

## Evaluation of Cd and Cr in Surface Sediments and Plants of *Phragmites australis* Anzali Wetland, Iran

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A high rate of population growth, development of different industrial sectors, and expansion of agricultural lands together is generating a large volume of different pollutants that discharged into aquatic ecosystems. Environmental pollution by different contaminants in aquatic ecosystems can be monitored through water, sediments, and aquatic life. In this study, total concentration of heavy metals (Cadmium and Chromium) in water, sediments and reed (*Phragmites australis*; dominant aquatic plant of Anzali Lagoon) were measured. Anzali Lagoon located in Iranian province of Gilan and the southwest of Caspian Sea. Also, the lagoon has been registered as an international wetland in the 1971 Ramsar Convention. The total area is less than 200 Km<sup>2</sup> (193Km<sup>2</sup>) and located between N 37° 24' and E 49° 35'. In order to evaluate, range of heavy metals (Cd, Cr), 8 stations sampling were selected and at each station, 3 samples (Water, sediment, and plant) were collected. All of samples, after preparation were analyzed with ICP-OES. The metal concentrations for Cd and Cr found in sediments were higher than plants, whereas metal concentrations for all plant bodies were similar. However, considering quality guideline values by US and Canadian EPA, the level of metal concentrations in sediments and water samples were lower than threshold effects.

**Key words:** Wetland, *Phragmites australis*, Sediment, Cd, Cr.

Nowadays, water pollution has been receiving a lot of international attention. Generally, water pollution threatens both human and animal health, which consequently affects aquatic ecosystems. It is well documented that water pollution, in the near future is the major risk for aquatic ecosystems, which pose serious stresses on environment. The main risk of pollution derived by heavy metals and their toxic effects is because of that they are stable in ecosystems<sup>10</sup>. Wetlands as aquatic ecosystems have economic, social, educational, recreational values. Also, they improve the environmental quality for aquatic plants and animals, placing a third of

world's animal species which are under threat and extinction<sup>12</sup>. Wetlands normally are formed along the lakes, reservoirs of flood plains, rivers or the mouth of rivers. Based on a study about 6% of the Earth's surface is covered by wetlands which is equal to 6.8 million square kilometers<sup>1</sup>. Anzali Lagoon located in the southwest of Caspian Sea, province of Gilan, Iran. Also because of unique characteristics, the lagoon has been registered in the 1971 Ramsar Convention. Moreover, as one of wetland of international importance from the point of ecological, economical and society received more attention<sup>7</sup>. Anzali Lagoon has both types of aquatic and terrestrial ecosystems in a unique complex which provide a safe environment for reproduction of native fishes. Traditionally, the wetland also has been exploited for haunting, reed beds, fishing and a sink for discharged wastewaters by industries<sup>6</sup>. Direct and indirect roles of aquatic

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plants on nutrition of a large group of aquatic animals, protection for nesting and spawning, biological activities of animals, filtration of aquatic ecosystems, minimizing re-suspension of sediment particles and reducing water velocity indicating how significantly aquatic plants, in particular macrophytes, maintaining resilience of an ecosystem<sup>9</sup>. Heavy metals are unwanted pollutants in natural environments that have serious risk of toxicity in contaminated environments, which their stability and accumulation followed by series of hazards. Therefore, accumulation of heavy metals in the environment has many risks for human and animals health<sup>2</sup>. Aquatic ecosystems, ground waters, soil and air, continuously are influencing by different forms of heavy metals, which released to environment by industrial plants. These contaminants, from the beginning of their impacts within ecosystems reduce biological activities and possibly may cause a big loss of biomass<sup>3</sup>. Among contaminants, which enter into the aquatic environment, heavy metals have been highlighted specifically due to their toxic effects and potential bioaccumulation in many aquatic species<sup>8</sup>.

#### Aims

1. Measurements of total concentration of cadmium and chromium in tissues of reed (*Phragmites australis*)
2. Measurements of total concentration of cadmium and chromium in water and sediment

#### MATERIALS AND METHODS

In Anzali Lagoon, the collection of samples was carried out in August 2012. Thereafter, chemical analyses of heavy metals in 8 stations

were completed.

#### Reasons for selection of stations

1. Availability of studied plant in selected stations
2. Confluence of rivers
3. Easy access and transportation to each station
4. Availability of enough water in selected stations

In order to achieve goals of the study it is required that concentration of metals in water, soil, sediment, and vegetation examined.

