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STUDIES ON SOME PHYSICOCHEMICAL PROPERTIES AND HEAVY METAL FROM SEDIMENTS AND THE LEAVES OF *XYLOCARPUS GRANATUM* KOENIG FROM REVADANDA AND JAIGAD ESTUARY OF MAHARASHTRA COAST (INDIA)

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ABSTRACT:
Mangroves are commonly grown the intertidal zone and border lines of fresh water and marine water. The physicochemical aspects of soil and quantitative estimation of heavy metal from two sampling sites from Maharashtra state was done in the present study. Physical parameter like pH, and electric conductivity, organic matter and chemical parameters were measured. Six heavy metals were quantitatively estimated. Their presence in both soil and plant sample indicates that, mangroves acts as a sink of heavy metals in the coastal region Concentration of heavy metal is remarkable in the plant material of Revadanda estuary. Present investigation suggests that, *Xylocarpus granatum* can be considered as potential accumulator for the heavy metal like lead.

Key Words: Heavy metals, mangroves, soil, Bioaccumulation

INTRODUCTION:

Mangrove forests are among the most productive ecosystem on the earth. They serve as custodian of their juvenile stock and form most valuable biomass (Odum, 1971). These plant species are salt tolerant and provide wide range of ecological and economical products and services and also support variety of other coastal and marine ecosystems. Mangrove exists under conditions of high salinity, extreme tides, strong wind, high temperature and muddy anaerobic soils. There may be no other group of plant with such highly developed morphological, biological, ecological and physiological adaptations to extreme condition. Mangroves are woody plants grows at the interface between land and sea in tropical and subtropical latitudes. These plants are associated with microbes, fungi, plants and animals to form a mangrove forest community or mangal. This vegetation occurs in rives deltas, lagoons and estuarine complexes (Thom, 1982), and also colonize shorelines and islands in sheltered coastal areas with locally variable topography and hydrology leading to relatively specific structure and function (Lugo and Snedaker 1974).

In the natural and contaminated environment, potentially hazardous heavy metals are present. In natural environment, they occur in very low concentration while in contaminated environment its concentration is very high. In environment, heavy metals arise from various industries. They remain in the ecosystem for

longer time moves from one tropic level to other in food chain (Basamba etal., 2010). Heavy metals are deposited in the mangrove soil through garbage, agricultural fieldand industrial waste (Harbison, 1986). Heavy metals have their impact on mangrove health and pollution status of ecosystem. The level of heavy metal in the ecosystem at particular level identified as toxic or harmful for the flora and fauna of ecosystem (Vidya and Patil, 2016).

METHODOLOGY:

Soil and plant samples were collected from the two different localities of Maharashtra state i.e. Kundalika estuary and Jaigad estuary. Soil samples were digestedin nitric acid: perchloric acid solution in 1:1 ratio. Digestion is carried out in Kjandahl's flask for 4-5 days till the solution becomes colorless and transparent. This solution is diluted with distilled water and made final volume 50 ml subjected to the Atomic Absorption Spectrophotometer for quantitative estimation of heavy metals. Chemical parameters of soil analyzed by standard methods (APHA, 1998).

RESULTS AND DISCUSSION:

A. Soil analysis:

Physical parameters of soil sample collected from Jaigad and Kundalika estuary were analysed with respect to three parameters listed in Table 1. Soil pH of Kundalika estuary is alkaline (8.15) and Jaigad estuary is neutral (7.01). Water holding capacity of soil is more at Kundalika river. Electric conductivity is more 22.6 at Jaigad estuary and less at Kundalika estuary is 8.90.

Calcium carbonate and Organic matter content of soil is determined. Kundalika Estuary shows 15.7 ppm whereas at Jaigad it was 1.5 ppm. Organic carbon is more at Jaigad Estuary (1.77).Three major nutrients were analyzed to detect its availability for the healthy growth of plant. Nitrogen content is more at Jaigad estuary (294 ppm) whereas the level of Phosphorus is more or less equal. Potassium is comparatively more in the sediments of Kundalika 503ppm than the Jaigad estuary (418 ppm).

Nutrients play an important role in the metabolic reactions of the plants. The nutrients such as P, K, Ca, Na, Mg and N were analysed. Calcium, Magnesium, Sodium found abundantly found in the Kundalika estuary than the Jaigad estuary. Boron and Chlorine abundantly found in Jaigad estuary whereas, the chlorides are three times more in the sediments of Jaigad than Kundalika estuary.

Heavy metals in soil: Heavy metals plays most significant role in the physiological activity of plants. Comparative analysis of heavy metal shown in table3. Chromium is abundantly found in the soil of Kundalika estuary 12.9. and the trends for heavy metal absorption at is Kundalika estuary was Cr>Zn>Pb>Ni>Cd>As and that of Jaigad estuary was Zn>Pb>Ni>Cd>Cr>As.

Along with the sediments the leaves of *X. granatum* were also analyzed for the important nutrients from the same sites. It was observed that phosphorus and potassium contents in the leaves of *X. granatum* at Revadanda are comparatively more whereas the calcium and magnesium content was more at Jaigad.

