieved results demonstrated bed sediments of Shadegan International Wetland have nickel pollution and phragmites australis capable for phytoextraction and accumulation of nickel in the macrophyte organs.

Key words: Phragmites Australis, Nickel, 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).

METHODS AND MATERIALS

According to survey of studied area 4 sampling stations based on aggregation and distribution of phragmites australis and entrance of pollutants sources were selected. Coordinate of selected stations have been presented in follow Table: 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 spectrophotometery 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 nickel concentrations in roots, stems and leaves of phragmites sp., 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.

Table 1. Characteristics of site position studied stations

Altitude (m)	Longitude	Latitude	Station Name	Station Number
6	0258558	3400324	Shoger site (Blank)	1
5	0265468	3397181	Rogbeh	2
1	0283444	3383003	Khoor doragh	3
6	0298001	3421517	Mansoreh	4

Then 1 g_r 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,

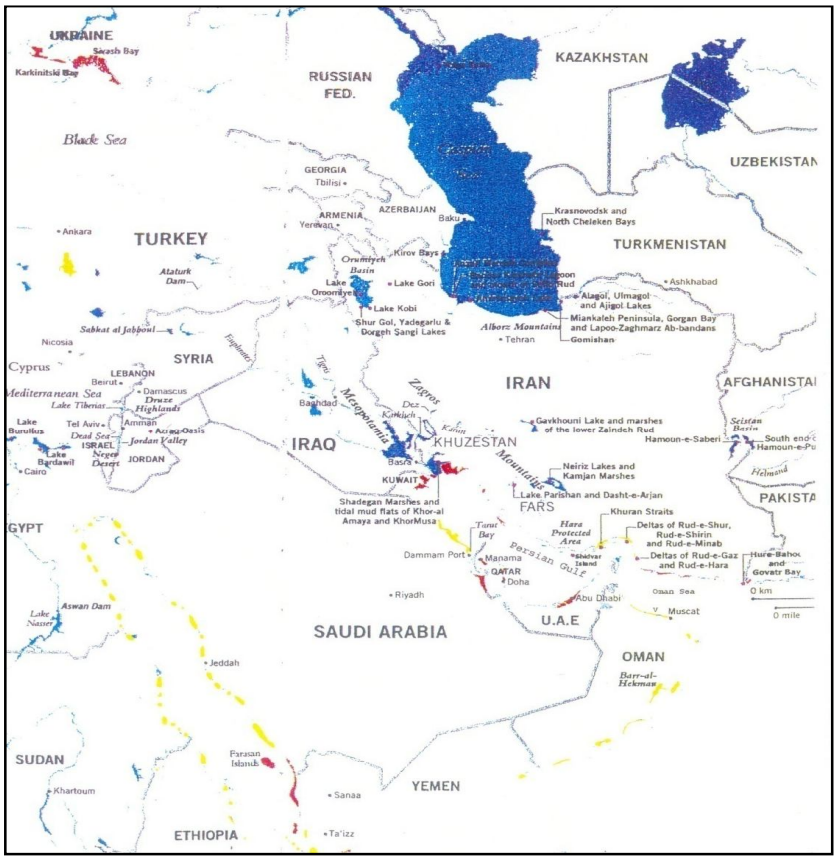

Fig.1 distribution of Iran wetlands

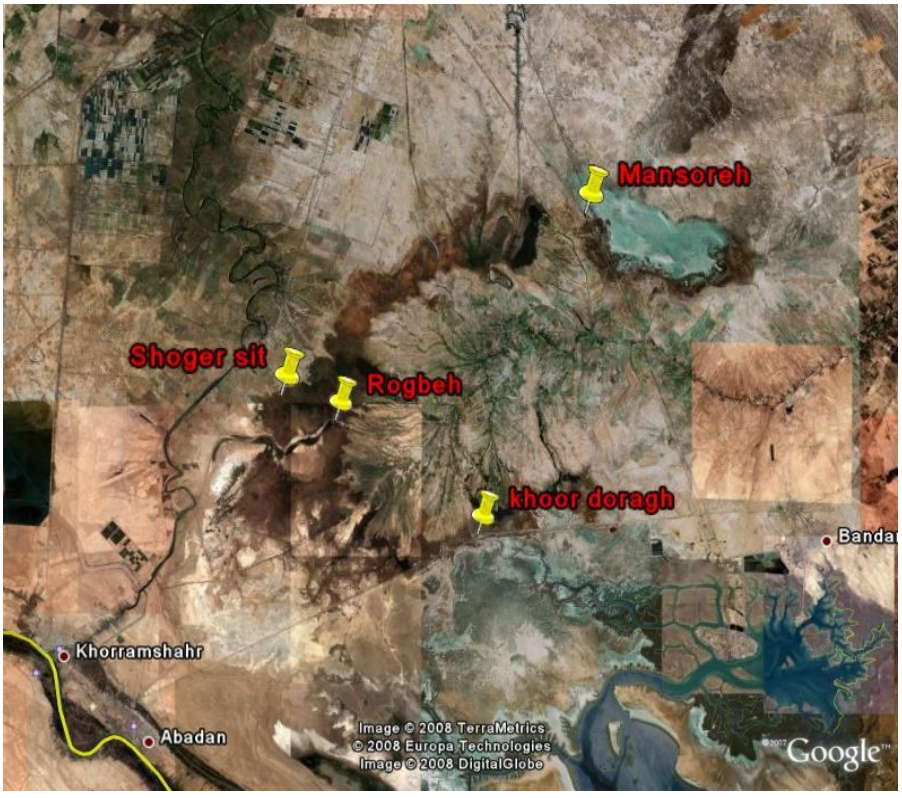

Fig.2 satellite imaging of site position studied stations

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 nickel in samples, they were injected to calibrated Flame atomic absorption spectrophotometery (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 nickel concentrations in all of