#### Number of samples and reasons

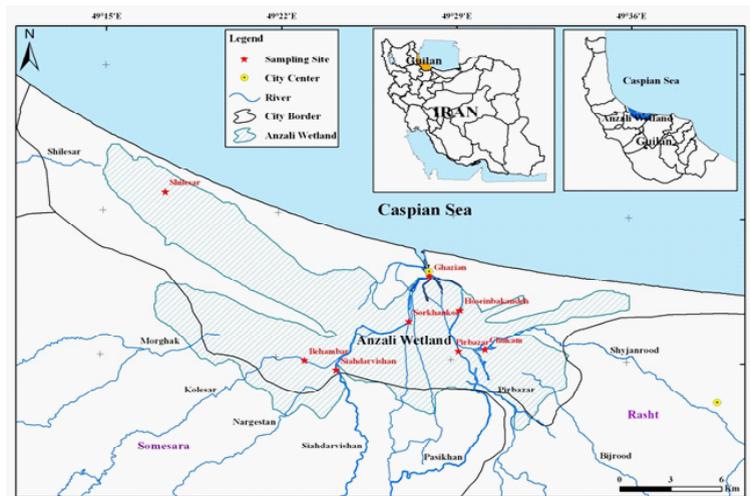
At each station, totally 9 samples (3 water samples, 3 sediment samples, and 3 plant samples) were collected. To have an average of metal concentration in studied environment, 3 samples from each media (water, sediment, and plant) was planned.

#### Sampling method

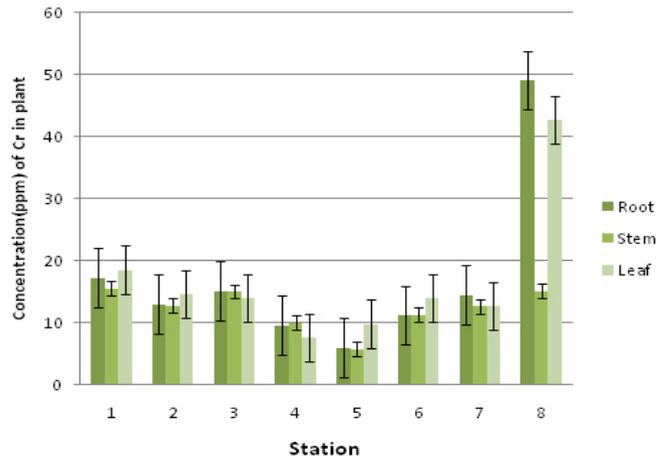
After a preliminary survey and field study of the site in 8 stations (Figure 1), based on vegetation density and entering rivers to the studied site, in three replicates performed. Plant samples at each station in three replicates was collected, followed by washing with wetland's water<sup>4</sup> and stored in plastic bags<sup>5</sup>. Also, at each station sediments samples in three replicate<sup>13</sup> were taken by a grabber and stored in plastic bags. Water samples in three replicates were filled in glasses and with acid nitric 65% pH adjusted to less than 2 for preservation of samples for further metal analysis<sup>11</sup>. After sampling, all samples for preparation, digestion and determination of heavy metals were sent to the laboratory, where after acid digestion of the samples, each sample were analyzed by ICP-OES for levels of Cd and Cr.

**Table 1 .** Geographical location of sampling stations

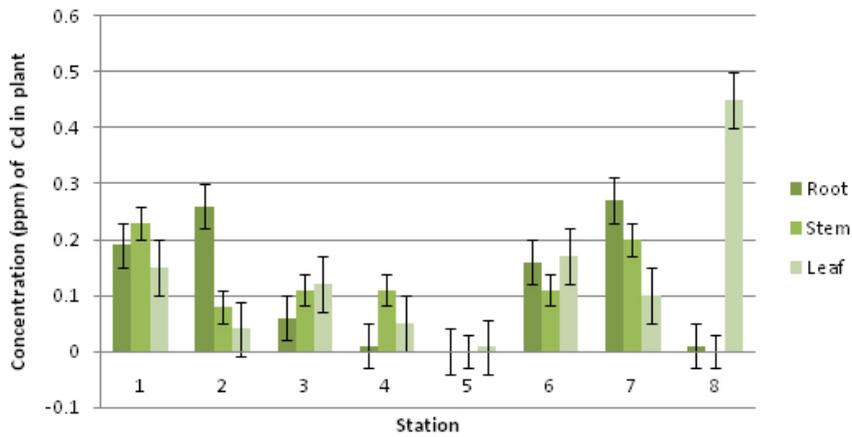
Number	Station	E	N
1	Bahmbr	49× 2310.3"	37× 24'55.2"
2	Choukam	49 30 22.2"	37× 25'23.5"
3	Hosein Bakande	49× 29 20.4"	37× 26'44.5"
4	Pir Bazar	49× 29'18.3"	37× 25'18.6"
5	Shileh Sar	49× 17'28.8"	37× 30'40"
6	Siyah Darvishan	49× 2426.7"	37× 24'36.5"
7	Sarkhankal	49× 27'18.9"	37× 26'19.6"
8	Ghazian	49 28 5.4"	37× 27'54.1"