Arsenic was not found accumulated in by the plants in both of the location whereas the concentration of heavy metals like Cadmium, Chromium, Nickel and Zink are more or less equal(Table 5) but the accumulation of lead is more at Kundalika Estuary than the Jaigad

Estuary may be because more lead is released in the rhizosphere as the large steel industry is located in the areas and boat transportation across the estuary may release the lead in the water and the plant may be adapted to the excess lead in the substratum. This may be one of the probable reason for the aggregation of *X. granatum* at this particular site.

Physicochemical properties of soil such as colour, texture, pH, electric conductivity of mangrove marshes are significant factors affect to the nutrient retention of this unique ecosystem (Rao *et al.,* 2014). In the present investigations, these parameters exhibited variations in the samples collected from two different sites of Raigad district. Soil properties differ with seasonal variation and spatial variation with respect to colour, texture, pH, salinity, electrical conductivity (Rao *et al.,* 2014). Similar studies were conducted by Saravanakumar *et al,* (2008) in mangroves of Kachchh, Gujarat. They too reported seasonal variations in these parameters. It is concluded that investigations of such physicochemical parameters could be used for ecological assessment and monitoring of coastal ecosystems of mangroves (Rao *et al.,* 2014; Saravanakumar *et al.,* 2008). Mangrove habitats are commonly contaminated with heavy metals such as lead, zinc, mercury, magnesium, nickel, chromium, cadmium, and manganese (Basamba *et al.,* 2010). These areas may act as a sink or a source of heavy metals in coastal environments because of their variable physical and chemical properties (Basamba *et al.,* 2010; Harbison, 1986). In the present findings in the soil sample collected from the Jaigad and Kundalika estuary.

Accumulation of trace metals in ten mangrove species from Sundarban has been analyzed and their presence was noticed in leaves, barks and roots as well Concentration of heavy metals was higher in soil sediments than various plant parts (Chowdhury *et al.,* 2015).Although there are variations in the levels of heavy metal tolerance exhibited by different types of mangroves, *A. marina* has a relatively higher tolerance level when compared with other mangrove species (Agormurthy *et al.,* 2015). Bioaccumulation potential of mangroves along the coast of Maharashtra is assessed by using statistical indices (Telave *et al.* 2020). Presence of Zn, Cu, Pb and Cd has been reported before in the stands of *Avicennia officinalis* growing in Mumbai. It was noted that concentration of zinc exceeds the MLRL (Maximum Level Recommended for Livestock) limit but rest of heavy metals copper, lead, arsenic and cadmium were found to be below the MLRL. The level of zinc concentrations indicates the risk of food chain contamination (Mendhulkar *et al.,* 2015). Present finding shows bioaccumulation of heavy metals by *X. granatum* in its leaves.

Present work helpful to know the mangroves like *X. granatum* and its soil sediments have an ecological value because they act as natural sinks for heavy metals.

CONCLUSION:

Xylocarpus granatum is critically endangered species and has also some important medicinal properties. This species has specific habitat requirement and hence found on some localities only. This species also exhibits accumulation potential for lead and hence can be studied further as bioaccumulation potential for lead.

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Table 1: Physicochemical properties of soil

Sr. No.	Heavy metal	Kundalika estuary	Jaigad estuary
1	Arsenic	0.09	0.08
2	Cadmium	0.84	1.32
3	Chromium	12.9	0.4
4	Nickel	2.75	4.3
5	Zinc	10.1	11.7
6	Lead	9.60	9.6

Table 2: Comparative major and minor elements in the sediments of *X. granatum* at Kundalika and Jaigad estuary

Sr. No.	Parameters	Kundalika Estuary	Jaigad Estuary
1	pH	8.15	7.01
2	Water holding capacity	90%	80%
3	Electrical conductivity	8.90	22.6
4	Calcium Carbonate	15.7	1.5
5	Organic Carbon	0.76	1.77

Table 3 : Concentration of heavy metal from soil of Kundalika and Jaigad Estuary

Parameters	Revadanda	Jaygad
P (Kg/ha)	37	37
K (Kg/ha)	503	418
N (Kg/ha)	4320	3920
Na (ppm)	132	294
Ca (ppm)	20460	15320
Mg (ppm)	3780	3270
Cl (ppm)	9750	25100
S (ppm)	776	490

Table 4: Comparative major and minor elements in *X. granatum* at Kundalika and Jaigad estuary.

Parameters	Revadanda	Jaigad
P (Kg/ha)	2535	2290
K (Kg/ha)	28600	27600
Nitrate Nitrogen (Kg/ha)	4990 ppm	6840
Ca (ppm)	11890	20990
Mg (ppm)	985	1220
Fe (ppm)	76	82
Mn (ppm)	22	33
Bo (ppm)	119	190
Cl (ppm)	480	715
Si (ppm)	6960	7200

Table 5. Concentration of heavy metal from plants of Kundalika and Jaigad Estuary

Sr. No.	Heavy metal	Kundalika Estuary	Jaigad Estuary
1	Arsenic	-	-
2	Cadmium	0.42	0.35
3	Chromium	0.48	0.4
4	Nickel	1.17	1.13
5	Zinc	0.68	0.8
6	Lead	4.14	2.03