samples flame atomic absorption spectrophotometery 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 phragmites sp., At 4 station have been presented in diagrams. Average nickel concentration in sediment, root and stem of phragmites sp., in summer (natal season) respectively were determined 42.25 (ppm), 27.5 (ppm) and 17.75 (ppm), Also average nickel concentrations in sediment, root and stem in winter (propinquity season) were defined respectively 46.57 (ppm), 29.5 (ppm) and 23 (ppm). Maximum of average concentration of nickel were measured in bed sediment equal 46.57 (ppm), then root organ had maximum average concentration of nickel uptake, equal 29.5 (ppm).

DISCUSSION AND DEDUCTION

Results of sediment instrumental analysis demonstrated that maximum nickel 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 nickel is the index of oil pollution, we expected concentration of Nickel in Khoor Douragh station sediments would be more than the other stations. Generally maximum bioaccumulation of nickel in root organ of phragmites sp., 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 nickel than the other organs.

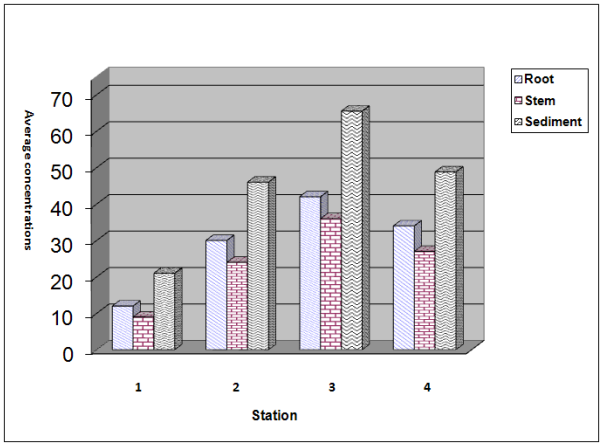

Fig.3 Average concentrations of nickel in sediment and organs in summer season

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

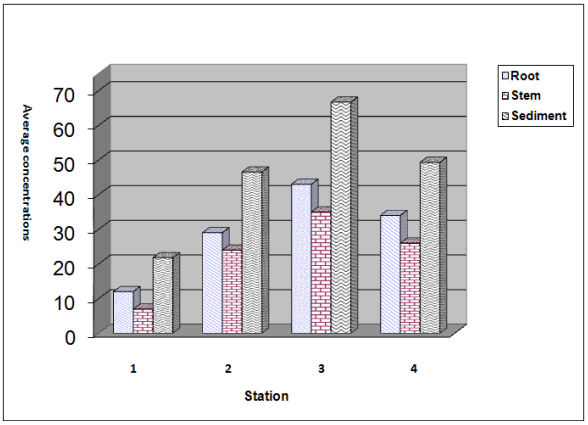

Fig.4 Average concentrations of nickel in sediment and organs in winter season

Arrival

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

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