**Fig. 1.** Entering Rivers to wetland and location of stations



**Fig. 2.** Chromium concentration (ppm) of plant samples in different stations of Anzali Lagoon



**Fig. 3.** Cadmium concentration (ppm) of plant samples in different stations of Anzali Lagoon

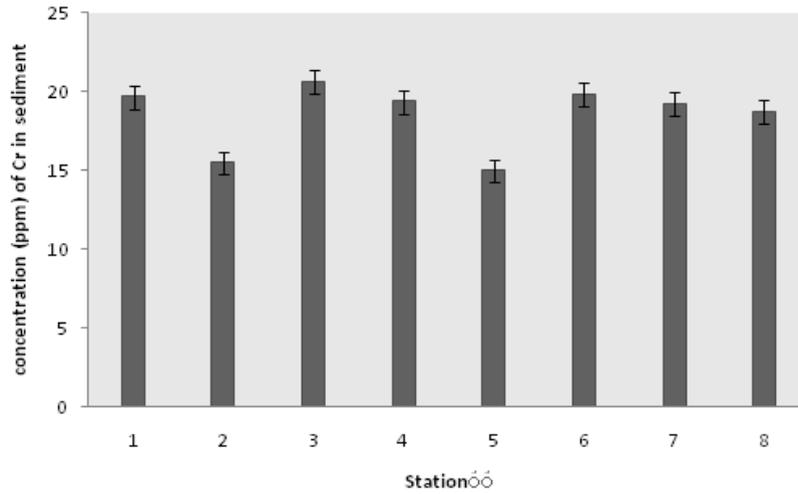


Fig. 4. Chromium concentration (ppm) of sediment samples in different stations of Anzali Lagoon

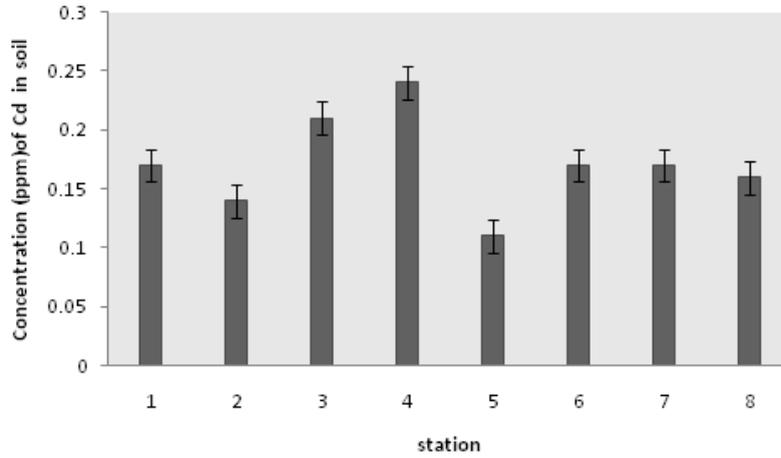


Fig. 5. Cadmium concentration (ppm) of sediment samples in different stations of Anzali Lagoon

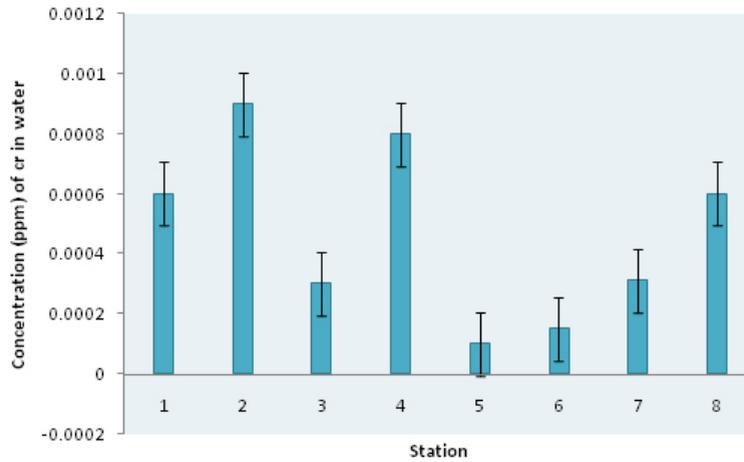


Fig. 6. Chromium concentration (ppm) of water samples in different stations of Anzali Lagoon

## CONCLUSION

The station of Hosein Bakande has the highest concentration of chromium, which decreasing from east to west of the lagoon as in station of Shileh Sar the lowest concentration was observed. The result of this study indicated that heavy metal concentrations in all stations are lower than standard values recommended by Canadian and US EPA.

### Suggestion

1. Monitoring and controlling all industrial activities within wetland
2. Studying accumulating rate of other plant species for heavy metals
3. Regular assessment and quality of water, sediments, and animals of wetland
4. Development of treatment systems for urban and industrial wastewater

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